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(54) **Automatic refrigeration apparatus with defrost control**

Automatisches Kältegerät mit Abtausteuerung

Appareil frigorifique automatique avec commande de dégivrage

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Description

[0001] The present invention refers to a refrigeration apparatus comprising a refrigerating circuit, preferably of the type with fan-cooled evaporator, associated to control means to perform automatic defrost phases of the same evaporator.

[0002] Defrosting the evaporator is generally known to become necessary owing to frozen water vapour accumulating on the surface of same evaporator (thereby bringing about the so-called "packing" or icing effect), whose heat-exchange efficiency with the ambient to be refrigerated, ie. cooled down, therefore decreases significantly, thereby affecting the performance of the whole apparatus to a substantial extent.

[0003] It is therefore a commonly known practice to let the evaporator undergo defrosting at more or less regular intervals by having the related defrost cycles started and carried out automatically through the use of appropriate means, such as for instance an electric heating element or hot-gas systems.

[0004] In the most simple cases, automatic defrost phases are started and terminated at pre-determined, regular time intervals. As an alternative thereto, the defrost phases can be caused to terminate on the basis of a thermostatic control, for instance on the basis of the surface temperature of the evaporator itself.

[0005] Examples of such known solutions are disclosed in US 4,297,852, US 4,528,821, US 4,327,556, EP 0 707 183 and US 5,231,844, wherein automatic defrost phases are substantially controlled on the basis of time measured as the duration period of a certain operation, such as door opening time, compressor run time, duration of the previous defrosting operation.

[0006] These solutions can actually be implemented with simple means, but generally turn out to be rather inaccurate since they do not take into due account the actual extent of packing, or icing, of the evaporator, which can vary in a substantial manner depending on the operating conditions of the refrigeration apparatus. The amount of frost that forms on the evaporator can in fact vary depending on a whole set of parameters, such as the relative ambient humidity and the humidity released by the food items stored in the apparatus, but in particular depending on the number of openings of the door of the apparatus and the duration of these openings.

[0007] So, after all, if evaporator defrosting is not correlated to the actual operating conditions, the same defrost process can most easily take place either all too frequently or all too seldom with respect to the real needs. In any case, the result is unfailingly a waste of energy and a loss of efficiency by the apparatus, apart of course from possible alterations in the storage quality and preservability of the foodstuffs.

[0008] In order to correlate defrost in a manner that is more accurately correlated to the amount of frost accumulated on the evaporator, the solution has been suggested, for instance in US-A-5 692 385, according to which defrost is started in response to variations in the static pressure of the air circulating through the evaporator. As an alternative thereto, JP-A-09159328 teaches to control defrosting by making use of a neural-network control rule that is driven by temperatures and air volumes measured at different points in the refrigeration apparatus.

[0009] Anyway, these prior-art solutions require the use of particularly sophisticated, critical and expensive measurement instruments and control methods, such as to practically discourage a utilization thereof in refrigeration apparatuses of usual home or commercial type.

[0010] It therefore is a main purpose of the present invention to provide an automatic refrigeration apparatus with an improved defrost control, which is at the same time simple, reliable and accurate, while taking substantially into account the actual operating conditions of the same apparatus.

[0011] According to the present invention, this aim is reached in an automatic refrigeration apparatus with defrost control having the characteristics as recited in the appended claims.

[0012] Anyway, features and advantages of the present invention can be more readily understood from the description that is given below by way of non-limiting example with reference to the accompanying drawings, in which:

- Figure 1 is a schematical view of a preferred embodiment of a refrigeration apparatus adapted to implement the present invention; and

- Figure 2 is a block diagram illustrating schematically the functional correlation between various control means of the refrigeration apparatus of Figure 1.

[0013] Referring now in particular to Figure 1, the refrigeration apparatus is for example a refrigerator, preferably of a commercial or professional type, but it can also be a freezer or a combination refrigerator/freezer appliance.

[0014] The apparatus comprises an outer casing 3 provided mainly with at least a compartment 4 to store items such as foodstuffs therein.

[0015] Located above the compartment 4 there is provided a so-called technical or machine compartment 5 accommodating a refrigerating circuit that preferably is of the type comprising such functional component parts as a compressor 6, an evaporator 7 and a condenser 8.

[0016] The evaporator 7 is preferably of the finned type and is fan-assisted by a fan 9, which is adapted to circulate according to a closed-loop pattern inside the compartment 4, through appropriate apertures 19 provided in the top wall of the same compartment, a flow of air that is cooled by the evaporator. The latter is preferably associated to a further functional component part, such as an electric defrost heating element 10.

