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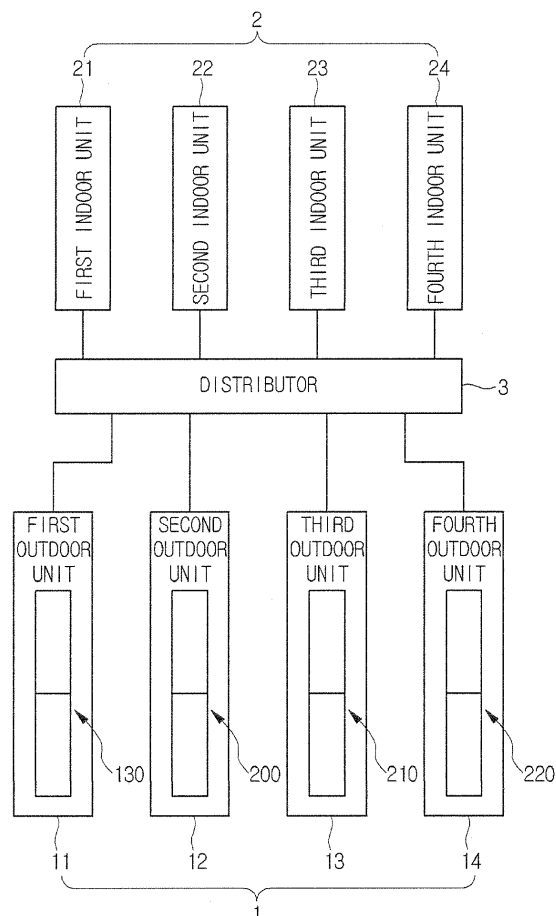
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(54) **Multi type air conditioner and operating method**

(57) Provided is a multi type air conditioner. The multi type air conditioner includes a plurality of indoor units, each comprising an indoor heat exchanger and a plurality of outdoor units connected to the plurality of indoor units, each comprising an outdoor heat exchanger. When a defrosting operation condition is satisfied during a heating operation, the plurality of outdoor units successively perform a defrosting operation.

FIG. 1



Description

[0001] The present disclosure relates to a multi type air conditioner.

[0002] In general, air conditioners are equipments for cooling/heating an indoor space or purifying indoor air using a refrigerant cycle of a compressor, a condenser, an expansion mechanism, and an evaporator to provide comfort indoor environment to users.

[0003] Such an air conditioner is classified into an air conditioner in which a single indoor unit is connected to a single outdoor unit and a multi type air conditioner in which a plurality of indoor units are connected to a single outdoor unit to provide effects similar to that of a plurality of air conditioners.

[0004] The multi type air conditioner may include a plurality of indoor units and a plurality of outdoor units. Each of the outdoor units includes an outdoor heat exchanger. Each of the outdoor heat exchanger is divided into an upper heat exchanger part and a lower heat exchanger part on the basis of a flow of a refrigerant. Thus, the refrigerant independently flows into the upper and lower heat exchanger parts.

[0005] In case of the multi type air conditioner according to the related art, when the heating operation is continuously performed, frost may occur on the outdoor heat exchanger. Thus, a defrosting operation should be performed. When the defrosting operation is performed, the frost on the upper heat exchanger part of each of the plurality of outdoor heat exchangers is removed first. Then, when the frost on the upper heat exchanger part is completely removed, the frost on the lower heat exchanger part is removed. When the defrosting operation is performed, a high-temperature high-pressure refrigerant discharged from a compression unit is bypassed to flow into the heat exchanger part in which the defrosting operation is performed.

[0006] In case of the above-described multi type air conditioner, a portion (about 50% of the whole outdoor heat exchanger) of the heat exchanger part in each of the outdoor heat exchangers of the whole outdoor unit performs the defrosting operation, and the remaining portion (about 50% of the whole outdoor heat exchanger) performs a heating operation. Thus, heating efficiency may be deteriorated.

[0007] Also, since the frost on the upper heat exchanger part is completely removed and then the frost on the lower heat exchanger part is removed, the frost on a boundary between the upper heat exchanger part and the lower heat exchanger part may not be smoothly removed. Thus, the frost may remain on the boundary.

[0008] Also, when the defrosting operation is performed, since the refrigerant bypassed in the compression unit flows into the outdoor heat exchanger, an amount of refrigerant flowing into the outdoor heat exchanger may be less. Thus, it may take relatively lone time to remove the frost.

[0009] The present invention provides a multi type air

conditioner according to claim 1, and an operating method according to claim 11. Preferred embodiments are specified in the dependent claims. Embodiments provide a multi type air conditioner in which a defrosting operation is performed in a state where deterioration of heating performance is minimized.

