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(54) **A REFRIGERATION CABINET SYSTEM AND A CONTROL METHOD THEREOF**

KÜHLSCHRANKSYSTEM UND STEUERVERFAHREN DAFÜR

SYSTÈME D'ARMOIRE DE RÉFRIGÉRATION ET PROCÉDÉ DE CONTRÔLE ASSOCIÉ

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to an improved refrigeration cabinet system and an improved method for controlling a refrigeration cabinet system.

BACKGROUND OF THE INVENTION

[0002] Refrigeration cabinets (refrigerators) are often used in various large supermarket, convenience stores or bakeries to preserve foods such as dairy products, beverages or bread. The refrigerators can be divided into a refrigerated display cabinet with remote condensing units (hereinafter referred to as a split cabinet) and a commercial refrigerator with self-contained condensing units (hereinafter referred to as an integrated cabinet). The integrated cabinet includes a compressor, a condenser and an evaporator that are integrated together, and the split cabinet includes an outdoor unit and one or more indoor units, wherein the compressor and the condenser are disposed in the outdoor unit, and the evaporator is disposed in each of the indoor units. In general, the operation of the refrigerator may cause the evaporators to frost, and the refrigeration system has a defrost mode to melt the frost condensed in the evaporators.

SUMMARY OF THE INVENTION

[0003] The object of the present invention is to solve or at least alleviate the problems in the related art.

[0004] According to the invention, a refrigeration cabinet system is provided as defined by appended independent claim 1.

[0005] The controller changes the operating frequency of the inverter compressor based on the pressure information to control the pressure on the suction side of the inverter compressor to be within a certain range, thereby maintaining a saturated evaporation temperature of each indoor unit to be within a range of -1.5°C to $+1.5^{\circ}\text{C}$.

[0006] In some embodiments of the refrigeration cabinets system, the controller changes the operating frequency of the inverter compressor based on the pressure information to control the pressure on the suction side of the inverter compressor to be within a range of $P1$ to $P2$, wherein $P1+\Delta P$ corresponds to the pressure of saturated refrigerant at a temperature of -1.5°C , and $P2+\Delta P$ corresponds to the pressure of the saturated refrigerant at a temperature of $+1.5^{\circ}\text{C}$, and wherein ΔP is a pressure correction value.

[0007] In some embodiments of the refrigeration cabinets system, the pressure correction value ΔP is determined based on field tests or depends on the lengths of the pipelines from the indoor unit outlets to the outdoor unit inlet.

[0008] In some embodiments of the refrigeration cabinets system, the refrigeration cabinets system includes

a plurality of indoor units, and length differences of the pipelines from each of the indoor unit outlets to the outdoor unit inlet range from -20% to $+20\%$.

[0009] In some embodiments of the refrigeration cabinets system, the evaporator of at least one of the indoor units is located above or below the display cabinet, and a fin density of the evaporator is in a range of 6-14 FPI, and/or the evaporator of at least one of the indoor units is located behind the display cabinet, and a fin density of the evaporator is in a range of 3-8 FPI.

[0010] In some embodiments of the refrigeration cabinets system, the indoor units do not have a defrost mode.

[0011] Also, an inventive method for controlling a refrigeration cabinets system is provided, which is defined by appended independent claim 7 and which is to be used in the refrigeration cabinets system according to the embodiments, wherein the method includes:

collecting pressure information on a suction side of an inverter compressor; and
changing an operating frequency of the inverter compressor based on the pressure information to control the pressure on the suction side of the inverter compressor to be within a certain range, thereby maintaining a saturated evaporation temperature of each indoor unit to be within a range of -1.5°C to $+1.5^{\circ}\text{C}$.

[0012] In some embodiments, the method includes: changing the operating frequency of the inverter compressor based on the pressure information to control the pressure on the suction side of the inverter compressor to be within a range of $P1$ to $P2$, wherein $P1+\Delta P$ corresponds to the pressure of saturated refrigerant at a temperature of -1.5°C , and $P2+\Delta P$ corresponds to the pressure of the saturated refrigerant at a temperature of $+1.5^{\circ}\text{C}$, and wherein ΔP is a pressure correction value.

[0013] In some embodiments, the pressure correction value ΔP is determined based on field tests or depends on the lengths of the pipelines from the indoor unit outlets to the outdoor unit inlet.

[0014] In some embodiments, the method includes: controlling length differences of the pipelines from each of the indoor unit outlets to the outdoor unit inlet to be within a range from -20% to $+20\%$; and

in some embodiments, the method includes: disposing the evaporators below or above the display cabinet and setting a fin density of the evaporators in a range of 6-14 FPI, and/or disposing the evaporators behind the display cabinet and setting a fin density of the evaporators in a range of 3-8 FPI.

