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(54) **A COOLING DEVICE AND A CONTROL METHOD THEREOF**

KÜHLVORRICHTUNG UND STEUERVERFAHREN DAFÜR

DISPOSITIF DE REFROIDISSEMENT ET SON PROCEDE DE COMMANDE

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• **PATENT ABSTRACTS OF JAPAN vol. 2003, no. 12, 5 December 2003 (2003-12-05) & JP 2003 294354 A (SANYO ELECTRIC CO LTD), 15 October 2003 (2003-10-15)**
• **PATENT ABSTRACTS OF JAPAN vol. 2003, no. 06, 3 June 2003 (2003-06-03) & JP 2003 042645 A (MATSUSHITA REFRIG CO LTD), 13 February 2003 (2003-02-13)**

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EP 1 749 174 B1

Description

[0001] This invention relates to a cooling device and a control method thereof wherein means are provided for sterilizing by removing microorganisms in order to prevent the foodstuff placed therein from spoiling.

[0002] Foods left open are the most suitable media where microorganisms can live and reproduce. If proper cautions are not considered during preservation of foods, said microorganisms reproduce rapidly and cause foods to spoil and, as a result of spoiling bad odour is generated. Preserving foods in cooling devices makes the food to spoil in a longer period of time; however, still it is not possible to completely destroy the microorganisms that cause the mentioned spoiling. For that reason, in cooling devices, various ionizers are utilized in order for foods to be preserved in a more sterile medium purified from microorganisms by removing microorganisms in the surroundings of the cooling device or on foods placed inside the cooling device as much as possible from the interior of the cooling and / or freezing compartments where foods are preserved.

[0003] Ionizer is simply a device comprising a high voltage generator and at least one electrode connected to the said high voltage generator. It is a device wherein the amount of ions in the environment is increased by ionizing the air around the electrode as a result of the high voltage applied to the mentioned electrode by the high voltage generator and, microorganisms in the environment are destroyed as they are surrounded by aforementioned ions.

[0004] In cooling devices, ionizers are utilized to remove microorganisms (bacteria, virus, microbe etc.) out of the cooling device, which microorganisms are located on the foods placed inside and / or enter inside as the door of the cooling compartment or freezing compartment is opened and which shorten the preservation period of the foodstuff placed inside and cause the generation of bad odour as a result of the spoiling of said foodstuff. Ionizers are also frequently utilized, particularly in air conditioners.

[0005] In the current state of the art, in the Switzerland Patent Document CH 618346, a description is given of an ionizer located inside a cooling device to enhance the sterilizing effect, whereby it is achieved to increase the amount of negative ions in the air by applying high voltage to the electrodes.

[0006] In the current state of the art, in the German Patent Document DE 3105886, a description is given of an ionizer which is positioned in the air duct and is supplied with high voltage.

[0007] In the current state of the art, in the Japanese Patent Document JP 5149671, a description is given of a deodorizer which consists of an ion generator that is activated and deactivated with respect to the frequency of the opening and closing of the door of the cooling device.

[0008] In the current state of the art, in the Japanese

Patent Document JP 11347111, a description is given of an application wherein an ionizer the operation of which is controlled by means of an ion sensor and a fan are active when foods are placed to a special compartment where said ionizer is located and, the ionizer is activated periodically in order to reduce energy consumption. JP 2003 294354 A discloses a cooling device according to the preamble of claim 1 and a control method thereof.

[0009] The object of the present invention is the realization of a cooling device and a control method thereof wherein means are provided for removing microorganisms and sterilizing, in order to prevent the foodstuff placed therein from spoiling.

[0010] The cooling device designed to fulfill the objectives of the present invention is illustrated in the attached figures where:

Fig. 1 - is a schematic view of a cooling device.

Fig.2 - is the flow chart of a control method of a cooling device.

[0011] Parts shown in figures are numbered as follows:

1. Cooling device
2. Compartment
3. Compressor
4. Evaporator
5. Fan
6. Ionizer
7. Electrode
8. Door
9. Display
10. Input device
11. Control card
12. Air return duct

[0012] The cooling device (1), the object of the present invention, comprises a compressor (3) used to circulate the refrigerant in the refrigeration cycle by compressing, one or more than one compartment (2) where foods are placed inside in order to be cooled and / or frozen, at least one door (8) whereby the user can reach inside, an evaporator (4) whereby heat transfer between the refrigerant and the environment is achieved, an ionizer (6), comprising a high voltage generator and at least one electrode (7) connected to the said high voltage generator, which (6) is utilized to increase the amount of neg-

ative ions by ionizing the air around the electrode (7) as a result of the high voltage applied to the mentioned electrode (7) by the high voltage generator wherein microorganisms inside the air are destroyed as they are surrounded by the said negative ions, an air return duct (12) with one of its ends communicating with the compartment (2) and the other end communicating with a volume including the evaporator (4), wherein the ionizer (6) is positioned before the evaporator (4) with respect to the direction of the air flow and whereby the air, containing microorganisms is sucked, air is warmed as foods are cooled because of the heat transfer between the cold air blown into the compartment (2) and the items placed inside the said compartment (2) and, a fan (5) whereby moist warm air and the microorganisms that pass over the ionizer (6) and are captured by negative ions generated are directly routed onto the evaporator (4) wherein said microorganisms are prevented from returning to the interior of the compartment (2) (Figure 1).