[0010] In one embodiment, a multi type air conditioner includes: a plurality of indoor units, each including an indoor heat exchanger; and a plurality of outdoor units connected to the plurality of indoor units, each including an outdoor heat exchanger, wherein, when a defrosting operation condition is satisfied during a heating operation, the plurality of outdoor units successively perform a defrosting operation.

[0011] The details of one or more embodiments are set forth in the accompanying drawings and the description below. Other features will be apparent from the description and drawings, and from the claims.

[0012] Fig. 1 is a schematic view of a multi type air conditioner according to an embodiment.

[0013] Fig. 2 is a circuit diagram illustrating a refrigerant cycle of the multi type air conditioner.

[0014] Fig. 3 is a circuit diagram illustrating a refrigerant flow when the multi type air conditioner performs a cooling operation.

[0015] Fig. 4 is a flowchart explaining a method of controlling the multi type air conditioner.

[0016] Figs. 5 to 8 are schematic views illustrating successive defrosting operations of a plurality of outdoor units.

[0017] Figs. 9 and 10 are circuit diagrams illustrating a refrigerant flow when a specific outdoor unit performs a defrosting operation, wherein Fig. 9 illustrates a refrigerant flow when a fourth outdoor unit performs a defrosting operation, and Fig. 10 illustrates a refrigerant flow when a first outdoor unit performs a defrosting operation.

[0018] Hereinafter, exemplary embodiments of the present disclosure will be described with reference to the accompanying drawings. Regarding the reference numerals assigned to the elements in the drawings, it should be noted that the same elements will be designated by the same reference numerals, wherever possible, even though they are shown in different drawings. Also, in the description of embodiments, detailed description of well-known related structures or functions will be omitted when it is deemed that such description will cause ambiguous interpretation of the present disclosure.

[0019] Fig. 1 is a schematic view of an air conditioner according to an embodiment. Fig. 2 is a circuit diagram illustrating a refrigerant cycle of the multi type air conditioner. For example, Fig. 2 illustrates a refrigerant flow when the multi type air conditioner performs a heating operation.

[0020] Referring to Figs. 1 and 2, the multi type air conditioner according to an embodiment includes an outdoor unit 1 and an indoor unit 2 connected to the outdoor unit 1 through a distributor 3. The outdoor unit 1 includes a plurality of outdoor units 11, 12, 13, and 14. The indoor

unit 2 includes a plurality of indoor units 21, 22, 23, and 24. For convenience of description, although the four indoor units are connected to the four outdoor units in the current embodiment, the present disclosure is not limited to the number of indoor unit and outdoor unit. That is, two or more indoor units may be connected to two or more outdoor units. Here, the number of indoor unit may be greater than that of outdoor unit.

[0021] The outdoor unit 1 includes a first outdoor unit 11, a second outdoor unit 12, a third outdoor unit 13, and a fourth outdoor unit 14. The first outdoor unit 11 has the same constitution as that of each of the second to fourth outdoor units 12, 13, and 14. Thus, only the constitution of the first outdoor unit 11 will be described below. The descriptions with respect to the first outdoor unit 11 may be equally applied to those of the second to fourth outdoor units. Also, reference numerals used for explaining the constitutions of the first outdoor unit 11 may be equally applied to those of the second to fourth outdoor units except for reference numerals necessary for explaining the present disclosure.

[0022] Each of the outdoor units 11, 12, 13, and 14 includes a compression unit 110 for compressing a refrigerant and outdoor heat exchangers 130, 200, 210, and 220 in which outdoor air is heat-exchanged with the refrigerant. The compression unit 110 may include one or more compressors. For example, the compression unit 110 including a plurality of compressors 111, 112, and 113 will be described as an example. A portion of the plurality of compressors 111, 112, and 113 may be an inverter compressor 111 having variable capacity, and other portions may be a constant-speed compressors 112 and 113. The plurality of compressors 111, 112, and 113 may be disposed in parallel. A portion of the plurality of compressors 111, 112, and 113 or the whole compressors 111, 112, and 113 may be operation according to the capacity of the indoor unit.

[0023] A discharge side tube of each of the compressors 111, 112, and 113 includes an individual tube 118 and a joint tube 119. That is, the individual tube 118 of each of the compressors 111, 112, and 113 is jointed to the joint tube 119. The individual tube 118 may include an oil separator 114, 115, or 116 for separating oil from the refrigerant, a temperature sensor 126 for detecting a temperature of the compressed refrigerant, and a compression sensor 127 for detecting a pressure of the compressed refrigerant.