[0015] The refrigeration cabinets system and the control method according to the embodiments of the present disclosure improve the efficiency of the refrigeration cabinets system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The contents of the present disclosure will be-

come easier to understand with reference to the accompanying drawings. It can be easily understood by those skilled in the art that the drawings are merely used for illustration, and are not intended to limit the scope of protection of the present disclosure. In addition, like parts are denoted by like numerals in the drawings, wherein:

FIG. 1 shows a schematic view of a refrigeration cabinets system according to an embodiment of the present disclosure; and

FIG. 2 shows a schematic structural view of a refrigeration cabinets system according to an embodiment of the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENT(S) OF THE INVENTION

[0017] It can be easily understood that according to the technical solutions of the present disclosure, without changing the essential spirit of the present disclosure, those skilled in the art can propose a variety of mutually replaceable structural modes and implementations. Therefore, the following specific embodiments and the accompanying drawings are merely exemplary illustrations of the technical solutions of the present disclosure, and should not be regarded as the entirety of the present disclosure or as definitions or limitations to the technical solutions of the present disclosure.

[0018] The orientational terms that have been mentioned or might be mentioned in this specification, such as "upper", "lower", "left", "right", "front", "rear", "front side", "back side", "top", "bottom", etc., are defined relative to the configurations shown in the drawings. They are relative concepts, so they may change accordingly according to their different locations and different states of use. Therefore, these or other orientational terms should not be interpreted as restrictive terms.

[0019] With reference to FIGS. 1 and 2, a refrigeration cabinets system according to an embodiment of the present disclosure is provided, which can be used in large supermarkets, convenience stores, cake shops, etc. The refrigeration cabinets system includes: one or more indoor units 21, 22, 23, an outdoor unit 1, and a pipeline 3 connecting the indoor units 21, 22 and 23 with the outdoor unit 1. The one or more indoor units 21, 22, 23 may be in the form of a cabinet, and they may respectively include: indoor unit inlets 211, 221, indoor unit outlets 212, 222, expansion valves 213, 223 between the indoor unit inlets 211, 221 and the indoor unit outlets 212, 222, such as thermal expansion valves or electronic expansion valves, evaporators 214, 224 downstream of the expansion valves 213, 223, and a display cabinet cooled by the evaporators 214, 224. The display cabinet may be open or closed, the food in it is cooled by the evaporators, and the display cabinet is used to place and display the food. In general, the display cabinet may be located above or below the evaporators. The outdoor unit 1 includes: an outdoor unit inlet 11, an outdoor unit outlet 12,

an inverter compressor 15 between the outdoor unit inlet 11 and the outdoor unit outlet 12, a pressure sensor 13 on an inlet side of the inverter compressor 15, a condenser 16 downstream of the inverter compressor 15, and a controller 14 for controlling an operating frequency of the inverter compressor 15. The outdoor unit outlet 12 is connected to each indoor unit inlet 211, 221 through a pipeline 31, and each indoor unit outlet 212, 222 is connected to the outdoor unit inlet 11 through pipelines 321, 322. In various embodiments of the present disclosure, the controller 14 is connected to the pressure sensor 13 to obtain pressure information of fluid on the inlet side of the inverter compressor 15, and the controller 14 changes the compressor frequency based on the pressure information to control the pressure at the outdoor unit inlet to be within a certain range, thereby controlling a saturated evaporation temperature of each indoor unit to be within a range of -1.5°C to $+1.5^{\circ}\text{C}$. According to the embodiment of the present disclosure, by changing the compressor frequency, the pressure on the inlet side of the compressor is controlled to be within a certain range, so that the temperature at the outlets of the evaporators are controlled to be within a range of -1.5°C to $+1.5^{\circ}\text{C}$, thereby avoiding frosting in the evaporators and ensuring the preservation temperature of the food is stable. In addition, since the evaporators do not frost, there is no need to configure a defrost mode for the evaporators, which can improve the energy efficiency of the entire system. In addition, since the evaporators do not have substantial frost, the density of the fins in the evaporators can also be increased, the heat exchange efficiency can be improved, and the refrigeration cabinets system can be operated stably in a humid environment.

