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(72) Inventors:

- **XU, Ying**
Shanghai, 201206 (CN)
- **MENG, Weidong**
Shanghai, 201206 (CN)
- **PAN, Yixin**
Shanghai, 201206 (CN)
- **LU, Shuang**
Shanghai, 201206 (CN)
- **DING, Yang**
Shanghai, 201206 (CN)

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(71) Applicant: **Carrier Corporation**

Palm Beach Gardens, FL 33418 (US)

(74) Representative: **Dehns**

10 Old Bailey
London EC4M 7NG (GB)

(54) OUTDOOR UNIT FOR REFRIGERATION CABINET AND REFRIGERATION CABINET

(57) An outdoor unit for a refrigeration cabinet comprises: a first unit (1) comprising a compressor; a second unit (2) comprising a condenser; wherein, the outdoor unit is configured to be installed in a first mode or a second mode; where in the first mode, the first unit (1) and the second unit (2) are installed adjacent to each other and connected with each other through fasteners, and the first unit and the second unit are connected through a first fluid pipeline passing through an adjacent surface between the first unit and the second unit; where

in the second mode, the first unit (1) and the second unit (2) are respectively installed at a first position and a second position spaced apart from each other, and the first unit and the second unit are connected through a second fluid pipeline extending between the first position and the second position. The outdoor unit and refrigeration cabinet according to the embodiments of the present invention provide more flexible installation options for outdoor units, where the outdoor units can be installed according to different on-site conditions.

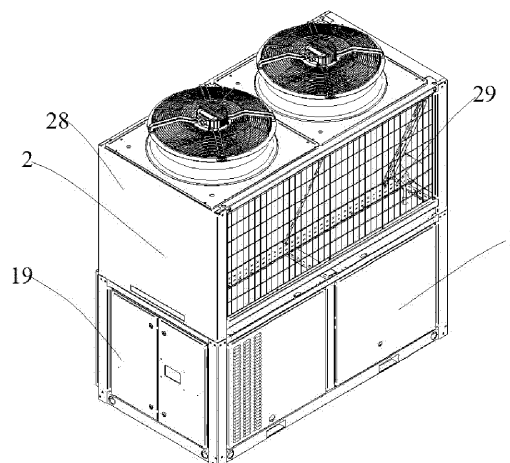


FIG. 1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to an outdoor unit for a refrigeration cabinet, and to a refrigeration cabinet comprising the outdoor unit.

BACKGROUND OF THE INVENTION

[0002] Refrigeration cabinets, such as refrigeration display cabinets, are often arranged in rows in supermarkets or convenience stores. A refrigeration cabinet generally includes an indoor load, i.e., a refrigeration display cabinet unit and an outdoor unit. A refrigeration display cabinet unit usually includes an evaporator and a throttling unit, while an outdoor unit includes components such as a compressor and a condenser.

[0003] In field installation of a refrigeration cabinet, due to limitations of outdoor installation space and conditions, it may not be possible to install the entire outdoor unit as a whole in a location close to the indoor unit. In this circumstance, longer pipelines need to be arranged, and the pipelines between the outdoor unit and the indoor load usually employ large-diameter copper pipes, which are costly and difficult to install.

SUMMARY OF THE INVENTION

[0004] At least preferred embodiments of the present invention solve or at least alleviate the problems existing in the prior art.

[0005] According to a first aspect of the present invention, an outdoor unit for a refrigeration cabinet is provided, comprising:

a first unit comprising a compressor;

a second unit comprising a condenser;

wherein, the outdoor unit is configured to be installed in a first mode or a second mode;

where in the first mode, the first unit and the second unit are installed adjacent to each other and connected with each other through fasteners, and the first unit and the second unit are connected through a first fluid pipeline passing through an adjacent surface between the first unit and the second unit;

where in the second mode, the first unit and the second unit are respectively installed at a first position and a second position spaced apart from each other, and the first unit and the second unit are connected through a second fluid pipeline extending between the first position and the second position.