[0017] The refrigeration apparatus further comprises a plurality of probes, or sensors, which are generally indicated at 12, 13, 14 in the Figures, and which are adapted to detect the temperature Tc of the air in the compartment 4, the temperature of the evaporator 7 and the opened and closed condition of at least an access door (generally indicated at 22 in Figure 1) of the compartment 4, respectively.

[0018] In a preferred manner, the apparatus also comprises further probes 15 and 16, which are adapted to detect the temperature of the condenser 8 and the temperature of the ambient in which the apparatus itself is installed, respectively.

[0019] In particular, according to a feature of the present invention the probe 13 is adapted to detect the contact temperature Te of the evaporator 7 in correspondence of its zone 19 at which the refrigerant gas flows into the evaporator coming from the condenser 8 through a flow throttling member 11. As this will more readily understood at a later point in this description, this feature of the invention enables the operating conditions of the evaporator 7 to be detected in a particularly accurate and quick manner, since, as this has also been found experimentally, under determined operating conditions the above cited inflow zone 19 represents the point at which the temperature Te of the evaporator is more stable and meaningful.

[0020] Referring now also to Figure 2, the probes 12 - 16 can be noticed to be adapted to drive associated inputs of control means 17 with respective reference signals that are indicative of the corresponding operational quantities being controlled. Correspondingly, and according to a programming scheme that will be described in greater detail further on, said control means 17 are adapted to actuate the functional component parts 1 - 10 associated to the refrigerating circuit so as to keep the cold storage compartment 4 conditioned to pre-determined optimum average values of temperature and, possibly, also moisture. In a per sè known manner, and according to a temperature set by means of the control means 17, this is obtained mainly through phases of actuation, ie. energization of the compressor 6 and the fan 9 with defrost phases of the evaporator 7 included therebetween. In the preferred example being described here, the defrost phases are mainly brought about by de-energizing, ie. switching off the compressor 6 and energizing, ie. switching on the electric heating element 10.

[0021] As illustrated in Figure 2, the control means 17 comprise preferably a microprocessor 18 (for example, of the Motorola 6805B32 type) that is driven by the probes 12 - 16 and comprises a plurality of outputs which are in turn adapted to drive respective functional component parts 6, 9, 10.

[0022] Obviously, said control means 17 will also comprise a setting input 20 adapted to be driven by selection means 21. These selection means may for instance comprise a keyboard or a push-button unit, or any appropriate so-called "user interface" device, by means of which the user is able to easily set (with an operation that is represented schematically by the arrow 25 in Figure 2) the storage temperature that should desirably prevail in the compartment 4 under steady-state conditions.

[0023] The present invention is based mainly on the consideration that, to the purpose of providing optimum defrost phases that enable efficiency losses of the refrigeration apparatus to be minimized along with the resulting alterations in the quality of the stored items, it is of paramount importance that the instants be most accurately determined at which it is appropriate for each defrost phase to be started. As this has been found even experimentally, a condition of such a packing, ie. excessive icing of the evaporator 7 as to urge the starting of a defrost phase occurs in different manners depending on two main different operating conditions, ie.:

- the apparatus is subject to one or more openings of the door 22, so as this occurs during the regular use of a refrigerator, or the like. Theoretically, it is only through an opening of the door 22 that humidity gets into the storage compartment 4 (where it freezes down on the evaporator);

- the apparatus is operating with its door 22 closed, as this happens for instance during periods in which the user is away. Under these conditions, in practice, air (and humidity) infiltrations can take place through the gaskets of the door 22 and/or humidity can be released by the food items stored in the storage compartment 4. Also in this case, therefore, the need arises for the evaporator 7 to be duly defrosted, but this shall of course happen in a different manner, ie. according to different criteria with respect to the operating mode described in connection with the preceding condition.

[0024] According to the present invention, as this has also been found experimentally, the need for the evaporator to be defrosted under the two above-described different operating conditions is discriminated on the basis of respective, significantly different parameters. Such a discrimination can be carried out by detecting, through the sensor 14, whether the refrigeration apparatus operates in a condition in which its door 22 is substantially open or in a condition in which the same door can be considered as being substantially closed. To such a purpose, the microprocessor 18 can be easily set so as to be able to control the beginning of the defrost phases according to a first or a second mode of operation depending on the probe 14 detecting an open or closed condition of the door 22. In a preferred manner, the microprocessor 18 is adapted to select the above cited first mode of operation, when the door 22 is sensed as being substantially open, throughout a period lasting until a certain time (for instance, 30 minutes) has

elapsed from the door having been closed again. Once this pre-determined additional period of time (which is preferably adjustable) has elapsed, the same microprocessor 18 is adapted to select the above cited second mode of operation. It should be noticed that, according to actual needs and the various operating conditions, the term "substantially open door" as used above can be intended to mean the exact instant in which the door is opened, possibly with an appropriate delay time.