[0020] In some embodiments, the controller 14 changes the operating frequency of the inverter compressor based on the pressure information to control the pressure on the suction side of the inverter compressor to be within a range of P_1 to P_2 , wherein $P_1 + \Delta P$ corresponds to the pressure of saturated refrigerant at a temperature of -1.5°C , and $P_2 + \Delta P$ corresponds to the pressure of the saturated refrigerant at a temperature of $+1.5^{\circ}\text{C}$, and wherein ΔP is a pressure correction value. For example, when the pressure on the suction side of the inverter compressor 15 exceeds an upper limit of a control range, the frequency of the inverter compressor 15 can be increased until the pressure on the suction side of the inverter compressor 15 is restored to the control range; otherwise, the frequency of the inverter compressor 15 is decreased.

[0021] In some embodiments, the pressure correction value ΔP may be determined based on field tests or depends on the lengths of the pipelines from the indoor unit outlets to the outdoor unit inlet. More specifically, since the goal is to control the temperature at the outlet of the evaporator of each indoor unit to be within a range of -1.5°C to $+1.5^{\circ}\text{C}$, when the fluid flows from the outlet of each evaporator to the inlet side of the inverter compressor of the outdoor unit, there will be pressure loss ΔP ,

which depends on factors such as pipeline lengths and surrounding environment. Once the installation of the system is completed, it may be considered that the loss is basically determined. Based on this knowledge, it can be understood that the saturation evaporation temperature (which corresponds to the pressure in an one-to-one correspondence) of each indoor unit has a correspondence to the pressure on the inlet side of the inverter compressor, and the goal of controlling the saturated evaporation temperature can be achieved by controlling the pressure on the inlet side of the inverter compressor. For example, the pressure on the suction side of the inverter compressor can be controlled to be within the range of P_1 to P_2 , wherein $P_1 + \Delta P$ corresponds to the pressure of saturated refrigerant at a temperature of -1.5°C , $P_2 + \Delta P$ corresponds to the pressure of the saturated refrigerant at a temperature of $+1.5^\circ\text{C}$, and ΔP may for example take an average pressure drop from each indoor unit to the suction side of the compressor, which may be estimated based on the pipeline lengths and empirical formulas related to the pipeline lengths, or may be set based on field commissioning results.

[0022] In some embodiments, in order to ensure an accurate control of the saturation evaporation temperature of the evaporator of each indoor unit, the lengths of the pipelines from each of the indoor unit outlets to the outdoor unit inlet need to be set substantially the same when arranging the pipelines, thereby making the pressure losses of the pipelines be basically the same or closer to the pressure correction value ΔP . In some embodiments, length differences of the pipelines from each of the indoor unit outlets to the outdoor unit inlet may range from -20% to $+20\%$. For example, in some embodiments, in front of the pipeline gathering point P , the pipeline of the nearer indoor unit may include at least one detour, so that the lengths of the pipelines from the indoor unit outlet of each indoor unit to the pipeline gathering pipe P are basically the same.

[0023] In some indoor units, the evaporators may be located above or below the display cabinet, and a fin density of the evaporators is in a range of 6-14 FPI, wherein FPI represents the number of fins per inch (2.54 cm) of length. In some indoor units, the evaporators may be located behind the display cabinet, and a fin density of the evaporators is in a range of 3-8 FPI. Since the indoor units according to the embodiment of the present disclosure do not have substantial frost, a thinner arrangement of the evaporators may be realized, so that the evaporators can be arranged on the back side of the refrigerator without occupying the spaces above or below the front side of the cabinet. Therefore, the display area on the front side of the cabinet of the refrigerator can be increased. In some embodiments, the indoor units do not have a defrost mode.

[0024] In another aspect, a method for controlling a refrigeration cabinets system is provided, which includes: collecting pressure information on a suction side of an inverter compressor; and changing an operating frequen-

cy of the inverter compressor based on the pressure information to control the pressure or temperature on the suction side of the inverter compressor to be within a certain range, thereby maintaining a saturated evaporation temperature of the evaporator of each indoor unit to be within a range of -1.5°C to $+1.5^\circ\text{C}$.

[0025] In ordinary timed-defrosting refrigerated display cabinets, after the defrosting is completed, due to excessive accumulation of thermal load at the terminal, within tens of minutes after starting up, the refrigerant flow required by the entire terminal refrigerated display cabinet circuit is much larger than the average value during frost-free operation, which results in the displacement of the compressor required to be selected for a system with ordinary timed-defrosting setting being much larger. In practical applications, an ordinary timed-defrosting refrigerated display cabinet configured in a convenience store having a footprint of 150m^2 requires a 7.4 kW (10 HP) unit to maintain normal food preservation temperatures, while a frost-free refrigerated display cabinet only requires an 6 kW (8 HP) unit to maintain normal food preservation temperatures. The food storage temperature is stable, and the unit is running stably without frequent start and stop.