[0006] Optionally, the first unit further comprises a re-

generative heat exchanger, wherein the regenerative heat exchanger comprises a first pipeline and a second pipeline;
the first unit comprising:

a first outlet port connected to an exhaust port of the compressor;

a first inlet port connected to a first end of the first pipeline of the regenerative heat exchanger;

a second outlet port connected to a second end of the first pipeline of the regenerative heat exchanger; and

a second inlet port connected to a first end of the second pipeline of the regenerative heat exchanger;

wherein, the second end of the second pipeline of the regenerative heat exchanger is connected to a suction port of the compressor, the first inlet port and the first outlet port are respectively configured to connect to the condenser of the second unit, and the second inlet port and the second outlet port are respectively configured to connect to an indoor load.

[0007] Optionally, the first unit comprises a first unit housing generally in the shape of a cube, the first inlet port and the first outlet port are arranged at the top of the first unit housing, wherein the first inlet port and the first outlet port are both vertically oriented upwards, the compressor, the regenerative heat exchanger and an optional oil separator, oil reservoir, refrigerant reservoir, and gas separator are arranged in the first unit housing.

[0008] Optionally, in the first unit, the exhaust port of the compressor is connected to the oil separator, the gas outlet of the oil separator is connected to the first outlet port, the oil outlet of the oil separator is connected to the oil reservoir, the oil reservoir is connected to the suction port of the compressor and/or the suction manifold of the compressor through capillaries, the suction port of the compressor is connected to the second end of the second pipeline of the regenerative heat exchanger via the gas separator, and the first end of the first pipeline of the regenerative heat exchanger is connected to the first inlet port via the refrigerant reservoir.

[0009] Optionally, the second unit comprises a bottom plate, a V-shaped heat exchange coil on the bottom plate, and a fan above the V-shaped heat exchange coil, wherein when installed in the first mode, the bottom plate of the second unit is installed adjacent to the top of the first unit.

[0010] Optionally, the V-shaped heat exchange coil comprises a first coil portion and a second coil portion, the first coil portion and the second coil portion each comprising an independent intake manifold, wherein each of the intake manifolds of the first coil portion and the second coil portion extends from the bottom to the top of the V-shaped heat exchange coil along one side of the first coil portion and the second coil portion respectively,

and each comprises an independent intake port, while the return manifolds of the first coil portion and the second coil portion converge to a return header that is vertically oriented and has a vertically downward return port.

[0011] Optionally, the bottom plate of the second unit comprises a bottom plate body supporting the bottom of the V-shaped heat exchange coil and a bottom plate frame outside of the bottom plate body; the second unit further comprises grid plates on both sides and end plates at both ends connected between the bottom plate frame and the top of the V-shaped heat exchange coil, making the second unit generally in the shape of a cube; the size and shape of the bottom plate frame are substantially the same as the size and shape of the top of the first unit; the top of the first unit has a positioning feature matching the bottom plate body and/or bottom plate frame of the second unit; the first unit and the second unit as a whole, when installed in the first mode, are generally in the shape of a cube.

[0012] Optionally, in the first mode, the first unit is connected to the second unit through a plurality of bolts arranged along the bottom plate body and/or the bottom plate frame, and the grid plates are installed after the assembly of the first unit and the second unit.

[0013] Optionally, the second unit is further configured with an electronic control module, where when installed in the second mode, an integrated electrical cable is connected between the first unit and the electronic control module of the second unit.

[0014] According to another aspect, a refrigeration cabinet is provided, comprising the outdoor unit according to the first aspect, optionally including any of the optional features thereof.

[0015] The outdoor unit and refrigeration cabinet according to the embodiments of the present invention provide more flexible installation options for outdoor units, where the outdoor units can be installed according to different on-site conditions.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] With reference to the accompanying drawings, the invention will become easier to understand. Those skilled in the art would easily understand that these drawings are for the purpose of illustration, and are not intended to limit the scope of protection of the present invention. In addition, in the figures, similar numerals are used to denote similar components, where:

FIG. 1 shows a three-dimensional view of an outdoor unit for a refrigeration cabinet installed in a first mode;

FIG. 2 shows an exploded view of an outdoor unit for a refrigeration cabinet;

FIG. 3 shows an internal structural view of an outdoor unit for a refrigeration cabinet;

FIG. 4 shows a flow path structure diagram of an outdoor unit for a refrigeration cabinet;

FIG. 5 shows an exploded view of an outdoor unit for a refrigeration cabinet; and

FIGS. 6 and 7 respectively show a three-dimensional view of an outdoor unit for a refrigeration cabinet, and a partially enlarged view of area A inside.