[0025] When the first defrost control mode is so selected (ie. in a substantially open condition of the door 22), the microprocessor is preferably so set as to determine the beginning of a defrost phase upon it detecting, through the corresponding signal delivered by the probe 13, that the afore cited temperature Te of the evaporator 7 decreases at a rate which is faster than a pre-determined value S. In other words, such a rate corresponds to the slope of the curve representing the variations vs. time of the temperature Te. This can be performed, in a per sè known manner for those of ordinary skill in the art, by repeatedly comparing the values of the temperature Te at pre-set time intervals t, eg. every 5 minutes.

[0026] It should be noticed that this mode of control is accurate and quick in its response, since it is not affected by the temperature rise that takes place in the compartment 4 when the door of the apparatus is opened. Furthermore, such a fast-rate decrease of the temperature Te indicates that, owing to a packing or heavily iced condition, the evaporator 7 is no longer in any acceptable heat-exchanging state with the compartment 4 to ensure an appropriate cooling down of the same compartment.

[0027] When the second defrost control mode is selected (ie. in a substantially closed condition of the door 22), the microprocessor 18 is preferably so set as to determine the beginning of a defrost phase upon it detecting, through the corresponding signals delivered by the probes 13 and 12 that the difference between the temperature Te of the evaporator and the actual temperature Tc in the storage compartment 4 exceeds a predetermined threshold value D, which may for instance be set at approx. 2-3°C.

[0028] It should be noticed that this control mode is particularly accurate and effective when the door of the apparatus is closed, since it enables the actual heat-exchange process to be measured, which is taking place between the evaporator 7 and the storage compartment 4, whose temperature (as opposed to what happens in the first control mode) is not substantially affected by warm air entering the same compartment from the outside ambient.

[0029] In any case, in the non-limiting example that is being described, the microprocessor 18 determines the beginning of the defrost phase by switching off the compressor 6 and the fan 9, while switching on the electric heating element 10.

[0030] In both modes of defrost control, the end of each so started defrost phase can be determined in any of a variety of manners suiting the particular purpose, preferably upon the microprocessor 18 detecting, through the signal delivered by the probe 13, that the temperature Te of the evaporator has risen beyond a pre-established threshold value F, eg. approx. 20°C.

[0031] The general operation of the apparatus can at this point go on in a substantially usual manner, that is not described here for reasons of greater simplicity.

[0032] It will of course be appreciated that the above described refrigeration apparatus may be subject to a number of modifications without departing from the scope of the present invention.

[0033] So, by mere way of example the probe 14 may be comprised of a usual microswitch or any other equivalent (optical, magnetic, etc.) monitoring device adapted to sense or detect the above cited open or closed conditions of the door 22.

Claims

1. Automatic refrigeration apparatus, comprising at least a refrigerating circuit provided with at least an evaporator (7) and driven by control means (17) to cool down to a pre-set steady-state temperature at least a storage compartment (4) accessible through at least a door (22), said control means being driven with respective signals by a plurality of sensor means and being in turn adapted to drive the functional component parts of the apparatus in view of carrying out automatic evaporator defrost phases, said sensor means comprising a monitoring device (14) adapted to detect an open or closed condition of said door, said control means (17) being adapted to drive the functional component parts (6, 9, 10), in response to the signals received from said sensor means (12-16), so as to selectively determine the beginning of said defrost phases of the evaporator (7) according to a first or a second operating mode when said monitoring device (14) detects a substantially open or a substantially closed condition of the door (22) of said storage compartment (4), respectively, **characterized in that** said sensor means comprise at least a first probe (13) adapted to detect the contact temperature (Te) of the evaporator (7) at a refrigerant-gas inflow zone (19) thereof, in said substantially open condition of the door (22), the control means (17) being adapted to determine the beginning of said defrost phases upon they detecting, through the corresponding signal delivered by the first probe (13), the above cited temperature (Te) of the evaporator (7) to decrease at a faster rate than a pre-established value (S).