[0013] Microorganisms which are surrounded by negative ions and stick onto the evaporator (4) are removed to the outside of the cooling device (1) through a defrost procedure.

[0014] The ionizer (6) incorporates a, preferably 5000 - 10000 DC V, high voltage generator which is supplied by the network voltage and which increases the network voltage and, an electrode (7) with one of its ends opening to the air return duct (12), preferably in a form with a cylindrical or needle end, connected to the outlet of the said high voltage generator. When high voltage is applied to the electrode (7), air molecules around the electrode (7) are ionized and the amount of the negative ions in the environment is increased.

[0015] Heat transfer occurs between the cold air which is cooled by means of the evaporator (4) and transferred into the compartment (2) by being blown by the fan (5) and the foodstuff placed inside the compartment (2) and, the air that is warmed as foods are cooled leaves the compartment (2) and enters the air return duct (12). As a result of the suction of the fan (5), the air passing over the foods and containing microorganisms passes over the electrode (7) positioned inside the air return duct (12). As the ionizer (6) operates, as a result of high voltage, an electric field is generated between the electrode (7) and the air around it and therefore, molecules inside the air (water etc.) dissociate into their ions and the amount of negative ions is increased in the air return duct (12) where the electrode (7) is placed. As a result, by surrounding the microorganisms inside the compartment (2) which are transferred to the air return duct (12) through the air current, said negative ions generated inside the air return duct (12) causes them either to die due to lack of air or to become heavier and precipitate.

[0016] In the afore-mentioned application, microorganisms surrounded by negative ions drift with the air flow velocity towards the evaporator (4) by passing through the air return duct (12). Moist warm air that returns from the compartment (2) after cooling the foods is

cooled again in the vicinity of the evaporator (4) and during this procedure, moist air thermally sticks to the surface of the evaporator (4) whereas microorganisms surrounded by negative ions stick electrically because the evaporator (4) is neutral. The moist air and microorganisms surrounded by negative ions that stick to the evaporator (4) freeze and, a frost layer is formed on the evaporator (4). Thereby since the microorganisms inside the compartment (2) stick onto the evaporator (4), it is achieved that the evaporator (4) functions as a trap for the said microorganisms and that the air that is cooled again on the said evaporator (4) is blown into the compartment (2) after it is cleaned. The frost layer which accumulates on the evaporator (4) and contains microorganisms surrounded by negative ions is then discharged to the outside of the cooling device (1) through a defrost procedure. Thereby, it is accomplished that microorganisms be captured in the air return duct (12) which obviously is a volume outside the compartment (2).

[0017] According to the present invention, the cooling device (1) comprises one or more than one input device (10) enabling the user to enter data and, a control card (11) used to control the ionizer (6) to operate with respect to the data entered through the input device (10). If large amounts of foods are loaded into the cooling device (1) and / or odorous foods are placed, the user may utilize the input device (10) to transfer time data to the control card (11) so as to change the operation intervals and operation period of the ionizer (6) enabling the control card (11) to activate the ionizer (6) with respect to the said periods. Thereby, it is achieved that the user may operate the ionizer (6) more frequently for a longer period of time.

[0018] To be able to describe the control method of a cooling device (1) the object of the present invention, following symbols are utilized :

$t_{\text{DOOR_ON/OFF}}$: is the number of the opening / closing of the compartment (2) door (8) by the user.

n : is the number of opening / closing of the compartment (2) door (8) necessary to operate the ionizer (6), determined by the manufacturer.

$t_{\text{ION_MAX}}$: is the predetermined maximum waiting time for the ionizer (6) to restart.

$t_{\text{ION_MIN}}$: is the predetermined minimum waiting time for the ionizer (6) to restart.

t_{ION} : is the predetermined operation period of the ionizer (6).

$t_{\text{ION_INPUT}}$: is the operation period of the ionizer (6) determined by the user.

$t_{\text{ION_INPUT_MIN}}$: is the minimum waiting time for the ionizer (6) to restart, determined by the user.

[0019] The input device (10) is positioned on the cooling device (1) and, as data is entered by means of the input device (10), through the control card (11), it is achieved that the ionizer (6) operates for a period ($t_{\text{ION_INPUT}}$) which is preferably longer than the pre-de-

terminated operation period (t_{ION}) and, that the minimum waiting time ($t_{ION_INPUT_MIN}$) for the ionizer (6) to restart is preferably shorter than the predetermined minimum waiting time (t_{ION_MIN}). As the periods (t_{ION_INPUT}) and ($t_{ION_INPUT_MIN}$) in this application started to be measured at the instant data entered may be the periods (t_{ION}) and (t_{ION_MIN}) determined by the manufacturer, they may also be periods changed by the user by means of the input device (10).