DETAILED DESCRIPTION OF EMBODIMENT(S) OF THE INVENTION

[0017] Referring to FIGS. 1 to 4, an outdoor unit for a refrigeration cabinet according to an embodiment of the present invention is described, which comprises: a first unit 1 comprising a compressor, such as a single compressor or two (or more) compressors 911, 912 connected in parallel; a second unit 2 comprising a condenser, for example, the condenser comprises two sets of coils 221, 222 and two fans 23. The outdoor unit can be installed in a first mode or a second mode. In the first mode as shown in FIG. 1, the first unit 1 and the second unit 2 are installed adjacent to each other and connected with each other through fasteners, and the first unit 1 and the second unit 2 are connected through a first fluid pipeline passing through the adjacent surface between the first unit and the second unit. In the second mode, the first unit 1 and the second unit 2 are respectively installed at a first position and a second position spaced apart from each other, and the first unit 1 and the second unit 2 are connected through a second fluid pipeline extending between the first position and the second position. Therefore, the outdoor unit according to the embodiment of the present invention provides two installation modes. In the first installation mode, the first unit 1 with a compressor and the second unit 2 with a condenser are configured in combination. The first mode is applicable to the working condition with good installation conditions. Whereas, in the second mode, the first unit 1 and the second unit 2 are arranged at different positions. This installation mode is applicable to the situation with limited installation conditions. For example, the first unit 1 can be installed at the first position near the indoor load but with poor ventilation, while the second unit 2 is installed at the second position with better ventilation but far away. Therefore, the outdoor unit according to the embodiments of the present invention provides installation flexibility, enabling the outdoor unit to flexibly adapt to various installation conditions. For example, outdoor units can be transported to the site in the first installation mode, and then installed in the first mode or the second mode according to on-site conditions.

[0018] In some embodiments, referring to FIGS. 3 and 4, the first unit 1 further comprises a regenerative heat exchanger 96, which comprises a first pipeline 961 and a second pipeline 962. The first unit 1 comprises: a first outlet port 120 connected to exhaust ports 913, 915 of the

compressors, and a first inlet port 121 connected to the first end of the first pipeline 961 of the regenerative heat exchanger 96; a second outlet port 127 connected to the second end of the first pipeline 961 of the regenerative heat exchanger 96; and a second inlet port 128 connected to the first end of the second pipeline 962 of the regenerative heat exchanger 96. The second end of the second pipeline 962 of the regenerative heat exchanger 96 is connected to suction ports 914, 916 of the compressors. The first inlet port 121 and the first outlet port 120 are respectively used to connect to the condenser of the second unit 2, i.e., the inlet and outlet of the condenser. The second inlet port 128 and the second outlet port 127 are respectively used to connect to the indoor load, i.e., the indoor load comprises a throttling unit and an evaporator. The first unit 1 of the outdoor unit according to the embodiment of the present invention is provided with a regenerative heat exchanger 96, which is particularly important in the second mode. Specifically, during installation in the second mode, because the pipeline between the first unit 1 and the second unit 2 may be relatively long and exposed to outdoors, this may cause part of the liquid refrigerant from the condenser outlet to evaporate before reaching the first unit 1 through the long pipeline and generate two-phase refrigerant. By exchanging heat with the refrigerant returned from the second pipeline 962 in the regenerative heat exchanger 96, the supercooling of the refrigerant in the first pipeline 961 and the superheat of the refrigerant in the second pipeline 962 will be increased, so as to avoid or at least mitigate the impact of two-phase refrigerant on the performance of the indoor load when it is transported to the indoor load.

[0019] In some embodiments, the first unit 1 comprises a first unit housing generally in the shape of a cube, comprising a top 12, a peripheral wall, and a bottom wall. An openable double door 11 can be provided at one end of the peripheral wall for purposes like maintenance. It can be seen from FIGS. 2 and 3 that the first outlet port 120 and the first inlet port 121 are provided at the top 12 of the first unit housing. Compressors 911, 912, the regenerative heat exchanger 96 and an optional oil separator 92, oil reservoir 93, refrigerant reservoir 94, and gas separator 95 are also installed in the first unit housing.