2. Automatic refrigeration apparatus, comprising at least a refrigerating circuit provided with at least an evaporator (7) and driven by control means (17) to cool down to a pre-set steady-state temperature at

least a storage compartment (4) accessible through at least a door (22), said control means being driven with respective signals by a plurality of sensor means and being in turn adapted to drive the functional component parts of the apparatus in view of carrying out automatic evaporator defrost phases, said sensor means comprising a monitoring device (14) adapted to detect an open or closed condition of said door, said control means (17) being adapted to drive the functional component parts (6, 9, 10), in response to the signals received from said sensor means (12-16), so as to selectively determine the beginning of said defrost phases of the evaporator (7) according to a first or a second operating mode when said monitoring device (14) detects a substantially open or a substantially closed condition of the door (22) of said storage compartment (4), respectively, **characterized in that** said sensor means comprise at least a first probe (13) adapted to detect the contact temperature (Te) of the evaporator (7) at a refrigerant-gas inflow zone (19), and at least a second probe (12), adapted to detect the temperature (Tc) in said storage compartment (4), in said substantially closed condition of the door (22), the control means (17) being adapted to determine the beginning of said defrost phases upon they detecting, through the corresponding signals delivered by the first and the second probe (13, 12), the difference between said temperature (Te) of the evaporator (7) and said temperature (Tc) in the storage compartment (4) to exceed a pre-established threshold value (D).

3. Automatic refrigeration apparatus according to any of the preceding claims, **characterized in that** said control means (17) are adapted to drive the functional component parts (6, 9, 10) so as to control said defrost phases of the evaporator (7) according to said first mode of operation, when the door (22) is substantially open, up to a certain period of time after the same door has been closed again, after which additional period of time the same control means (17) are then adapted to control said defrost phases according to said second mode of operation.

4. Automatic refrigeration apparatus, comprising at least a refrigerating circuit provided with at least an evaporator (7) and driven by control means (17) to cool down to a pre-set steady-state temperature at least a storage compartment (4) accessible through at least a door (22), said control means being driven with respective signals by a plurality of sensor means and being in turn adapted to drive the functional component parts of the apparatus in view of carrying out automatic evaporator defrost phases, said sensor means comprising a monitoring device (14) adapted to detect an open or closed condition of said door, said control means (17) being adapted to drive the functional component parts (6, 9, 10) , in response to the signals received from said sensor means (12-16), so as to selectively determine the beginning of said defrost phases of the evaporator (7) according to a first or a second operating mode when said monitoring device (14) detects a substantially open or a substantially closed condition of the door (22) of said storage compartment (4), respectively, **characterized in that** said sensor means comprise at least a first probe (13) adapted to detect the contact temperature (Te) of the evaporator (7) at a refrigerant-gas inflow zone (19) thereof, the control means (17) being adapted to determine the end of said defrost phases upon they detecting, through the corresponding signal delivered by said first probe (13), the above cited temperature (Te) of the evaporator (7) to exceed a pre-established threshold value (F).

Patentansprüche

1. Automatische Kühlvorrichtung, welche mindestens einen Kühlkreislauf umfasst, der mit mindestens einem Verdampfer (7) ausgestattet ist und von Steuerungsmitteln (17) angesteuert wird, um mindestens ein Aufbewahrungsfach (4), welches durch mindestens eine Tür (22) zugänglich ist, auf eine vorher eingestellte Dauerzustandstemperatur abzukühlen, wobei die besagten Steuerungsmittel durch zugehörige Signale von einer Anzahl von Sensormitteln angesteuert werden und ihrerseits so ausgelegt sind, dass sie die funktionellen Bestandteile der Vorrichtung dergestalt ansteuern, dass automatische Phasen zum Abtauen des Verdampfers ablaufen, wobei die besagten Sensormittel eine Überwachungsvorrichtung (14) umfassen, die so ausgelegt ist, dass sie den offenen oder geschlossenen Zustand der besagten Tür erkennen, wobei die besagten Steuerungsmittel (17) so ausgelegt sind, dass sie die funktionellen Bestandteile (6, 9, 10) als Reaktion auf die von den besagten Sensormitteln (12 - 16) aufgenommenen Signalen dergestalt ansteuern, dass sie auf selektive Weise den Beginn der besagten Abtauphasen des Verdampfers (7) gemäß einem ersten oder einem zweiten Betriebsmodus festlegen, wenn die besagte Überwachungsvorrichtung (14) einen im Wesentlichen offenen bzw. einen im Wesentlichen geschlossenen Zustand der Tür (22) des besagten Aufbewahrungsfachs (4) erkennt, **dadurch gekennzeichnet, dass** die besagten Sensormittel mindestens eine erste Sonde (13) umfassen, welche so ausgelegt ist, dass sie die Kontakttemperatur (Te) des Verdampfers (7) in seinem Kühlgas-Einströmbereich (19) bei besagtem, im Wesentlichen offenen Zustand der Tür (22) feststellt, wobei die Steuerungsmittel (17)

so ausgelegt sind, dass sie den Beginn der besagten Abtauphasen festlegen, sobald sie durch das entsprechende, von der ersten Sonde (13) gelieferte Signal erkennen, dass die oben angeführte Temperatur (Te) des Verdampfers (7) mit einer schnelleren Änderungsgeschwindigkeit als ein vorher festgelegter Wert (S) absinkt.