[0024] The joint tube 119 is connected to a plurality of four-way valves 121 and 122 for switching a flow of the refrigerant. The plurality of four-way valves 121 and 122 include a first four-way valve 121 and a second four-way valve 122. The first and second four-way valves 121 and 122 are disposed in parallel.

[0025] Each of the four-way valves 121 and 122 is connected to the outdoor heat exchanger 130 through first connection tubes 123 and 124. The first connection tubes 123 and 124 include a first heat exchanger part connection tube 123 and a second heat exchanger connection

tube 124.

[0026] Each of the outdoor heat exchangers 130, 200, 210, and 220 may include a plurality of heat exchanger parts. For example, the plurality of heat exchanger parts includes a first heat exchanger part 131 and a second heat exchanger part 132. The first and second heat exchanger parts 131 and 132 may be independent heat exchangers separated from each other or heat exchangers divided into two parts in a single outdoor heat exchanger based on the refrigerant flow. The first four-way valve 121 is connected to the first heat exchanger part 131 through the first heat exchanger part connection tube 123, and the second four-way valve 122 is connected to the second heat exchanger part 132 through the second heat exchanger part connection tube 124. The first and second heat exchanger parts 131 and 132 are disposed in parallel. For example, the first and second heat exchanger parts 131 and 132 may be horizontally or vertically disposed with respect to each other. Also, the refrigerant may flow into each of the first and second heat exchanger parts 131 and 132 or one of the first and second heat exchanger parts 131 and 132. The refrigerant may flow into the first heat exchanger part 131 in a direction opposite to that of the refrigerant flowing into the second heat exchanger part 132. That is, the first and second heat exchanger parts 131 and 132 may be independently operated. That is, each of the heat exchangers may independently serve as a condenser or an evaporator.

[0027] Although the outdoor heat exchanger is divided into the plurality of heat exchanger parts and includes the plurality of four-way valves in the current embodiment, the present disclosure is not limited thereto. For example, a single four-way valve may be connected to the outdoor heat exchanger.

[0028] The refrigerant within the outdoor heat exchanger may be heat-exchanged with outdoor air blowing by a fan motor assembly 140 (including an outdoor fan and a fan motor). The fan motor assembly may be provided in one or plurality. For example, Fig. 1 illustrates two outdoor fan motor assemblies.

[0029] Also, each of the four-way valves 121 and 122 may be connected to an accumulator 135 through the second connection tube 134. Also, each of the four-way valves 121 and 122 may be connected to closed tubes 121a and 122a.

[0030] Each of the outdoor units 11, 12, and 13, and 14 may further include an outdoor expansion mechanism 150. The outdoor expansion mechanism 150 does not expand a refrigerant when the refrigerant passing through the outdoor heat exchangers 130, 200, 210, and 220 passes, but expand a refrigerant when the refrigerant which does not pass through the outdoor heat exchangers 130, 200, 210, and 220 passes.

[0031] The outdoor expansion mechanism 150 includes a first outdoor expansion valve 151 corresponding to the first heat exchanger part 131 and a second outdoor expansion valve 152 corresponding to the second heat

exchanger part 132. The first and second outdoor expansion valves 151 and 152 are disposed in parallel. That is, the refrigerant expanded by the first outdoor expansion valve 151 may flow into the first heat exchanger part 131, and the refrigerant expanded by the second outdoor expansion valve 152 may flow into the second heat exchanger part 132. For example, each of the outdoor expansion valves 151 and 152 may be an electronic expansion valve (EEV).

[0032] Each of the outdoor units 11, 12, 13, and 14 is connected to the distributor 3 through a low pressure gas tube 311 and a low pressure connection tube 312. Also, each of the outdoor units 11, 12, 13, and 14 is connected to the distributor 3 through a high pressure tube 321 and a high pressure connection tube 322. Also, each of the outdoor units 11, 12, 13, and 14 is connected to the distributor 3 through a liquid tube and a liquid connection tube 332.

[0033] The low pressure tube 311 is connected to the second connection tube 134 and the low pressure connection tube 312. The high pressure tube 321 is connected to the joint tube 119 and the high pressure connection tube 322 which are disposed downward from the four-way valves 121 and 122. The liquid tube 331 is connected to the outdoor expansion mechanism 150 and the liquid connection tube 332.

[0034] The distributor 3 is connected to the plurality of indoor units 21, 22, 23, and 24 and the outdoor unit 1 to control the refrigerant flow. The distributor 3 is connected to each of the indoor units 21, 22, 23, and 24 through an indoor gas tube 313 and an indoor liquid tube 333.