[0020] In some embodiments, referring to FIG. 4, the second unit 2 is marked by a box, and the remaining parts outside the box belong to the first unit 1. In this embodiment, the compressor exhaust ports 913, 915 of the two parallel compressors 911, 912 (alternatively, the number of compressors can be changed) are connected to the oil separator 92, and the gas outlet 921 of the oil separator is connected to the first outlet port 120. In the embodiment illustrated, two parallel first outlet ports 120 are provided (alternatively, the number of first outlet ports 120 can be changed). The oil outlet 922 of the oil separator 92 is connected to the oil reservoir 93. The oil reservoir 93 is further connected to the compressor suction ports 914, 916 and/or the compressor suction manifold 917 through

capillaries. The compressor suction ports 914, 916 are connected to the second end of the second pipeline 962 of the regenerative heat exchanger 96 via the gas separator 95. The first end of the first pipeline 961 of the regenerative heat exchanger 96 is connected to the first inlet port 121 via the refrigerant reservoir 94.

[0021] In some embodiments, as shown in FIG. 3, the second unit 2 comprises a bottom plate, a V-shaped heat exchange coil 221, 222 on the bottom plate, and two fans 23 above the V-shaped heat exchange coil 221, 222 (alternatively, the number of fans 23 can be changed). When installed in the first mode, the bottom plate of the second unit is installed adjacent to the top 12 of the first unit. The fan 23 comprises a motor, blades, and grills. During operation, the fan draws air from both sides which allows the airflow to pass through the V-shaped heat exchange coil 221, 222, and then dissipates from the top after exchanging heat with the refrigerant in the heat exchange coil 221, 222. By virtue of the structures of the V-shaped heat exchange coil and the fans on the top of the second unit 2, even when the second unit 2 is installed above the first unit 1 in the first mode, the operation of the second unit 2 will not be hindered.

[0022] In some embodiments, the V-shaped heat exchange coil comprises a first coil portion 221 and a second coil portion 222 independent of each other, with the first coil portion 221 and the second coil portion 222 being plate-like, respectively and arranged in a V-shaped manner. The first coil portion 221 and the second coil portion 222 each includes an independent intake manifold 226, which extends from the bottom to the top along one side of the first coil portion 221 and the second coil portion 222, and each includes independent inlet ports. In the first mode, each inlet port is connected to the first outlet port 120 of the first unit through an L-shaped pipe 31, while the return liquid of the first coil portion 221 and the second coil portion 222 converges and connects to the return header 225 through the return manifold 224. The return header 225 is generally T-shaped and includes a vertically oriented part, where the vertically oriented part has a downward return liquid port. In the first mode, the return liquid port is connected with the first inlet port 121 of the first unit 1, which is also vertically oriented, so that the liquid refrigerant can return back to the first unit 1 by gravity.

[0023] In some embodiments, the bottom plate of the second unit comprises a bottom plate body 21 supporting the bottom of the V-shaped heat exchange coil and a bottom plate frame 211, 212 outside of the bottom plate body 21. In the embodiment illustrated, the bottom plate frame is generally rectangular and comprise transverse frames 212 and longitudinal frames 211. In addition, for structural stability, vertical beams 223 are also provided at the four corners of the bottom plate frame. As shown in FIG. 1, in some embodiments, the second unit 2 may further comprise grid plates 29 on both sides and end plates 28 at both ends connected between the bottom plate frame and the top of the V-shaped heat exchange

coil, so that the second unit is generally in the shape of a cube. The size and shape of the bottom plate frame of the second unit 2 are basically the same as the size and shape of the top 12 of the first unit 1, so that the outdoor unit is generally in the shape of a cube after the first unit 1 and the second unit 2 are assembled in the first mode, thereby facilitating the outdoor unit assembled in the first mode to be placed in a regular outdoor installation space.

[0024] In some embodiments, as shown in FIG. 2, when installed in the first mode, the frame of the bottom plate of the second unit can be connected to the first unit through a plurality of bolts 3. Alternatively, a plurality of bolts can also be used to connect the bottom plate body of the second unit 2 and the first unit. The grid plates 29 can be installed after assembly of the first unit and the second unit using the plurality of bolts 3. In addition, when installed in the first mode, the first unit 1 and the second unit 2 can be directly assembled by inserting a short fluid pipeline, such as the L-shaped fluid pipeline 31 as shown. Furthermore, the control cable for the fan of the condenser of the second unit 2 can be easily connected between the first unit and the second unit. In other embodiments, when the first unit 1 and the second unit 2 are installed in the second mode, the second unit 2 can be configured with an electronic control module 27. In this circumstance, the electrical lines between the first unit 1 and the second unit 2 can be integrated into a single electrical cable and connected to the electronic control module 27 of the second unit, thus facilitating the regulation and arrangement of long-distance electrical lines. In some embodiments, when installed in the second mode, the electrical cable and fluid pipeline can also be integrated into one integrated line. In some embodiments, as shown in FIGS. 6 and 7, the top of the first unit 1 may have a positioning feature 17 that matches the bottom plate frame or bottom plate body of the second unit, thereby facilitating the assembly of both. According to other embodiments, a refrigeration cabinet comprising the outdoor unit according to the respective embodiments is further provided.