[0026] The specific embodiments described above are merely for describing the principle of the present disclosure more clearly, and various components are clearly illustrated or depicted to make it easier to understand the principle of the present disclosure. Those skilled in the art can readily make various modifications or changes to the present disclosure without departing from the scope of the present invention which is solely defined by the appended claims.

Claims

1. A refrigeration cabinet system, comprising:

one or more indoor units (21, 22, 23), each of which comprises: an indoor unit inlet (211, 221), an indoor unit outlet (212, 222), an expansion valve (213, 223) between the indoor unit inlet and the indoor unit outlet, an evaporator (214, 224) downstream of the expansion valve, and a display cabinet cooled by the evaporator; and an outdoor unit (1), which comprises: an outdoor unit inlet (11), an outdoor unit outlet (12), an inverter compressor (15) between the outdoor unit inlet and the outdoor unit outlet, a condenser (16) downstream of the inverter compressor, a controller (14) for controlling an operating frequency of the inverter compressor, and a pressure sensor (13) on a suction side of the inverter compressor; wherein the outdoor unit outlet (12) is connected to each indoor unit inlet (211, 221) through a pipeline (31), and each indoor unit outlet (212,

- 222) is connected to the outdoor unit inlet (11) through pipelines (321, 322); and wherein the controller (14) is connected to the pressure sensor (13) to obtain pressure information on the suction side of the inverter compressor (15), and the controller is configured to change the operating frequency of the inverter compressor based on the pressure information to control the pressure on the suction side of the inverter compressor to be within a certain range; **characterised in that** the controller is configured to, by changing the operating frequency of the inverter compressor to control the pressure on the suction side of the inverter compressor to be within a certain range, maintain a saturated evaporation temperature of each indoor unit (21, 22, 23) to be within a range of -1.5°C to +1.5°C.
2. The refrigeration cabinet system according to claim 1, wherein the controller (14) configured to change the operating frequency of the inverter compressor (15) based on the pressure information to control the pressure on the suction side of the inverter compressor to be within a range of P1 to P2, and wherein P1+ Δ P corresponds to the pressure of saturated refrigerant at a temperature of -1.5°C, P2+ Δ P corresponds to the pressure of the saturated refrigerant at a temperature of +1.5°C, and Δ P is a pressure correction value.
 3. The refrigeration cabinet system according to claim 2, wherein the pressure correction value Δ P is determined based on field tests or depends on the lengths of the pipelines (321, 322) from the indoor unit outlets (212, 222) to the outdoor unit inlet (11).
 4. The refrigeration cabinet system according to claim 1, wherein the refrigeration cabinet system comprises a plurality of indoor units (21, 22, 23), and length differences of the pipelines (321, 322) from each of the indoor unit outlets (212, 222) to the outdoor unit inlet (11) range from -20% to +20%.
 5. The refrigeration cabinet system according to claim 1, wherein the evaporator (214, 224) of at least one of the indoor units (21, 22, 23) is located above or below the display cabinet, and a fin density of the evaporator is in a range of 6-14 FPI (2-5 fins per cm), and/or the evaporator of at least one of the indoor units is located behind the display cabinet, and a fin density of the evaporator is in a range of 3-8 FPI (1-3 fins per cm).
 6. The refrigeration cabinet system according to claim 1, wherein the indoor units (21, 22, 23) do not have a defrost mode.
 7. A method for controlling a refrigeration cabinet system, which can be applied to the refrigeration cabinet system according to any one of claims 1 to 6, wherein the method comprises:
 - collecting pressure information on a suction side of an inverter compressor (15); and
 - changing an operating frequency of the inverter compressor based on the pressure information to control the pressure on the suction side of the inverter compressor to be within a certain range; **characterised in that** changing the operating frequency of the inverter compressor maintains a saturated evaporation temperature of each indoor unit (21, 22, 23) to be within a range of -1.5°C to +1.5°C.
 8. The method according to claim 7, further comprising: changing the operating frequency of the inverter compressor (15) based on the pressure information to control the pressure on the suction side of the inverter compressor to be within a range of P1 to P2, wherein P1+ Δ P corresponds to the pressure of saturated refrigerant at a temperature of -1.5°C, P2+ Δ P corresponds to the pressure of the saturated refrigerant at a temperature of +1.5°C, and Δ P is a pressure correction value.
 9. The method according to claim 8, wherein the pressure correction value Δ P is determined based on field tests or depends on the lengths of the pipelines (321, 322) from the indoor unit outlets (212, 222) to the outdoor unit inlet (11).
 10. The method according to claim 9, wherein the method comprises: controlling length differences of the pipelines (321, 322) from each of the indoor unit outlets (212, 222) to the outdoor unit inlet (11) to be within a range from -20% to +20%; and the method comprises: disposing the evaporators (214, 224) below or above the display cabinet and setting a fin density of the evaporators in a range of 6-14 FPI (2-5 fins per cm), and/or disposing the evaporators behind the display cabinet and setting a fin density of the evaporators in a range of 3-8 FPI (1-3 fins per cm).