[0035] The distributor 3 includes a low pressure gas pipe 31, a high pressure gas pipe 32, a liquid pipe 33, a low pressure valve 314, and a high pressure valve 324. The low pressure connection tube 312 and the indoor gas tube 313 are connected to the low pressure gas pipe 31, and the indoor liquid tube 333 and the liquid connection tube 332 are connected to the liquid pipe 33. Also, the high pressure connection tube 322 and a branch tube 323 connected to the indoor liquid tube 333 are connected to the high pressure gas pipe 32. The low pressure gas tube 311 includes first valves 315 and 316, the high pressure gas tube 321 includes second valves 325 and 326, and the liquid tube 331 includes third valves 335 and 336.

[0036] The indoor gas tube 313 includes the low pressure valve 314, and the high pressure valve 324 is connected to the branch tube 323. In the current embodiment, the low pressure valve 314 and the high pressure valve 324 may be an EEV in which an opening degree thereof is adjusted linearly or in a stepwise fashion.

[0037] Each of the indoor units 21, 22, 23, and 24 includes indoor heat exchangers 211, 221, 231, and 241, indoor fans 212, 222, 232, and 242, and indoor expansion mechanisms 213, 223, 233, and 243. For example, each of the indoor expansion mechanisms 213, 223, 233, and 243 may be an EEV.

[0038] Hereinafter, an operation of the multi type air

conditioner will be described.

[0039] Referring to Fig. 2, when the multi type air conditioner performs a heating operation, i.e., when one or more indoor units perform a heating operation (for example, the four indoor units perform the heating operation in Fig. 1), a high temperature refrigerant discharged from the compression unit 110 of the plurality of outdoor units 11, 12, 13, and 14 flows toward the indoor unit. Here, the low pressure valve 314 is closed, and the high pressure valve 324 is opened. Also, the first valves 315 and 316 disposed in the low pressure gas tube 311 may be closed.

[0040] The high-temperature high-pressure refrigerant discharged from the compression unit 110 flows into the high pressure gas pipe 32 along the high pressure gas tube 321 by adjusting the refrigerant flow through the four-way valves 121 and 122. Here, since the joint tube 119 communicates with the closed tubes 121a and 122a by the four-way valves 121 and 122, the refrigerant does not flow from an end of the closed tubes 121a and 122a any more and thus flows along the high pressure gas tube 321.

[0041] The refrigerant flowing into the high pressure gas pipe 32 flows into each of the indoor heat exchangers 211, 221, 231, and 241 through the branch tube 323 and the indoor gas tube 313. Then, the refrigerant is condensed in the indoor heat exchangers 211, 221, 231, and 241 and passes through the indoor expansion mechanisms 213, 223, 233, and 243 without being expanded to flow into the liquid pipe 33 through the indoor liquid tube 333. The refrigerant flowing into the liquid pipe 33 flows along the liquid connection tube and the liquid tube 331. Then, the refrigerant is expanded by the outdoor expansion mechanism 150 to flow into the outdoor heat exchangers 130, 200, 210, and 220. Then, the refrigerant is evaporated while passing through the outdoor heat exchangers 130, 200, 210, and 220, and then the refrigerant passes through each of the four-way valves 121 and 122 to flow into the accumulator 135. A gaseous refrigerant of the refrigerant introduced into the accumulator 135 is introduced into the compression unit 110.

[0042] As described above, when the heating operation is continuously performed, frost may occur on the outdoor heat exchangers 130, 200, 210, and 220. Thus, a defrosting operation for removing the frost from the outdoor heat exchangers 130, 200, 210, and 220 is required. The defrosting operation will be described later.

[0043] Fig. 3 is a circuit diagram illustrating a refrigerant flow when the multi type air conditioner performs a cooling operation.

[0044] Referring to Fig. 3, a cooling operation will be described.

[0045] When the multi type air conditioner performs a cooling operation, i.e., when one or more indoor units perform a cooling operation (for example, the four indoor units perform the cooling operation in Fig. 3), a refrigerant discharged from the compression unit 130 of the plurality of outdoor units 11, 12, 13, and 14 flows toward the outdoor heat exchangers 130, 200, 210, and 220. Here, the

high pressure valve 324 is closed, and the low pressure valve 314 is opened. Also, the second valves 325 and 326 disposed in the high pressure gas tube 321 may be closed.