[0025] The outdoor unit according to the present invention can be transported to the site in the first mode (alternatively, it can also be transported in a split manner), and then determined to be installed in the first mode or in the second mode based on on-site conditions. The installation in the first mode only requires welding the corresponding pipelines, and installing fasteners and electrical lines. The installation in the second mode may consider to use a single mixed line including electrical connection and fluid communication to be reasonably arranged and connected between the first unit 1 and the second unit 2. It should be appreciated that the outdoor unit is usually arranged outdoors, but this is not restrictive. In fact, outdoor unit is only intended to indicate that it can be in a different space relative to the indoor load, rather than that it must be exposed to the outdoor environment. For example, the first unit 1 can also be arranged in a space indoors that is different from the

space of the indoor load, or the first unit 1 and the second unit 2 can be jointly arranged in spaces indoors that are different from the space of the indoor load.

[0026] The specific embodiments described above are merely intended to describe the principles of the present invention more clearly, wherein various components are clearly shown or described to facilitate the understanding of the principles of the present invention. Those skilled in the art may, without departing from the scope of the present invention, make various modifications or changes. Therefore, it should be understood that these modifications or changes should be included within the scope of patent protection, as defined by the appended claims.

Claims

1. An outdoor unit for a refrigeration cabinet, comprising:

a first unit (1) comprising a compressor (911, 912);

a second unit (2) comprising a condenser; wherein, the outdoor unit is configured to be installed in a first mode or a second mode; where in the first mode, the first unit (1) and the second unit (2) are installed adjacent to each other and connected with each other through fasteners (3), and the first unit and the second unit are connected through a first fluid pipeline passing through an adjacent surface between the first unit and the second unit;

where in the second mode, the first unit (1) and the second unit (2) are respectively installed at a first position and a second position spaced apart from each other, and the first unit and the second unit are connected through a second fluid pipeline (31) extending between the first position and the second position.

2. The outdoor unit according to claim 1, wherein the first unit (1) further comprises a regenerative heat exchanger (96), and the regenerative heat exchanger comprises a first pipeline (961) and a second pipeline (962);

the first unit comprising:

a first outlet port (120) connected to an exhaust port (913, 915) of the compressor (911, 912);

a first inlet port (121) connected to a first end of the first pipeline (961) of the regenerative heat exchanger (96);

a second outlet port (127) connected to a second end of the first pipeline (961) of the regenerative heat exchanger (96); and

a second inlet port (128) connected to a first end of the second pipeline (962) of the regenerative