[0020] In the preferred embodiment of the present invention, the cooling device (1) comprises a display (9) which gets active when the ionizer (6) is activated. Thereby, whether the ionizer (6) is operating or not is shown to the user.

[0021] A control method is developed for both sterilizing the cooling device (1) in a most efficient manner and for minimizing the energy consumption by effectively operating the ionizer (6).

[0022] In the control method of the present invention, it is achieved that both energy is saved and the internal volume of the cooling device (1) is sterilized in a most effective manner by operating the ionizer (6) for certain periods of time determined with respect to the number of opening / closing of the compartment (2) door (8) and to the operation of the fan (5).

[0023] In the control method of the present invention, if the fan (5) is not operating, the ionizer (6) does not operate even when the minimum waiting time (t_{ION_MIN}) for the ionizer (6) to restart or the maximum waiting time (t_{ION_MAX}) for the ionizer (6) to restart are completed (Figure 2).

[0024] The cooling device (1) is operated with a control method comprising following steps;

- Measure the number ($f_{DOOR_ON/OFF}$) of opening / closing of the compartment (2) door (8) by the user during the minimum waiting time (t_{ION_MIN}) for the ionizer (6) to restart (101) and compare the number ($f_{DOOR_ON/OFF}$) of opening / closing of the door (8) with the predetermined number (n) of the opening / closing (102),
- If the number ($f_{DOOR_ON/OFF}$) of opening / closing of the door (8) during the minimum waiting time (t_{ION_MIN}) for the ionizer (6) to restart is equal to or smaller than the predetermined number (n) of the opening / closing ($f_{DOOR_ON/OFF} \leq n$), meaning that the door (8) is opened and closed at infrequent intervals, decide to operate the ionizer (6) at the end of the predetermined maximum waiting time (t_{ION_MAX}) of the ionizer (6) (103),
- If the number ($f_{DOOR_ON/OFF}$) of opening / closing of the door (8) is larger than the predetermined number (n) of the opening / closing ($f_{DOOR_ON/OFF} > n$), meaning that the door (8) is opened and closed at frequent intervals, decide to operate the ionizer (6) at the end of the predetermined minimum waiting time (t_{ION_MIN}) of the ionizer (6) (104),
- Check whether the fan (5) is operating in order to

apply the afore-mentioned steps (103 and 104) wherein decisions are given concerning the operation of the ionizer (6) (105),

- If the fan (5) is not operating, wait until the fan (5) operates in order to apply the decisions concerning the operation of the ionizer (6) (106),
- If the fan (5) is operating or after waiting until the fan (5) operates, operate the ionizer (6) for the predetermined operation period (t_{ION}) of the ionizer (6) as long as the fan (5) is operating (107),
- At the same time, check whether the predetermined operation period (t_{ION}) of the ionizer (6) is completed (108),
- If the predetermined operation period (t_{ION}) of the ionizer (6) is completed, stop the operation of the ionizer (6) (109),
- If the predetermined operation period (t_{ION}) of the ionizer (6) is not completed, check whether the door (8) is opened and / or the fan (5) is operating during that time (110),
- If the door (8) is not opened and / or the fan (5) does not stop, go back to the step (107) wherein the ionizer (6) is operated,
- If the door (8) is opened and / or the fan (5) stops, stop the operation of the ionizer (6) (111),
- Save the time of the operation of the ionizer (6) in the memory (112),
- Check whether the door (8) is closed and the fan (5) is operating (113),
- If the door (8) is not closed and the fan (5) is not operating, go back to the step (112) wherein the time of the operation of the ionizer (6) is saved in the memory,
- If the door (8) is closed and the fan (5) is operating, go back to the step (107) wherein the ionizer (6) is operated.

[0025] By means of the cooling device (1), object of the present invention, by removing the microorganisms inside the cooling device (1) to the outside of the cooling device (1), it is achieved that foods are cooled in a sterile medium, for a longer period without spoiling.