2. Automatische Kühlvorrichtung, welche mindestens einen Kühlkreislauf umfasst, der mit mindestens einem Verdampfer (7) ausgestattet ist und von Steuerungsmitteln (17) angesteuert wird, um mindestens ein Aufbewahrungsfach (4), welches durch mindestens eine Tür (22) zugänglich ist, auf eine vorher eingestellte Dauerzustandstemperatur abzukühlen, wobei die besagten Steuerungsmittel durch zugehörige Signale von einer Anzahl von Sensormitteln angesteuert werden und ihrerseits so ausgelegt sind, dass sie die funktionellen Bestandteile der Vorrichtung dergestalt ansteuern, dass automatische Phasen zum Abtauen des Verdampfers ablaufen, wobei die besagten Sensormittel eine Überwachungsvorrichtung (14) umfassen, die so ausgelegt ist, dass sie den offenen oder geschlossenen Zustand der besagten Tür erkennen, wobei die besagten Steuerungsmittel (17) so ausgelegt sind, dass sie die funktionellen Bestandteile (6, 9, 10) als Reaktion auf die von den besagten Sensormitteln (12 - 16) aufgenommenen Signalen dergestalt ansteuern, dass sie auf selektive Weise den Beginn der besagten Abtauphasen des Verdampfers (7) gemäß einem ersten oder einem zweiten Betriebsmodus festlegen, wenn die besagte Überwachungsvorrichtung (14) einen im Wesentlichen offenen bzw. einen im Wesentlichen geschlossenen Zustand der Tür (22) des besagten Aufbewahrungsfachs (4) erkennt, **dadurch gekennzeichnet, dass** die besagten Sensormittel mindestens eine erste Sonde (13) umfassen, welche so ausgelegt ist, dass sie die Kontakttemperatur (Te) des Verdampfers (7) in seinem Kühlgas-Einströmbereich (19) erkennt, sowie mindestens eine zweite Sonde (12), die so ausgelegt ist, dass sie die Temperatur (Tc) in dem besagten Aufbewahrungsfach (4) im besagten geschlossenen Zustand der Tür (22) erkennt, wobei die Steuerungsmittel (17) so ausgelegt sind, dass sie den Beginn der besagten Abtauphasen festlegen, sobald sie über die entsprechenden Signale, die von der ersten und der zweiten Sonde (13, 12) geliefert werden, feststellen, dass die Differenz zwischen der besagten Temperatur (Te) des Verdampfers (7) und der besagten Temperatur (Tc) im Aufbewahrungsfach (4) einen vorher eingestellten Schwellwert (D) übersteigt.

3. Automatische Kühlvorrichtung gemäß einem beliebigen der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die besagten Steuerungsmittel (17) so ausgelegt sind, dass sie die funktionellen Bestandteile (6, 9, 10) dergestalt ansteuern, dass die besagten Abtauphasen des Verdampfers (7) gemäß dem besagten ersten Betriebsmodus, wenn nämlich die Tür (22) im Wesentlichen geöffnet ist, über eine gewisse Zeitspanne, nachdem die Tür wieder geschlossen worden ist, gesteuert werden, wobei nach dieser zusätzliche Zeitspanne die Steuerungsmittel (17) dann so angepasst werden, dass sie die besagten Abtauphasen gemäß dem besagten zweiten Betriebsmodus steuern.

4. Automatische Kühlvorrichtung, welche mindestens einen Kühlkreislauf umfasst, der mit mindestens einem Verdampfer (7) ausgestattet ist und von Steuerungsmitteln (17) angesteuert wird, um mindestens ein Aufbewahrungsfach (4), welches durch mindestens eine Tür (22) zugänglich ist, auf eine vorher eingestellte Dauerzustandstemperatur abzukühlen, wobei die besagten Steuerungsmittel durch zugehörige Signale von einer Anzahl von Sensormitteln angesteuert werden und ihrerseits so ausgelegt sind, dass sie die funktionellen Bestandteile der Vorrichtung dergestalt ansteuern, dass automatische Phasen zum Abtauen des Verdampfers ablaufen, wobei die besagten Sensormittel eine Überwachungsvorrichtung (14) umfassen, die so ausgelegt ist, dass sie den offenen oder geschlossenen Zustand der besagten Tür erkennen, wobei die besagten Steuerungsmittel (17) so ausgelegt sind, dass sie die funktionellen Bestandteile (6, 9, 10) als Reaktion auf die von den besagten Sensormitteln (12 - 16) aufgenommenen Signalen dergestalt ansteuern, dass sie auf selektive Weise den Beginn der besagten Abtauphasen des Verdampfers (7) gemäß einem ersten oder einem zweiten Betriebsmodus festlegen, wenn die besagte Überwachungsvorrichtung (14) einen im Wesentlichen offenen bzw. einen im Wesentlichen geschlossenen Zustand der Tür (22) des besagten Aufbewahrungsfachs (4) erkennt, **dadurch gekennzeichnet, dass** die besagten Sensormittel mindestens eine erste Sonde (13) umfassen, welche so ausgelegt ist, dass sie die Kontakttemperatur (Te) des Verdampfers (7) an seinem Kühlgas-Einströmbereich (19) feststellen, wobei die Steuerungsmittel (17) so ausgelegt sind, dass sie das Ende der besagten Abtauphasen festlegen, sobald sie über das entsprechende Signal, das von der besagten ersten Sonde (13) geliefert wird, feststellen, dass die oben angegebene Temperatur (Te) des Verdampfers (7) einen vorher festgelegten Schwellwert (F) überschreitet.