- heat exchanger (96);
 wherein, the second end of the second pipeline (962) of the regenerative heat exchanger (96) is connected to a suction port (914, 916) of the compressor, the first inlet port (121) and the first outlet port (120) are configured to connect to the condenser of the second unit respectively, and the second inlet port (128) and the second outlet port (127) are configured to connect to an indoor load respectively.
3. The outdoor unit according to claim 2, wherein the first unit (1) comprises a first unit housing generally in the shape of a cube, the first inlet port (121) and the first outlet port (120) are arranged at the top (12) of the first unit housing, the first inlet port and the first outlet port are both vertically oriented upwards, and the compressor (911, 912), the regenerative heat exchanger (96) and an optional oil separator (92), oil reservoir (93), refrigerant reservoir (94), and gas separator (95) are arranged in the first unit housing.
 4. The outdoor unit according to claim 3, wherein in the first unit, the exhaust port (913, 915) of the compressor (911, 912) is connected to the oil separator (92), a gas outlet (921) of the oil separator is connected to the first outlet port (120), an oil outlet (922) of the oil separator is connected to the oil reservoir (93), the oil reservoir is connected to the suction port (914, 916) of the compressor and/or a suction manifold (917) of the compressor through capillaries, the suction port (914, 916) of the compressor is connected to the second end of the second pipeline (962) of the regenerative heat exchanger (96) via the gas separator (95), and the first end of the first pipeline (961) of the regenerative heat exchanger (96) is connected to the first inlet port (121) via the refrigerant reservoir (94).
 5. The outdoor unit according to any of claims 1-4, wherein the second unit (2) comprises a bottom plate, a V-shaped heat exchange coil (221, 222) on the bottom plate, and a fan (23) above the V-shaped heat exchange coil, where when installed in the first mode, the bottom plate of the second unit (2) is installed adjacent to the top (12) of the first unit (1).
 6. The outdoor unit according to claim 5, wherein the V-shaped heat exchange coil comprises a first coil portion (221) and a second coil portion (222), with the first coil portion and the second coil portion being plate-like respectively and arranged in a V-shaped manner, and the first coil portion (221) and the second coil portion (222) each comprises an independent intake manifold (226), where each of the intake manifolds of the first coil portion and the second coil portion extends from the bottom to the top of the coil along one side of the first coil portion (221) and the second coil portion (222) respectively, and each comprises an independent inlet port, while return manifolds (224) of the first coil portion and the second coil portion converge to a return header (225) that is vertically oriented and has a vertically downward return port.
 7. The outdoor unit according to claim 5 or 6, wherein the bottom plate of the second unit comprises a bottom plate body (21) supporting the bottom of the V-shaped heat exchange coil (221, 222) and a bottom plate frame (211, 212) outside of the bottom plate body; the second unit (2) further comprises grid plates (29) on both sides and end plates (28) at both ends connected between the bottom plate frame (211, 212) and the top of the V-shaped heat exchange coil, making the second unit (2) generally in the shape of a cube; a size and shape of the bottom plate frame (211, 212) are substantially the same as size and shape of the top (12) of the first unit (1); the top of the first unit (1) has a positioning feature (17) matching the bottom plate body (21) and/or bottom plate frame (211, 212) of the second unit; the first unit (1) and the second unit (2) as a whole, when installed in the first mode, are generally in the shape of a cube.
 8. The outdoor unit according to claim 7, wherein in the first mode, the first unit (1) is connected to the second unit (2) through a plurality of bolts (3) arranged along the bottom plate body (21) and/or the bottom plate frame (211, 212), and the grid plates (29) are installed after assembly of the first unit and the second unit.
 9. The outdoor unit according to any of claims 1-8, wherein the second unit (2) is further configured with an electronic control module (27), where when installed in the second mode, an integrated electrical cable is connected between the first unit (1) and the electronic control module (27) of the second unit (2).
 10. A refrigeration cabinet, wherein the refrigeration cabinet comprises an outdoor unit according to any of claims 1-9.