Patentansprüche

1. Kältschranksystem, Folgendes umfassend:

eine oder mehrere Inneneinheiten (21, 22, 23), die jeweils Folgendes umfassen: einen Inneneinheit-Einlass (211, 221), einen Inneneinheit-Auslass (212, 222), ein Expansionsventil (213, 223) zwischen dem Inneneinheit-Einlass und dem Inneneinheit-Auslass, einen Verdampfer (214, 224) stromabwärts des Expansionsventils

- und einen durch den Verdampfer gekühlten Schauschrank; und
eine Außeneinheit (1), die Folgendes umfasst:
einen Außeneinheit-Einlass (11), einen Außeneinheit-Auslass (12), einen Wechselrichterverdichter (15) zwischen dem Außeneinheit-Einlass und dem Außeneinheit-Auslass, einen Kondensator (16) stromabwärts des Wechselrichterverdichters, eine Steuerung (14) zum Steuern einer Betriebsfrequenz des Wechselrichterverdichters und einen Drucksensor (13) auf einer Saugseite des Wechselrichterverdichters; wobei der Außeneinheit-Auslass (12) mit jedem Inneneinheit-Einlass (211, 221) durch eine Rohrleitung (31) verbunden ist, und jeder Inneneinheit-Auslass (212, 222) mit dem Außeneinheit-Einlass (11) durch Rohrleitungen (321, 322) verbunden ist; und
wobei die Steuerung (14) mit dem Drucksensor (13) verbunden ist, um Druckinformationen auf der Saugseite des Wechselrichterverdichters (15) zu erhalten, und die Steuerung konfiguriert ist, um die Betriebsfrequenz des Wechselrichterverdichters basierend auf den Druckinformationen zu ändern, um den Druck auf der Saugseite des Wechselrichterverdichters zu steuern, damit er innerhalb eines bestimmten Bereichs liegt; **dadurch gekennzeichnet, dass** die Steuerung konfiguriert ist, um durch Ändern der Betriebsfrequenz des Wechselrichterverdichters, um den Druck auf der Saugseite des Wechselrichterverdichters zu steuern, damit er innerhalb eines bestimmten Bereichs liegt, eine Sättigungsverdampfungstemperatur jeder Inneneinheit (21, 22, 23) aufrecht zu erhalten, damit sie innerhalb eines Bereichs von -1,5 °C bis +1,5 °C liegt.
2. Kühlschranksystem nach Anspruch 1, wobei die Steuerung (14) konfiguriert ist, um die Betriebsfrequenz des Wechselrichterverdichters (15) basierend auf den Druckinformationen zu ändern, um den Druck auf der Saugseite des Wechselrichterverdichters zu steuern, damit er innerhalb eines Bereichs von P1 bis P2 liegt, und wobei P1+ Δ P dem Druck des gesättigten Kältemittels bei einer Temperatur von -1,5 °C entspricht, P2+ Δ P dem Druck des gesättigten Kältemittels bei einer Temperatur von +1,5 °C entspricht, und Δ P ein Druckkorrekturwert ist.
3. Kühlschranksystem nach Anspruch 2, wobei der Druckkorrekturwert Δ P basierend auf Feldversuchen bestimmt wird oder von den Längen der Rohrleitungen (321, 322) von den Inneneinheit-Auslässen (212, 222) zu dem Außeneinheit-Einlass (11) abhängt.
4. Kühlschranksystem nach Anspruch 1, wobei das Kühlschranksystem eine Vielzahl von Inneneinheiten (21, 22, 23) umfasst und Längendifferenzen der Rohrleitungen (321, 322) von jedem der Inneneinheit-Auslässe (212, 222) zu dem Außeneinheit-Einlass (11) von -20 % bis +20 % reichen.
5. Kühlschranksystem nach Anspruch 1, wobei sich der Verdampfer (214, 224) mindestens einer der Inneneinheiten (21, 22, 23) oberhalb oder unterhalb des Schauschranks befindet und eine Lamellendichte des Verdampfers in einem Bereich von 6-14 FPI (2-5 Lamellen pro cm) liegt, und/oder sich der Verdampfer mindestens einer der Inneneinheiten hinter dem Schauschrank befindet und eine Lamellendichte des Verdampfers in einem Bereich von 3-8 FPI (1-3 Lamellen pro cm) liegt.
6. Kühlschranksystem nach Anspruch 1, wobei die Inneneinheiten (21, 22, 23) keinen Abtaumodus aufweisen.
7. Verfahren zum Steuern eines Kühlschranksystems, das auf das Kühlschranksystem nach einem der Ansprüche 1 bis 6 angewendet werden kann, wobei das Verfahren Folgendes umfasst:
Sammeln von Druckinformationen auf einer Saugseite eines Wechselrichterverdichters (15); und
Ändern einer Betriebsfrequenz des Wechselrichterverdichters basierend auf den Druckinformationen, um den Druck auf der Saugseite des Wechselrichterverdichters zu steuern, damit er innerhalb eines bestimmten Bereichs liegt; **dadurch gekennzeichnet, dass** Ändern der Betriebsfrequenz des Wechselrichterverdichters eine Sättigungsverdampfungstemperatur jeder Inneneinheit (21, 22, 23) aufrechterhält, damit sie in einem Bereich von -1,5 °C bis +1,5 °C liegt.
8. Verfahren nach Anspruch 7, ferner Folgendes umfassend:
Ändern der Betriebsfrequenz des Wechselrichterverdichters (15) basierend auf den Druckinformationen zu ändern, um den Druck auf der Saugseite des Wechselrichterverdichters zu steuern, damit er innerhalb eines Bereichs von P1 bis P2 liegt, wobei P1+ Δ P dem Druck des gesättigten Kältemittels bei einer Temperatur von -1,5 °C entspricht, P2+ Δ P dem Druck des gesättigten Kältemittels bei einer Temperatur von +1,5 °C entspricht, und Δ P ein Druckkorrekturwert ist.
9. Verfahren nach Anspruch 8, wobei der Druckkorrekturwert Δ P basierend auf Feldversuchen bestimmt wird oder von den Längen der Rohrleitungen (321, 322) von den Inneneinheit-Auslässen (212, 222) zu