Revendications

1. Dispositif de réfrigération automatique, comportant au moins un circuit réfrigérant muni d'au moins un

évaporateur (7) et entraîné par des moyens de commande (17) pour refroidir jusqu'à une température en régime permanent préétablie au moins un compartiment de stockage (4) accessible par l'intermédiaire d'au moins une porte (22), lesdits moyens de commande étant entraînés à l'aide de signaux respectifs par une pluralité de moyens capteurs et étant à leur tour adaptés pour entraîner les parties constituantes fonctionnelles du dispositif en vue d'effectuer des phases de décongélation d'évaporateur automatiques, lesdits moyens capteurs comportant un dispositif de surveillance (14) adapté pour détecter une condition ouverte ou fermée de ladite porte, lesdits moyens de commande (17) étant adaptés pour entraîner les parties constituantes fonctionnelles (6, 9, 10), en réponse aux signaux reçus depuis lesdits moyens capteurs (12-16), de manière à déterminer de façon sélective le début desdites phases de décongélation de l'évaporateur (7) conformément à un premier ou un second mode de fonctionnement lorsque ledit dispositif de surveillance (14) détecte une condition sensiblement ouverte ou sensiblement fermée de la porte (22) dudit compartiment de stockage (4), respectivement, **caractérisé en ce que** lesdits moyens capteurs comportent au moins une première sonde (13) adaptée pour détecter la température de contact (Te) de l'évaporateur (7) dans une zone d'admission de gaz réfrigérant (19) de celui-ci, dans ladite condition sensiblement ouverte de la porte (22), les moyens de commande (17) étant adaptés pour déterminer le début desdites phases de décongélation lorsqu'ils détectent, par l'intermédiaire du signal correspondant délivré par la première sonde (13), que la température citée ci-dessus (Te) de l'évaporateur (7) diminue à une vitesse plus rapide qu'une valeur préétablie (S).

2. Dispositif de réfrigération automatique, comportant au moins un circuit réfrigérant muni d'au moins un évaporateur (7) et entraîné par des moyens de commande (17) pour refroidir jusqu'à une température en régime permanent préétablie au moins un compartiment de stockage (4) accessible par l'intermédiaire d'au moins une porte (22), lesdits moyens de commande étant entraînés à l'aide de signaux respectifs par une pluralité de moyens capteurs et étant à leur tour adaptés pour entraîner les parties constituantes fonctionnelles du dispositif en vue d'effectuer des phases de décongélation d'évaporateur automatiques, lesdits moyens capteurs comportant un dispositif de surveillance (14) adapté pour détecter une condition ouverte ou de fermée de ladite porte, lesdits moyens de commande (17) étant adaptés pour entraîner les parties constituantes fonctionnelles (6, 9, 10), en réponse aux signaux reçus depuis lesdits moyens capteurs (12-16), de manière à déterminer de façon sélective le début desdites phases de décongélation de l'évaporateur (7) conformément à un premier ou un second mode de fonctionnement lorsque ledit dispositif de surveillance (14) détecte une condition sensiblement ouverte ou sensiblement fermée de la porte (22) dudit compartiment de stockage (4), respectivement, **caractérisé en ce que** lesdits moyens capteurs comportent au moins une première sonde (13), adaptée pour détecter la température de contact (Te) de l'évaporateur (7) dans une zone d'admission de gaz réfrigérant (19), et au moins une seconde sonde (12), adaptée pour détecter la température (Tc) dans ledit compartiment de stockage (4), dans ladite condition sensiblement fermée de la porte (22), les moyens de commande (17) étant adaptés pour déterminer le début desdites phases de décongélation lorsqu'ils détectent, par l'intermédiaire des signaux correspondants délivrés par la première et la seconde sonde (13, 12), que la différence entre ladite température (Te) de l'évaporateur (7) et ladite température (Tc) dans le compartiment de stockage (4) dépasse une valeur de seuil préétablie (D).