[0046] The high-temperature high-pressure refrigerant discharged from the compression unit 110 flows into each of the outdoor heat exchangers 130, 200, 210, and 220 along the first connection tubes 123 and 124 by adjusting the refrigerant flow through the four-way valves 121 and 122. Then, the refrigerant is condensed while passing through the outdoor heat exchangers 130, 200, 210, and 220 to pass through the outdoor expansion mechanism 150 without being expanded. The refrigerant passing through the outdoor expansion mechanism 150 flows into the liquid pipe 33 along the liquid tube 331 and the liquid connection tube 332. The refrigerant flowing into the liquid pipe 33 is expanded while passing through the indoor liquid tube 333 to flow into each of the indoor expansion mechanisms 213, 223, 233, and 243. The expanded refrigerant is evaporated while passing through each of the indoor heat exchangers 211, 221, 231, and 241. The evaporated refrigerant flows into the low pressure gas pipe 31 along the indoor gas tube 313. The refrigerant flowing into the low pressure gas pipe 31 flows into the second connection tube 134 along the low pressure connection tube 312 and the low pressure gas tube 311. Then, the refrigerant is introduced into the accumulator 135. A gaseous refrigerant of the refrigerant introduced into the accumulator 135 is introduced into the compression unit 110.

[0047] Fig. 4 is a flowchart explaining a method of controlling the multi type air conditioner. Figs. 5 to 8 are schematic views illustrating successive defrosting operations of the plurality of outdoor units. Figs. 9 and 10 are circuit diagrams illustrating a refrigerant flow when a specific outdoor unit performs a defrosting operation. Fig. 9 illustrates a refrigerant flow when a fourth outdoor unit performs a defrosting operation, and Fig. 10 illustrates a refrigerant flow when a first outdoor unit performs a defrosting operation.

[0048] Referring to Figs. 4 to 10, the multi type air conditioner performs a heating operation by a heating operation command in operation S1. In operation S2, a control unit (not shown) determines that defrosting operation conditions are satisfied during the heating operation of the multi type air conditioner.

[0049] In the current embodiment, for example, whether the defrosting operation conditions are satisfied may be determined by comparing an outlet tube temperature of the outdoor heat exchanger to an outdoor temperature. Here, since the plurality of outdoor units are operated at the same time, time points at which the defrosting operation conditions are satisfied in the plurality of outdoor units may be similar to each other. However, the time points at which the defrosting operation conditions are satisfied in the outdoor units may be different from each other. In case where the defrosting operation conditions are satisfied in the multi type air conditioner, the defrost-

ing operation conditions are satisfied in the whole outdoor units or in the reference number of outdoor units.

[0050] In the current embodiment, whether the defrosting operation conditions are satisfied may be determined through various methods except for the above-described method. That is, the present disclosure is not limited to a method for determining whether the defrosting operation conditions are satisfied.

[0051] In the result determined in the operation S2, when the defrosting operation conditions are satisfied, the multi type air conditioner is operated in a defrosting operation mode. Specifically, in operation S3, the plurality of outdoor units may be successively operated in the defrosting operation mode. That is, one outdoor unit performs the defrosting operation, and the remaining outdoor units perform the heating operation. When one outdoor unit completely performs the defrosting operation, the next outdoor unit performs the defrosting operation.

[0052] In the current embodiment, for example, an order of the outdoor units performing the defrosting operation may be decided by capacity (heat exchange capacity) of each of the outdoor units. That is, in case where the whole or portions of the outdoor units may have capacities different from each other, the outdoor unit having relatively small capacity performs the defrosting operation first. If the whole or portions of the outdoor units have the same capacity, the outdoor units perform the defrosting operation according to a preset order. That is, when products are manufactured, the order of the outdoor units performing the defrosting operation may be previously decided, and this order may be stored in a memory (not shown). When the defrosting operation conditions are satisfied, the defrosting operation may be performed according to the preset order. Here, a change of the previously decided order may be impossible or possible.

[0053] For another example, the order of the outdoor units performing the deforesting operation may be decided whenever the defrosting operation conditions are satisfied. For example, the outdoor units may perform the defrosting operation in an order from time the fastest time points at which the defrosting operation conditions are satisfied.

[0054] In the current embodiment, for example, the outdoor units perform the defrosting operation in an order of a fourth indoor unit, a third indoor unit, a second indoor unit, and a first indoor unit.

[0055] Referring to Figs. 5 to 9, when the fourth outdoor unit 14 performs the defrosting operation, the outdoor heat exchanger 220 of the fourth outdoor unit 14 is switched into a condenser state by switching the refrigerant flow through the four-way valve of the fourth outdoor unit 14. That is, as shown in Fig. 5, the plurality of heat exchanger parts of the fourth outdoor unit 14 is switched into the condenser state. Here, each of the outdoor heat exchanger 130, 200, and 210 of the first to third indoor units 11, 12, and 13 is maintained in an evaporator state, and each of the indoor heat exchangers 211, 221, 231, and 241 of each of the indoor units 21, 22, 23, and 24 is

maintained in the condenser state.