Claims

1. A cooling device (1) comprising

- a compressor (3) used to circulate the refrigerant in the refrigeration cycle by compressing,
- one or more than one compartment (2) where foods are placed inside in order to be cooled and / or frozen,
- at least one door (8) whereby the user can reach inside,
- an evaporator (4) whereby heat transfer between the refrigerant and the environment is achieved,

- an ionizer (6), comprising a high voltage generator and at least one electrode (7) connected to the said high voltage generator, which (6) is utilized to increase the amount of negative ions by ionizing the air around the electrode (7) as a result of the high voltage applied to the mentioned electrode (7) by the high voltage generator wherein microorganisms inside the air are destroyed as they are surrounded by the said negative ions,

an air return duct (12) with one of its ends communicating with the compartment (2) and the other end communicating with a volume including the evaporator (4), wherein the ionizer (6) is positioned before the evaporator (4) with respect to the direction of the air flow and whereby air is sucked and, by a fan (5) whereby moist warm air and the microorganisms, which pass over the ionizer (6) and are captured by negative ions generated, are directly routed onto the evaporator (4) wherein said microorganisms are prevented from returning to the interior of the compartment (2), **characterized in that** it further comprises a control card (11) for controlling the ionizer (6), an input device (10) by means of which the user may enter data concerning the operation intervals and operation period of the ionizer (6) according to the amount and type of the food loaded and **in that** said control card (11) operates the ionizer (6) with respect to the mentioned operation intervals and operation periods and in such a way that the ionizer (6) does not operate, if the fan (5) is not operating, even when the minimum waiting time ($t_{\text{ION_MIN}}$) for the ionizer (6) to restart or the maximum waiting time ($t_{\text{ION_MAX}}$) for the ionizer (6) to restart are completed.

2. A cooling device (1) as described in Claims 1, **characterized by** an ionizer (6) comprising one or more than one electrode (7) in cylindrical form.

3. A cooling device (1) as described in Claims 1 or 2, **characterized by** a display (9) which gets active as the ionizer (6) is activated, whereby whether the ionizer (6) is operating or not is shown to the user.

4. A control method for a cooling device (1) as described in any one of the above Claims, comprising following steps;

- Measure the number ($f_{\text{DOOR_ON/OFF}}$) of opening / closing of the compartment (2) door (8) by the user during the minimum waiting time ($t_{\text{ION_MIN}}$) for the ionizer (6) to restart (101) and compare the number ($f_{\text{DOOR_ON/OFF}}$) of opening / closing of the door (8) with the predetermined number (n) of the opening / closing (102),
- If the number ($f_{\text{DOOR_ON/OFF}}$) of opening / closing of the door (8) during the minimum waiting

time ($t_{\text{ION_MIN}}$) for the ionizer (6) to restart is equal to or smaller than the predetermined number (n) of the opening / closing ($f_{\text{DOOR_ON/OFF}} \leq n$), meaning that the door (8) is opened and closed at infrequent intervals, decide to operate the ionizer (6) at the end of the predetermined maximum waiting time ($t_{\text{ION_MAX}}$) of the ionizer (6) (103),

- If the number ($f_{\text{DOOR_ON/OFF}}$) of opening / closing of the door (8) is larger than the predetermined number (n) of the opening / closing ($f_{\text{DOOR_ON/OFF}} > n$), meaning that the door (8) is opened and closed at frequent intervals, decide to operate the ionizer (6) at the end of the predetermined minimum waiting time ($t_{\text{ION_MIN}}$) of the ionizer (6) (104),

- Check whether the fan (5) is operating in order to apply the afore-mentioned steps (103 and 104) wherein decisions are given concerning the operation of the ionizer (6) (105),

- If the fan (5) is not operating, wait until the fan (5) operates in order to apply the decisions concerning the operation of the ionizer (6) (106),

- If the fan (5) is operating or after waiting until the fan (5) operates, operate the ionizer (6) for the predetermined operation period (t_{ION}) of the ionizer (6) as long as the fan (5) is operating (107),

- At the same time, check whether the predetermined operation period (t_{ION}) of the ionizer (6) is completed (108),

- If the predetermined operation period (t_{ION}) of the ionizer (6) is completed, stop the operation of the ionizer (6) (109),

- If the predetermined operation period (t_{ION}) of the ionizer (6) is not completed, check whether the door (8) is opened and / or the fan (5) is operating during that time (110),

- If the door (8) is not opened and / or the fan (5) does not stop, go back to the step (107) wherein the ionizer (6) is operated,

- If the door (8) is opened and / or the fan (5) stops, stop the operation of the ionizer (6) (111),

- Save the time of the operation of the ionizer (6) in the memory (112),

- Check whether the door (8) is closed and the fan (5) is operating (113),

- If the door (8) is not closed and the fan (5) is not operating, go back to the step (112) wherein the time of the operation of the ionizer (6) is saved in the memory,

- If the door (8) is closed and the fan (5) is operating, go back to the step (107) wherein the ionizer (6) is operated.