3. Dispositif de réfrigération automatique selon l'une quelconque des revendications précédentes, **caractérisé en ce que** lesdits moyens de commande (17) sont adaptés pour entraîner les parties constituantes fonctionnelles (6, 9, 10) de manière à commander lesdites phases de décongélation de l'évaporateur (7) conformément audit premier mode de fonctionnement, lorsque la porte (22) est sensiblement ouverte, jusqu'à une certaine période de temps après que cette même porte ait été fermée à nouveau, après laquelle période supplémentaire de temps, les mêmes moyens de commande (17) sont alors adaptés pour commander lesdites phases de décongélation conformément audit second mode de fonctionnement.

4. Dispositif de réfrigération automatique, comportant au moins un circuit réfrigérant muni d'au moins un évaporateur (7) et entraîné par des moyens de commande (17) pour refroidir jusqu'à une température en régime permanent préétablie au moins un compartiment de stockage (4) accessible par l'intermédiaire d'au moins une porte (22), lesdits moyens de commande étant entraînés à l'aide de signaux respectifs par une pluralité de moyens capteurs et étant à leur tour adaptés pour entraîner les parties constituantes fonctionnelles du dispositif en vue d'effectuer des phases de décongélation d'évaporateur automatiques, lesdits moyens capteurs comportant un dispositif de surveillance (14) adapté pour détecter une condition ouverte ou fermée de ladite porte, lesdits moyens de commande (17) étant adaptés pour entraîner les parties constituantes fonctionnelles (6, 9, 10), en réponse aux si-

gnaux reçus depuis lesdits moyens capteurs (12-16), de manière à déterminer de façon sélective le début desdites phases de décongélation de l'évaporateur (7) conformément à un premier ou un second mode de fonctionnement lorsque ledit dispositif de surveillance (14) détecte une condition sensiblement ouverte ou sensiblement fermée de la porte (22) dudit compartiment de stockage (4), respectivement, **caractérisé en ce que** lesdits moyens capteurs comportent au moins une première sonde (13) adaptée pour détecter la température de contact (Te) de l'évaporateur (7) dans une zone d'admission de gaz réfrigérant (19) de celui-ci, les moyens de commande (17) étant adaptés pour déterminer la fin desdites phases de décongélation lorsqu'ils détectent, par l'intermédiaire du signal correspondant délivré par ladite première sonde (13), que la température citée ci-dessus (Te) de l'évaporateur (7) dépasse une valeur de seuil préétablie (F).