dem Außeneinheit-Einlass (11) abhängt.

10. Verfahren nach Anspruch 9, wobei das Verfahren Folgendes umfasst: Steuern von Längendifferenzen der Rohrleitungen (321, 322) von jedem der Inneneinheit-Auslässe (212, 222) zu dem Außeneinheit-Einlass (11), damit sie innerhalb eines Bereichs von -20 % bis +20 % liegen; und das Verfahren Folgendes umfasst: Anordnen der Verdampfer (214, 224) unterhalb oder oberhalb des Schauschranks und Einstellen einer Lamellendichte der Verdampfer in einem Bereich von 6-14 FPI (2-5 Lamellen pro cm), und/oder Anordnen der Verdampfer hinter dem Schauschrank und Einstellen einer Lamellendichte der Verdampfer in einem Bereich von 3-8 FPI (1-3 Lamellen pro cm) .

Revendications

1. Système d'armoire de réfrigération, comprenant :

une ou plusieurs unités intérieures (21, 22, 23), dont chacune comprend : une entrée d'unité intérieure (211, 221), une sortie d'unité intérieure (212, 222), une vanne de détente (213, 223) entre l'entrée d'unité intérieure et la sortie d'unité intérieure, un évaporateur (214, 224) en aval de la vanne de détente, et une armoire d'affichage refroidie par l'évaporateur ; et une unité extérieure (1), qui comprend : une entrée d'unité extérieure (11), une sortie d'unité extérieure (12), un compresseur onduleur (15) entre l'entrée d'unité extérieure et la sortie d'unité extérieure, un condenseur (16) en aval du compresseur onduleur, un dispositif de commande (14) pour commander une fréquence de fonctionnement du compresseur onduleur, et un capteur de pression (13) sur un côté aspiration du compresseur onduleur ; dans lequel la sortie d'unité extérieure (12) est reliée à chaque entrée d'unité intérieure (211, 221) par l'intermédiaire d'un conduit (31), et chaque sortie d'unité intérieure (212, 222) est reliée à l'entrée d'unité extérieure (11) par l'intermédiaire de conduites (321, 322) ; et dans lequel le dispositif de commande (14) est connecté au capteur de pression (13) pour obtenir des informations de pression sur le côté aspiration du compresseur onduleur (15), et le dispositif de commande est configuré pour modifier la fréquence de fonctionnement du compresseur onduleur sur la base des informations de pression pour commander la pression sur le côté aspiration du compresseur onduleur pour être dans une certaine plage ; **caractérisé en ce que** le dispositif de commande est configuré pour, en modifiant la fréquence de fonctionne-

ment du compresseur onduleur pour commander la pression sur le côté aspiration du compresseur onduleur pour être dans une certaine plage, maintenir une température d'évaporation saturée de chaque unité intérieure (21, 22, 23) de -1,5 °C à +1,5 °C.