Patentansprüche

1. Kühlvorrichtung (1) umfassend

- einen Kompressor (3), der verwendet ist, um das Kältemittel in dem Kühlkreislauf durch Komprimieren umzuwälzen,
- ein oder mehr als ein Fach (2) in dem Lebensmittel zum Abkühlen und / oder zum Gefrieren gelagert sind,
- mindestens eine Tür (8), durch die der Benutzer hineingreifen kann,
- einen Verdampfer (4), durch den Wärmeübertragung zwischen dem Kältemittel und die Umgebung erfolgt,
- einen Ionisator (6) umfassend einen Hochspannungsgenerator und mindestens eine Elektrode (7), die mit dem Hochspannungsgenerator verbunden ist, der (6) verwendet ist, um die Menge an negativen Ionen in der Luft um die Elektrode (7) durch Ionisierung infolge der Hochspannung zu erhöhen, die der Elektrode (7) durch die Hochspannungsgenerator aufgebracht ist, wobei Mikroorganismen in der Luft zerstört sind, wenn sie von den negativen Ionen umgeben sind,

einen Luftrückführkanal (12), der mit einem seinen Enden mit dem Fach (2) und mit dem anderen Ende mit einem Volumen umfassend den Verdampfer (4) in Verbindung steht, wobei der Ionisator (6) vor dem Verdampfer (4) in Bezug auf die Richtung der Luftströmung positioniert ist und wobei Luft angesaugt ist und durch einen Ventilator (5), wobei feuchte warme Luft und die Mikroorganismen, die über den Ionisator (6) passieren und von negativen Ionen aufgenommen werden, direkt auf den Verdampfer (4) geleitet werden wobei verhindert ist, dass die Mikroorganismen in das Innere des Fachs (2) zurückkehren,

dadurch gekennzeichnet, dass sie ferner folgendes umfasst

eine Steuerkarte (11) zum Steuern des Ionisators (6),
 eine Eingabeeinrichtung (10), durch die der Benutzer Daten über Betriebsintervalle und Betriebszeit des Ionisators (6) gemäß der Menge und Art der geladene Lebensmittel und dadurch, dass die Steuerkarte (11) den Ionisator (6) in Bezug auf die erwähnten Betriebsintervalle und Betriebszeiten betätigt und derart, dass der Ionisator (6) nicht arbeitet, wenn der Ventilator (5) nicht in Betrieb ist, auch wenn die Mindestwartezeit (T_{ION_MIN}) für den Ionisator (6) neu startet oder die maximale Wartezeit (T_{ION_MAX}) für der Ionisator (6) zum Neustart abgeschlossen ist.

2. Kühlvorrichtung (1) nach Anspruch 1 **gekennzeichnet durch** einen Ionisator (6), umfassend eine oder

mehr als eine Elektrode (7), in Form eines Zylinders.

3. Kühlvorrichtung (1) nach Anspruch 1 oder 2, **gekennzeichnet durch** eine Anzeige (9) die sich aktiviert, sofern der Ionisator (6) aktiviert ist, der dem Benutzer zeigt, ob der Ionisator (6) im Betrieb ist oder nicht.

4. Steuerungsmethode für eine Kühlvorrichtung (1) nach einem der vorangehenden Ansprüche mit folgenden Schritte:

- Die Anzahl ($f_{DOOR_ON/OFF}$) des Öffnens / Schließens der Tür (8) des Fachs (2) durch den Benutzer während der Mindestwartezeit (T_{ION_MIN}) messen, damit der Ionisator (6) neu startet (101) und die Anzahl ($f_{DOOR_ON/OFF}$) des Öffnens / Schließens der Tür (8) mit der vorbestimmten Anzahl (n) des Öffnens / Schließens (102) vergleichen,
- Wenn die Anzahl ($f_{DOOR_ON/OFF}$) des Öffnens / Schließens der Tür (8) während der Mindestwartezeit (T_{ION_MIN}) gleich oder kleiner als eine vorbestimmte Anzahl (n) des Öffnens/ Schließens ($f_{DOOR_ON/OFF} \leq n$) ist, das heißt, dass die Tür (8) in unregelmäßigen Intervallen geöffnet und geschlossen ist, beschließen, den Ionisator (6) am Ende der vorbestimmten maximalen Wartezeit (T_{ION_MAX}) des Ionisators (6) zu betreiben (103),
- Wenn die Anzahl ($f_{DOOR_ON/OFF}$) des Öffnens/ Schließens der Tür (8) größer als die vorbestimmte Anzahl (n) des Öffnens/ Schließens ($f_{DOOR_ON/OFF} > n$) ist, das heißt, dass die Tür (8) in unregelmäßigen Intervallen geöffnet und geschlossen ist, beschließen, den Ionisator (6) am Ende der vorbestimmten maximalen Wartezeit (T_{ION_MAX}) des Ionisators (6) zu betreiben (104),
- Überprüfen ob der Ventilator (5) im Betrieb ist, um die oben erwähnten Schritte (103 und 104) anzuwenden, in denen Entscheidungen bezüglich des Betriebs des Ionisators (6) getroffen sind (105),
- Wenn der Ventilator (5) nicht im Betrieb ist, warten, bis der Ventilator (5) arbeitet, um die Entscheidungen bezüglich des Betriebs des Ionisators (6) zu treffen (106),
- Wenn der Ventilator (5) im Betrieb ist oder nach dem Warten, bis der Ventilator (5) in Betrieb ist, den Ionisator (6) für die vorbestimmte Betriebszeit (t_{ION}) des Ionisators (6) betätigen, solange der Ventilator (5) in Betrieb ist (107)
- Zugleich überprüfen, ob die vorbestimmte Betriebszeit (t_{ION}) des Ionisators (6) abgeschlossen ist (108),
- Wenn die vorbestimmte Betriebszeit (t_{ION}) des Ionisators (6) abgeschlossen ist, den Betrieb