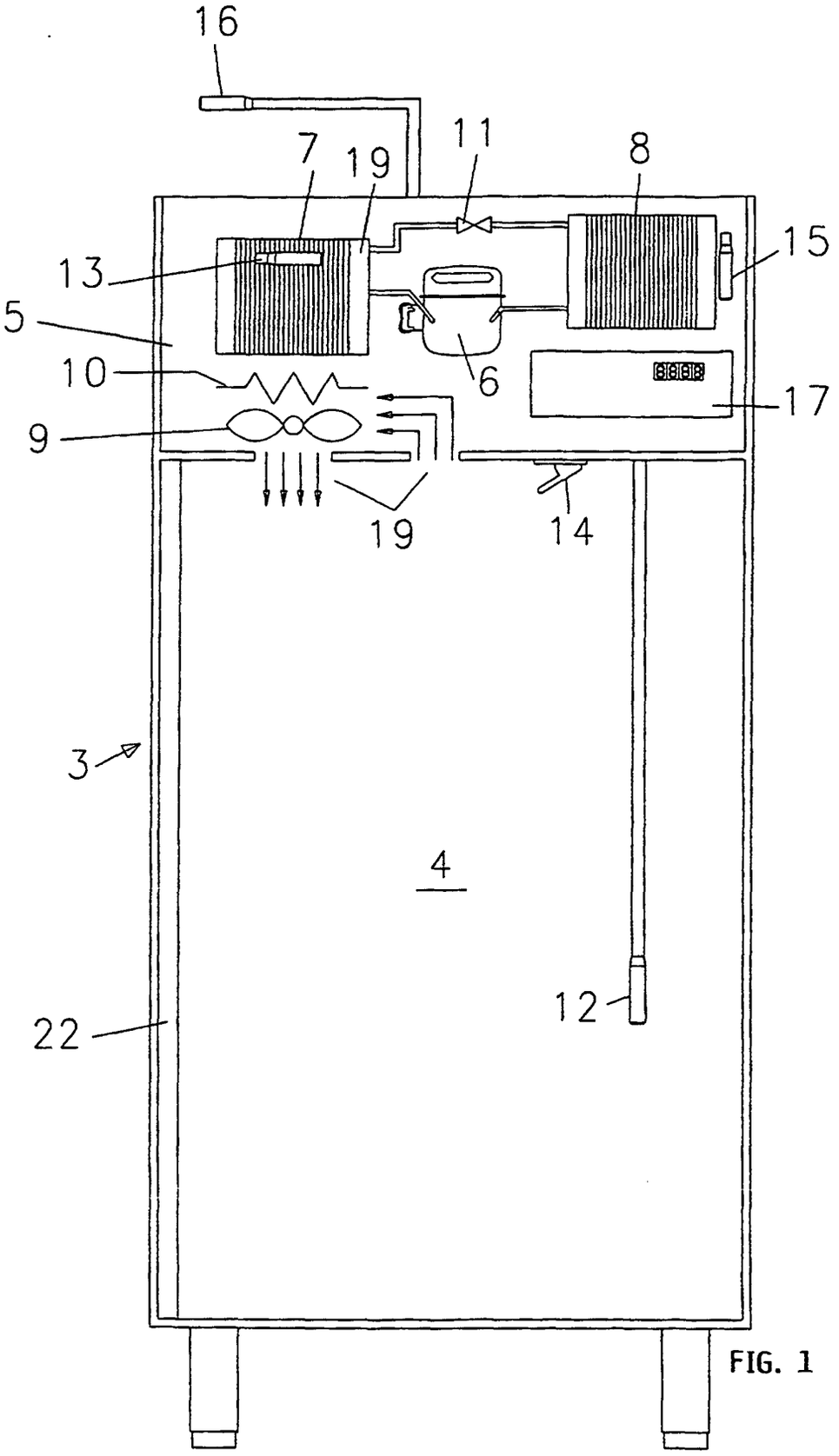


FIG. 1

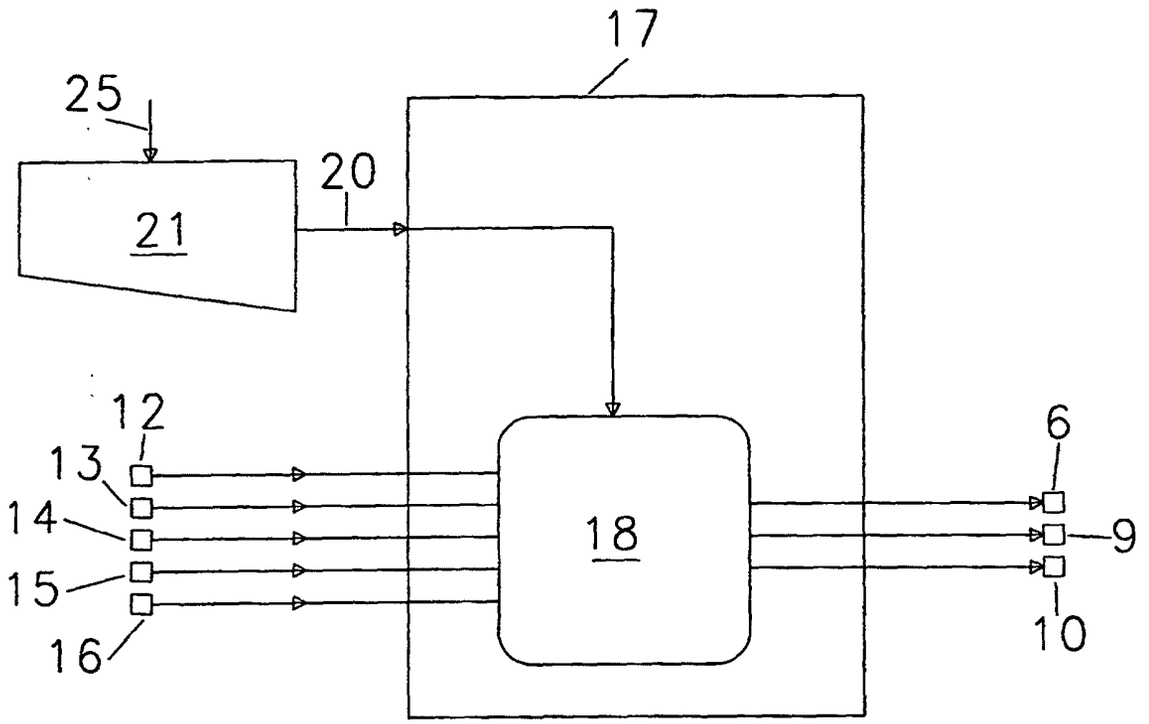


FIG. 2