[0056] Thus, the high-temperature high-pressure refrigerant discharged from the compression unit of the fourth outdoor unit 14 flows into the outdoor heat exchanger 220 via the four-way valve. When the high-temperature high-pressure refrigerant passes through the outdoor heat exchanger 220, frost on the outdoor heat exchanger 220 may be removed.

[0057] The refrigerant passing through the outdoor heat exchanger 220 of the fourth outdoor unit 14 flows along the liquid tube of the fourth outdoor unit 14, and then the refrigerant together with the refrigerant discharged from the liquid pipe 33 is introduced into the liquid tube of the first outdoor unit 11. The second valve 326 disposed in the high pressure gas tube of the fourth outdoor unit 14 may be closed during the defrosting operation of the fourth outdoor unit 14. An operation of the fan motor assembly disposed in the fourth outdoor unit 14 may be stopped during the defrosting operation of the fourth outdoor unit 14. Also, an opening degree of the outdoor expansion valve of the fourth outdoor unit 14 may be greater than that of the previous state (i.e., an opening degree of the outdoor expansion valve when the outdoor heat exchanger of the fourth outdoor unit serves as an evaporator).

[0058] Also, a portion of the refrigerant evaporated while passing through the outdoor heat exchanger in the first to third outdoor units 11, 12, and 13 flows into the accumulator 135 of the first to third outdoor units 11, 12, and 13. The other portion of the refrigerant flows the accumulator of the fourth outdoor unit 14 along the low pressure gas tube 311.

[0059] When the defrosting operation of the fourth outdoor unit 14 is completed, the outdoor heat exchanger 220 of the fourth outdoor unit 14 is switched into the evaporator state by switching the refrigerant flow through the four-way valve.

[0060] Thus, as shown in Fig. 6, the third outdoor unit 13 performs the defrosting operation. When the third outdoor unit 13 performs the defrosting operation, the outdoor heat exchanger 210 of the third outdoor unit 13 serves as the condenser, and the outdoor heat exchangers of the remaining outdoor units serve as the evaporators. When the defrosting operation of the third outdoor unit 13 is finished, the second outdoor unit 12 performs the defrosting operation as shown in Fig. 7. When the second outdoor unit 12 performs the defrosting operation, the outdoor heat exchanger 210 of the second outdoor unit 12 serves as the condenser, and the outdoor heat exchangers of the remaining outdoor units serve as the evaporators. When the defrosting operation of the second outdoor unit 12 is finished, the first outdoor unit 11 performs the defrosting operation.

[0061] Referring to Fig. 10, when the first outdoor unit 11 performs the defrosting operation, the outdoor heat exchanger 130 of the first outdoor unit 11 is switched in the condenser state by switching the refrigerant flow through the four-way valve. Here, each of the outdoor

heat exchangers of the second to fourth outdoor units 12, 13, and 14 is maintained in the evaporator state, and each of the indoor heat exchangers 211, 221, 231, and 241 of each of the indoor units 21, 22, 23, and 24 is maintained in the condenser state.

[0062] Thus, the high-temperature high-pressure refrigerant discharged from the compression unit of the first outdoor unit 11 flows into the outdoor heat exchanger 130 via the four-way valve. When the high-temperature high-pressure refrigerant passes through the outdoor heat exchanger 130, frost on the outdoor heat exchanger 130 may be removed.

[0063] The refrigerant passing through the outdoor heat exchanger 130 of the first outdoor unit 11 flows along the liquid tube of the first outdoor unit 11, and then the refrigerant together with the refrigerant discharged from the liquid pipe 33 is introduced into the liquid tubes of the second to fourth outdoor units 12, 13, and 14. The second valve 325 disposed in the high pressure gas tube of the first outdoor unit 11 may be closed during the defrosting operation of the first outdoor unit 11. An operation of the fan motor assembly disposed in the first outdoor unit 11 may be stopped during the defrosting operation of the first outdoor unit 11. Also, an opening degree of the outdoor expansion valve of the first outdoor unit 11 may be greater than that of the previous state (i.e., an opening degree of the outdoor expansion valve when the outdoor heat exchanger of the first outdoor unit serves as an evaporator).

[0064] When the defrosting operation of the first outdoor unit 11 is completed, the defrosting operation of the whole outdoor units is finished in operation S4. Then, the defrosting process returns to the operation S1, and each of the outdoor heat exchangers 130, 200, 210, and 220 of each of the outdoor units 11, 12, 13, and 14 becomes in the evaporator state.