des Ionisateurs (6) anhalten (109),

- Wenn die vorbestimmte Betriebszeit (t_{ION}) des Ionisateurs (6) nicht abgeschlossen ist, überprüfen, ob die Tür (8) geöffnet ist und/oder der Ventilator (5) in der Zeit im Betrieb ist (110), 5
- Wenn die Tür (8) nicht geöffnet ist und / oder der Ventilator (5) nicht anhält, zum Schritt (107) zurückgehen, in dem der Ionisator (6) betrieben ist,
- Wenn die Tür (8) geöffnet ist und/ oder der Ventilator (5) anhält, Anhalten des Betriebes des Ionisateurs (6) (111), 10
- Die Betriebszeit des Ionisateurs (6) im Speicher (112) speichern,
- Überprüfen, ob die Tür (8) geschlossen sind und der Ventilator (5) im Betrieb ist (113), 15
- Wenn die Tür (8) nicht geschlossen ist und / oder der Ventilator (5) nicht im Betrieb ist, zum Schritt (112) zurückgehen, in dem der Ionisator (6) im Speicher gespeichert ist, 20
- Wenn die Tür (8) geschlossen ist und / oder der Ventilator (5) im Betrieb ist, zum Schritt (107) zurückgehen, in dem der Ionisator (6) im Betrieb ist.

Revendications

1. Dispositif de refroidissement (1) comprenant:

- un compresseur (3) utilisé pour faire circuler le réfrigérant dans le cycle de réfrigération en le comprimant,
- un ou plusieurs compartiments (2) où les aliments sont placés à l'intérieur pour être refroidis et / ou congelés,
- au moins une porte (8) par laquelle l'utilisateur peut atteindre l'intérieur,
- un évaporateur (4) par lequel le transfert de chaleur entre le réfrigérant et l'environnement est réalisé, 40
- un ioniseur (6) comprenant un générateur haute tension et au moins une électrode (7) connectée audit générateur haute tension, lequel ioniseur (6) est utilisé pour augmenter la quantité d'ions négatifs en ionisant l'air autour de l'électrode (7) en raison de la haute tension appliquée à l'électrode mentionnée (7) par le générateur haute tension dans lequel les microorganismes à l'intérieur sont détruits comme ils sont entourés par lesdits ions négatifs, 50

un conduit de retour d'air (12) avec l'une de ses extrémités communiquant avec le compartiment (2) et l'autre extrémité communiquant avec un volume 55 comprenant l'évaporateur (4), dans lequel l'ioniseur (6) est positionné avant l'évaporateur (4) par rapport à la direction du flux d'air et par lequel de l'air est

aspiré et, par un ventilateur (5) dans lequel l'air chaud humide et les microorganismes, qui passent au-dessus de l'ioniseur (6) et sont captés par les ions négatifs générés, sont directement acheminés sur l'évaporateur (4), empêchant ces microorganismes de retourner à l'intérieur le compartiment (2), **caractérisé en ce qu'il** comprend en outre une carte de contrôle (11) pour commander l'ioniseur (6), un dispositif d'entrée (10) au moyen duquel l'utilisateur peut entrer des données concernant les intervalles de fonctionnement et la période de fonctionnement de l'ioniseur (6) en fonction de la quantité et du type de l'aliment chargé et **en ce que** ladite carte de contrôle (11) actionne l'ioniseur (6) par rapport aux intervalles de fonctionnement et périodes de fonctionnement mentionnés et de telle manière que l'ioniseur (6) ne fonctionne pas, si le ventilateur (5) ne fonctionne pas, lorsque le temps d'attente minimum (t_{ION_MIN}) pour redémarrer l'ioniseur (6) ou que le temps d'attente maximum (t_{ION_MAX}) pour redémarrer l'ioniseur (6) est terminé.

2. Dispositif de refroidissement (1) selon la revendication 1, **caractérisé par** un ioniseur (6) comprenant une ou plusieurs électrodes (7) sous forme cylindrique.

3. Dispositif de refroidissement (1) selon les revendications 1 ou 2, **caractérisé par** un affichage (9) qui devient actif lorsque l'ioniseur (6) est activé, ce qui permet de voir si l'ioniseur (6) fonctionne ou non.