2. Système d'armoire de réfrigération selon la revendication 1, dans lequel le dispositif de commande (14) est configuré pour modifier la fréquence de fonctionnement du compresseur onduleur (15) sur la base des informations de pression pour commander la pression sur le côté aspiration du compresseur onduleur pour qu'elle soit dans une plage de P1 à P2, et dans lequel P1+ Δ P correspond à la pression du réfrigérant saturé à une température de -1,5 °C, P2+ Δ P correspond à la pression du réfrigérant saturé à une température de +1,5 °C, et Δ P est une valeur de correction de pression.
3. Système d'armoire de réfrigération selon la revendication 2, dans lequel la valeur de correction de pression Δ P est déterminée sur la base d'essais sur le terrain ou dépend des longueurs des conduites (321, 322) depuis les sorties d'unité intérieure (212, 222) vers l'entrée d'unité extérieure (11) .
4. Système d'armoire de réfrigération selon la revendication 1, dans lequel le système d'armoire de réfrigération comprend une pluralité d'unités intérieures (21, 22, 23), et en ce que les différences de longueur des conduites (321, 322) depuis chacune des sorties d'unité intérieure (212, 222) vers l'entrée d'unité extérieure (11) sont comprises entre -20 % et +20 %.
5. Système d'armoire de réfrigération selon la revendication 1, dans lequel l'évaporateur (214, 224) d'au moins l'une des unités intérieures (21, 22, 23) est situé au-dessus ou en dessous de l'armoire d'affichage, et la densité des ailettes de l'évaporateur est comprise dans une plage de 6 à 14 FPI (2 à 5 ailettes par cm), et/ou l'évaporateur d'au moins l'une des unités intérieures est situé derrière l'armoire d'affichage, et une densité des ailettes de l'évaporateur est comprise dans une plage de 3 à 8 FPI (1 à 3 ailettes par cm).
6. Système d'armoire de réfrigération selon la revendication 1, dans lequel les unités intérieures (21, 22, 23) ne sont pas en mode dégivrage.
7. Procédé de commande d'un système d'armoire de réfrigération, applicable au système d'armoire de réfrigération selon l'une quelconque des revendications 1 à 6, dans lequel le procédé comprend :

la collecte d'informations de pression sur un côté

aspiration d'un compresseur onduleur (15) ; et le changement d'une fréquence de fonctionnement du compresseur onduleur sur la base des informations de pression pour commander la pression sur le côté aspiration du compresseur onduleur pour être dans une certaine plage ;
caractérisé en ce que le changement de la fréquence de fonctionnement du compresseur onduleur maintient une température d'évaporation saturée de chaque unité intérieure (21, 22, 23) dans une plage de -1,5 °C à +1,5 °C.

8. Procédé selon la revendication 7, comprenant également :
la modification de la fréquence de fonctionnement du compresseur onduleur (15) sur la base des informations de pression pour commander la pression sur le côté aspiration du compresseur onduleur pour qu'elle soit dans une plage de P1 à P2, dans lequel P1+ Δ P correspond à la pression du réfrigérant saturé à une température de -1,5 °C, P2+ Δ P correspond à la pression du réfrigérant saturé à une température de +1,5 °C, et Δ P est une valeur de correction de pression.
9. Procédé selon la revendication 8, dans lequel la valeur de correction de pression Δ P est déterminée sur la base d'essais sur le terrain ou dépend des longueurs des conduites (321, 322) depuis les sorties d'unité intérieure (212, 222) vers l'entrée d'unité extérieure (11).
10. Procédé selon la revendication 9, dans lequel le procédé comprend : la commande des différences de longueur des conduites (321, 322) depuis chacune des sorties d'unité intérieure (212, 222) vers l'entrée d'unité extérieure (11) dans une plage allant de -20 % à +20 % ; et
le procédé comprend : la disposition des évaporateurs (214, 224) en dessous ou au-dessus de l'armoire d'affichage et le réglage d'une densité d'ailette des évaporateurs dans une plage de 6-14 FPI (2-5 ailettes par cm), et/ou la disposition des évaporateurs derrière l'armoire d'affichage et le réglage d'une densité d'ailette des évaporateurs dans une plage de 3-8 FPI (1-3 ailettes par cm).