[0065] According to the embodiment, since the indoor unit performs the heating operation during the defrosting operation of the air conditioner, the indoor space may be continuously heated to maintain a comfort indoor space.

[0066] Also, since the outdoor heat exchanger do not perform the defrosting operation at the same time, but successively perform the defrosting operation, the deterioration of the heating performance may be minimized.

[0067] Also, since the frost on the whole outdoor heat exchangers of each of the outdoor units is removed, it may prevent the frost from remaining on a portion of the outdoor heat exchangers.

[0068] Even though all the elements of the embodiments are coupled into one or operated in the combined state, the present disclosure is not limited to such an embodiment. That is, all the elements may be selectively combined with each other without departing the scope of the invention. Furthermore, when it is described that one comprises (or includes or has) some elements, it should be understood that it may comprise (or include or has) only those elements, or it may comprise (or include or have) other elements as well as those elements if there

is no specific limitation. Unless otherwise specifically defined herein, all terms including technical or scientific terms are to be given meanings understood by those skilled in the art. Like terms defined in dictionaries, generally used terms needs to be construed as meaning used in technical contexts and are not construed as ideal or excessively formal meanings unless otherwise clearly defined herein.

[0069] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the scope of the invention as defined by the appended claims. Therefore, the preferred embodiments should be considered in descriptive sense only and not for purposes of limitation, and also the technical scope of the invention is not limited to the embodiments. Furthermore, is defined not by the detailed description of the invention but by the appended claims, and all differences within the scope will be construed as being comprised in the present disclosure.

Claims

1. A multi type air conditioner comprising:

a plurality of indoor units (21, 22, 23, 24), each comprising an indoor heat exchanger (211, 221, 231, 241); and
a plurality of outdoor units (11, 12, 13, 14) connected to the plurality of indoor units (21, 22, 23, 24), each comprising an outdoor heat exchanger (130, 200, 210, 220),
wherein, when a defrosting operation condition is satisfied during a heating operation, the plurality of outdoor units (11, 12, 13, 14) successively perform a defrosting operation.

2. The multi type air conditioner according to claim 1, wherein each of the plurality of outdoor units (11, 12, 13, 14) comprises a four-way valve, and during the heating operation, the outdoor heat exchanger (130, 200, 210, 220) of each of the plurality of outdoor units (11, 12, 13, 14) is configured to serve as an evaporator by switching a refrigerant flow through the four-way valve, and the outdoor heat exchanger (130, 200, 210, 220) in which the defrosting operation is performed is configured to serve as a condenser by switching the refrigerant flow through the corresponding four-way valve.

3. The multi type air conditioner according to claim 2, wherein the outdoor heat exchanger (130, 200, 210, 220) is divided into a plurality of heat exchanger parts (131, 132) through which a refrigerant separably flows, and

when a specific outdoor unit of the plurality of outdoor units (11, 12, 13, 14) performs the defrosting operation, frost on the whole heat exchanger parts (131, 132) of the specific outdoor unit is removed.

4. The multi type air conditioner according to claim 3, wherein each of the outdoor units (11, 12, 13, 14) comprises a plurality of four-way valves (121, 122), and the number of four-way valves (121, 122) is equal to that of heat exchanger parts (131, 132).

5. The multi type air conditioner according to claim 1, wherein an order of the plurality of outdoor units (11, 12, 13, 14) performing the defrosting operation is decided according to heat exchange capacity of the outdoor heat exchanger (130, 200, 210, 220) of each of the outdoor units (11, 12, 13, 14).

6. The multi type air conditioner according to claim 4, wherein the outdoor unit comprising the outdoor heat exchanger having relatively small capacity performs the defrosting operation first.

7. The multi type air conditioner according to claim 1, wherein an order of the plurality of outdoor units (11, 12, 13, 14) performing the defrosting operation is previously decided and stored in a memory.

8. The multi type air conditioner according to claim 1, wherein an order of the plurality of outdoor units (11, 12, 13, 14) performing the defrosting operation is determined whenever the defrosting operation condition is satisfied.

9. The multi type air conditioner according to claim 1, wherein, after a specific outdoor unit completely performs the defrosting operation, the next outdoor unit performs the defrosting operation.

10. The multi type air conditioner according to any one of claims 1 to 9, wherein, during the defrosting operation, an operation of an outdoor fan (140) disposed in the outdoor unit performing the defrosting operation is stopped.

11. A method of operating multi type air conditioner comprising a plurality of indoor units (21, 22, 23, 24), each comprising an indoor heat exchanger (211, 221, 231, 241); and a plurality of outdoor units (11, 12, 13, 14) connected to the plurality of indoor units (21, 22, 23, 24), each comprising an outdoor heat exchanger (130, 200, 210, 220), wherein, when a defrosting operation condition is satisfied during a heating operation, the plurality of outdoor units (11, 12, 13, 14) successively perform a defrosting operation.