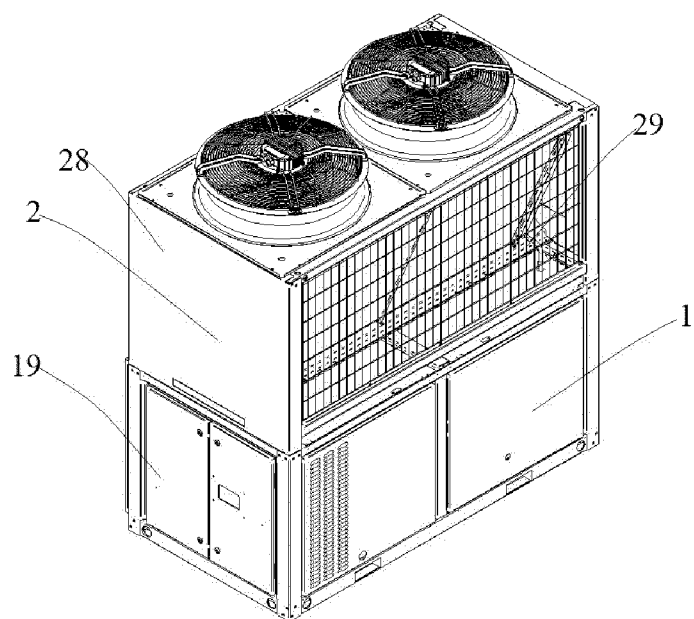


FIG. 1

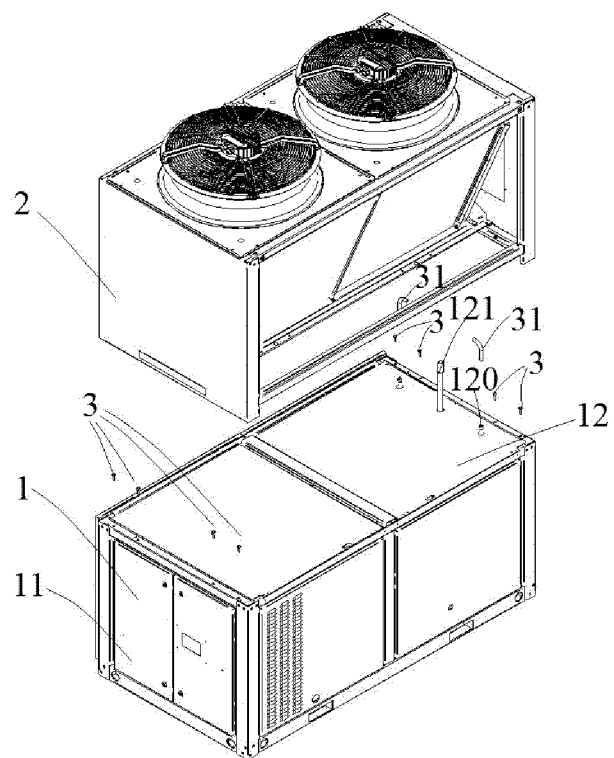


FIG. 2

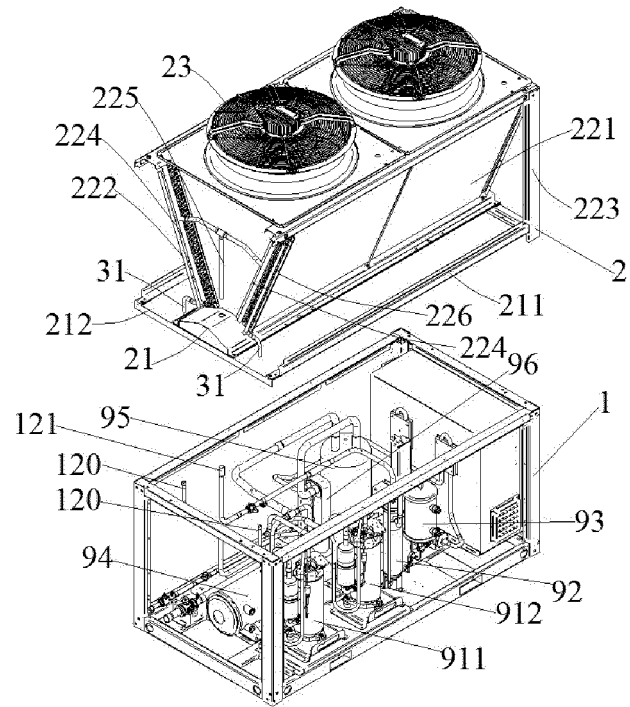


FIG. 3

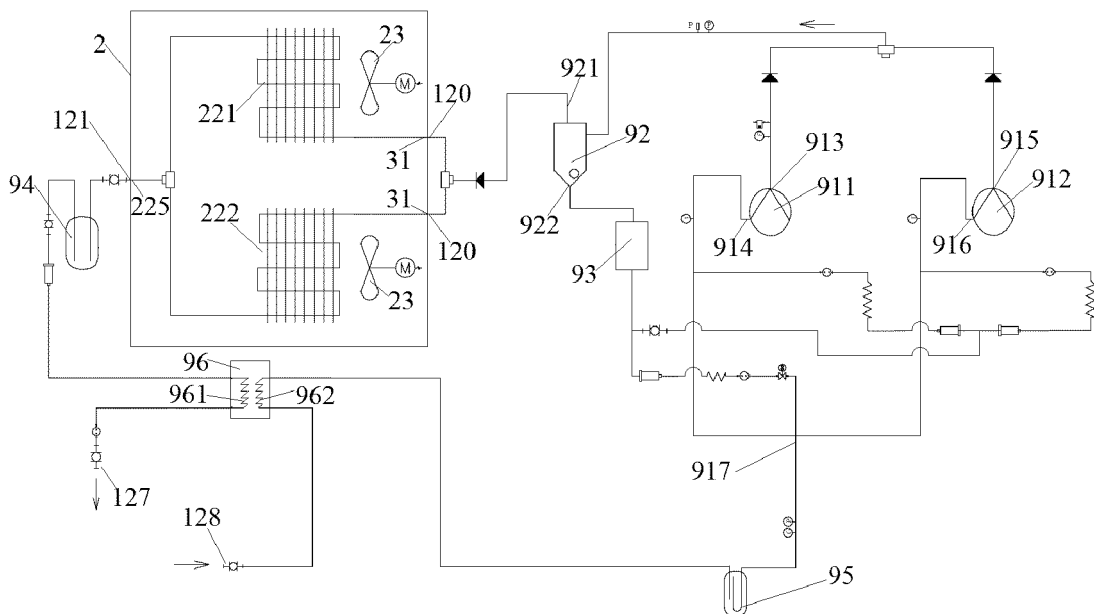


FIG. 4

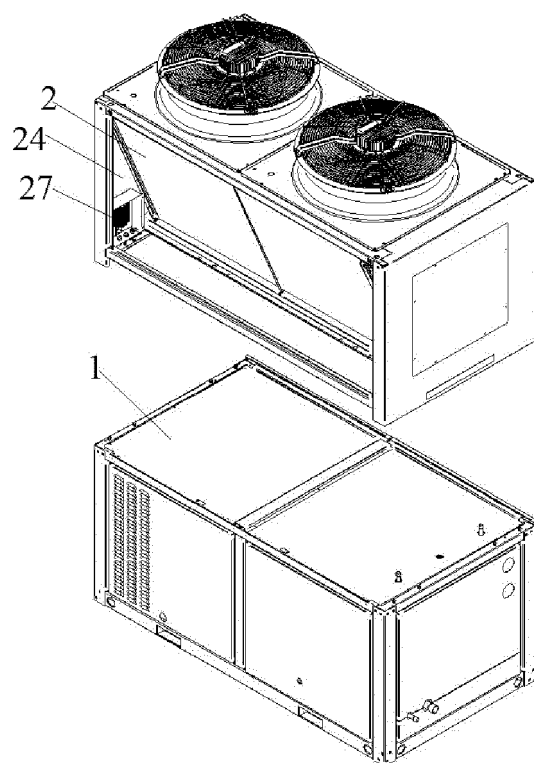


FIG. 5

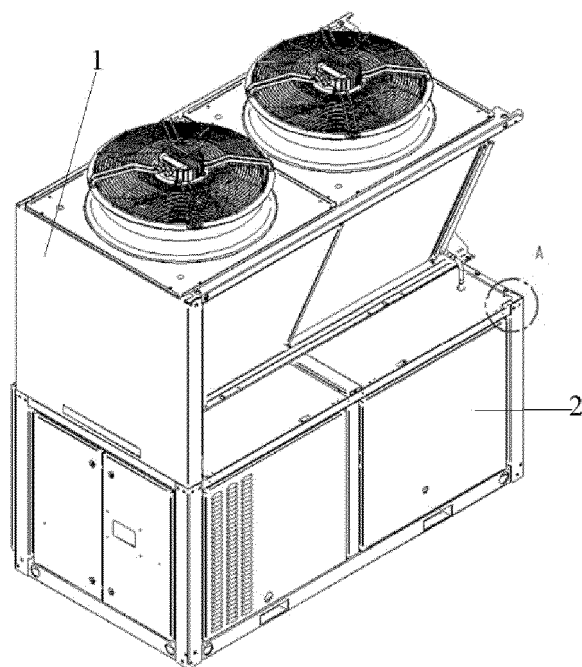


FIG. 6

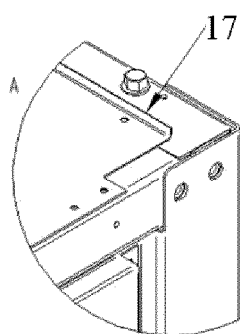


FIG. 7



EUROPEAN SEARCH REPORT

Application Number

EP 24 18 7467

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	* paragraphs [0038] - [0141]; figures 1-18 *	5-8	
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Place of search		Date of completion of the search	Examiner
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CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82