4. Procédé de commande pour un dispositif de refroidissement (1) tel que décrit dans l'une quelconque des revendications précédentes, comprenant les étapes suivantes;

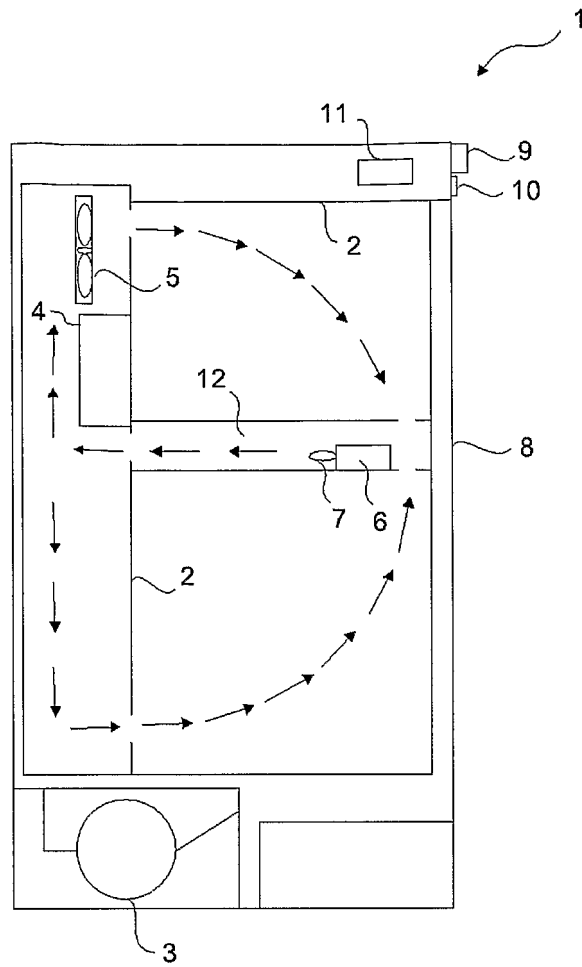
- Mesurer le nombre ($f_{DOOR_ON / OFF}$) d'ouverture / fermeture de la porte (8) du compartiment (2) par l'utilisateur pendant le temps d'attente minimum (t_{ION_MIN}) pour que l'ioniseur (6) redémarre (101) et comparer le nombre ($f_{DOOR_ON / OFF}$) d'ouverture / fermeture de la porte (8) avec le nombre prédéterminé (n) de l'ouverture / fermeture (102),
- Si le nombre ($f_{DOOR_ON / OFF}$) d'ouverture / fermeture de la porte (8) pendant le temps d'attente minimum (t_{ION_MIN}) pour le redémarrage de l'ioniseur (6) est égal ou inférieur au nombre prédéterminé (n) de l'ouverture / fermeture ($f_{DOOR_ON / OFF} \leq n$), ce qui signifie que la porte (8) est ouverte et fermée à des intervalles peu fréquents, décidez de faire fonctionner l'ioniseur (6) à la fin du temps d'attente maximum prédéterminé (t_{ION_MAX}) de l'ioniseur (6) (103),
- Si le nombre ($f_{DOOR_ON / OFF}$) d'ouverture / fermeture de la porte (8) est supérieur au nombre