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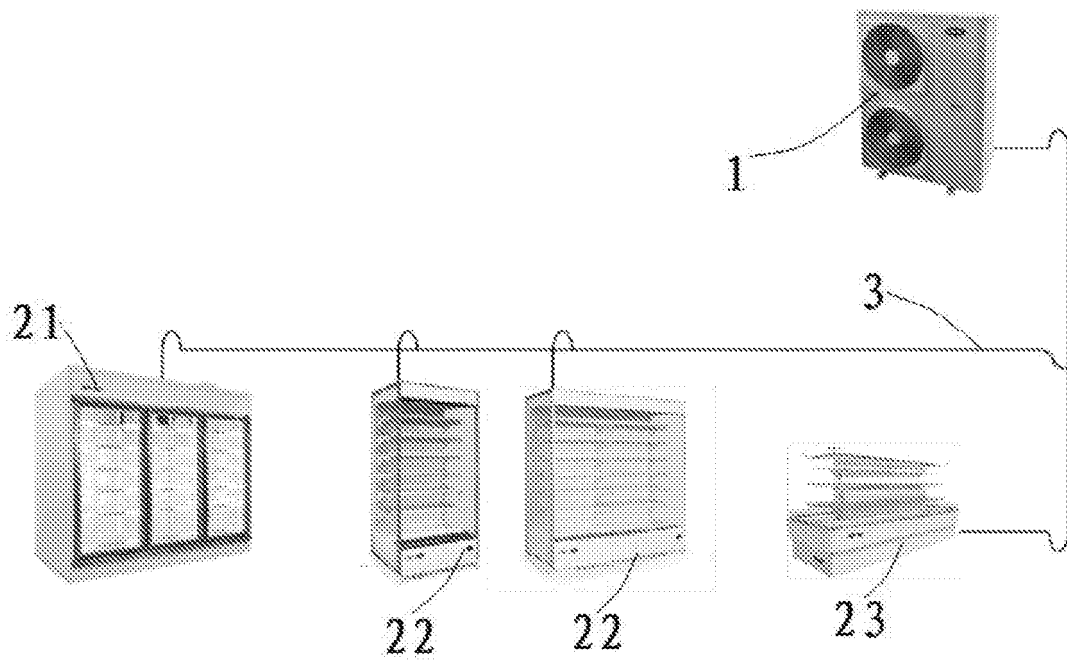


Fig. 1

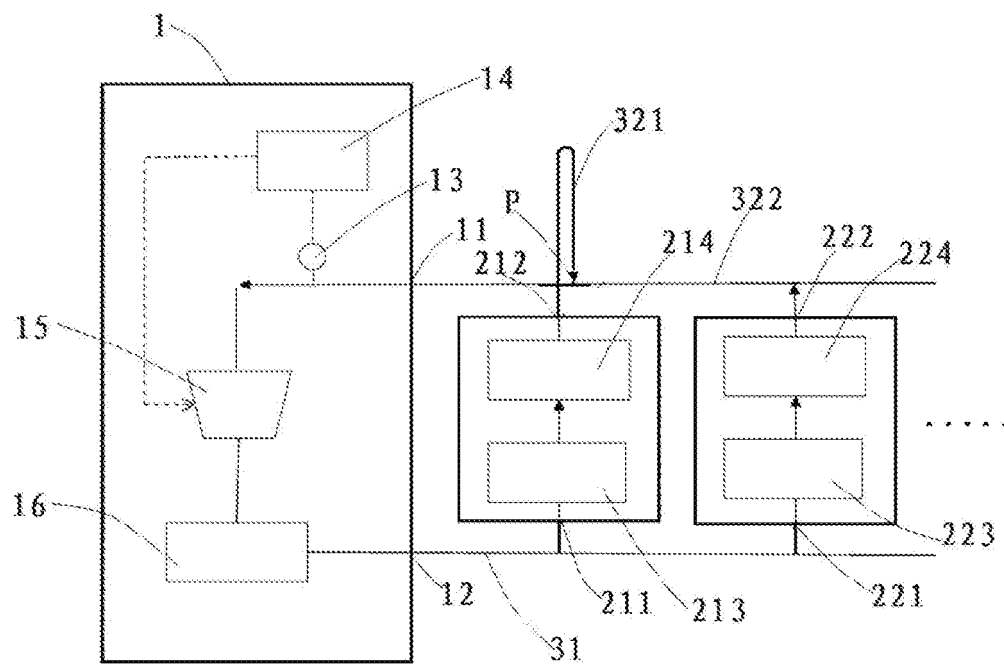


Fig.2