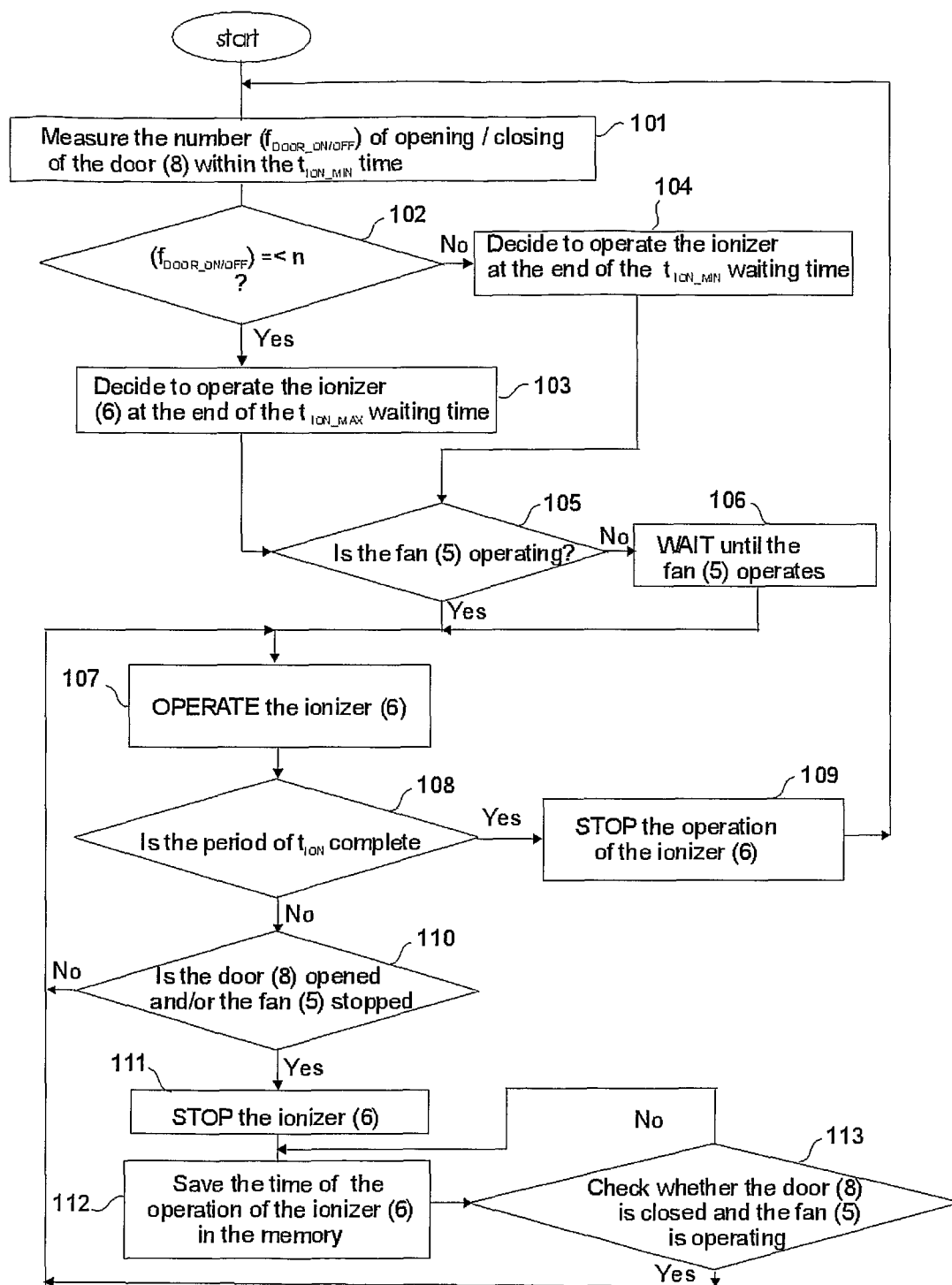
prédéterminé (n) de l'ouverture / fermeture ($f_{\text{DOOR_ON/OFF}} > n$), ce qui signifie que la porte (8) est ouverte et fermée à des intervalles fréquents, décidez de faire fonctionner l'ioniseur (6) à la fin du temps d'attente minimum prédéterminé ($t_{\text{ION_MIN}}$) de l'ioniseur (6) (104), 5

- Vérifier si le ventilateur (5) fonctionne pour appliquer les étapes précitées (103 et 104) dans lesquelles sont prises des décisions concernant le fonctionnement de l'ioniseur (6) (105), 10
- Si le ventilateur (5) ne fonctionne pas, attendez que le ventilateur (5) fonctionne pour appliquer les décisions concernant le fonctionnement de l'ioniseur (6) (106),
- Si le ventilateur (5) fonctionne ou après avoir attendu que le ventilateur (5) fonctionne, actionner l'ioniseur (6) pendant la période de fonctionnement prédéterminée (t_{ION}) de l'ioniseur (6) tant que le ventilateur (5) fonctionne (107), 15
- En même temps, vérifier si la période de fonctionnement prédéterminée (t_{ION}) de l'ioniseur (6) est terminée (108), 20
- Si la période de fonctionnement prédéterminée (t_{ION}) de l'ioniseur (6) est terminée, arrêter le fonctionnement de l'ioniseur (6) (109), 25
- Si la période de fonctionnement prédéterminée (t_{ION}) de l'ioniseur (6) n'est pas terminée, vérifier si la porte (8) est ouverte et / ou si le ventilateur (5) fonctionne pendant ce temps (110),
- Si la porte (8) n'est pas ouverte et / ou si le ventilateur (5) ne s'arrête pas, revenir à l'étape (107) dans laquelle l'ioniseur (6) est actionné, 30
- Si la porte (8) est ouverte et / ou le ventilateur (5) s'arrête, arrêter le fonctionnement de l'ioniseur (6) (111), 35
- Sauvegarder le temps de fonctionnement de l'ioniseur (6) dans la mémoire (112),
- Vérifier si la porte (8) est fermée et si le ventilateur (5) fonctionne (113),
- Si la porte (8) n'est pas fermée et que le ventilateur (5) ne fonctionne pas, revenir à l'étape (112) dans laquelle le temps de fonctionnement de l'ioniseur (6) est sauvegardé dans la mémoire, 40
- Si la porte (8) est fermée et que le ventilateur (5) fonctionne, retourner à l'étape (107) dans laquelle l'ioniseur (6) est actionné. 45

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REFERENCES CITED IN THE DESCRIPTION

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