12. The method of claim 11, wherein each of the plurality of outdoor units (11, 12, 13, 14) comprises a four-way valve, and during the heating operation, the outdoor heat exchanger (130, 200, 210, 220) of each of the plurality of outdoor units (11, 12, 13, 14) switches a refrigerant flow through the four-way valve thus serving as an evaporator, and the outdoor heat exchanger (130, 200, 210, 220) in which the defrosting operation is performed switches the refrigerant flow through the corresponding four-way valve thus serving as a condenser. 5 10
13. The method of claim 12, wherein the outdoor heat exchanger (130, 200, 210, 220) is divided into a plurality of heat exchanger parts (131, 132) through which a refrigerant separably flows, and when a specific outdoor unit of the plurality of outdoor units (11, 12, 13, 14) performs the defrosting operation, removing frost on the whole heat exchanger parts (131, 132) of the specific outdoor unit. 15 20
14. The method of any one of claims 11 to 13, further comprising deciding an order of the plurality of outdoor units (11, 12, 13, 14) performing the defrosting operation according to heat exchange capacity of the outdoor heat exchanger (130, 200, 210, 220) of each of the outdoor units (11, 12, 13, 14). 25
15. The method of any one of claims 11 to 14, wherein the outdoor unit comprising the outdoor heat exchanger having relatively small capacity performs the defrosting operation first. 30

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FIG. 1

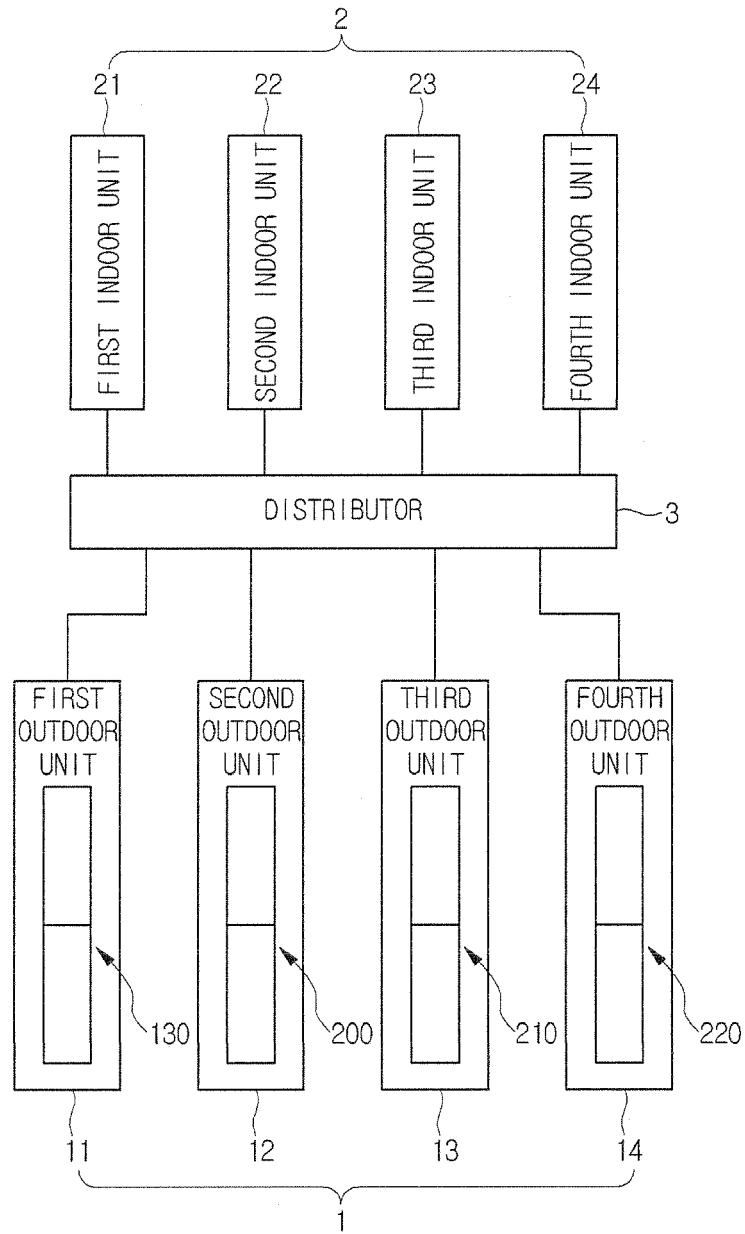


FIG. 2

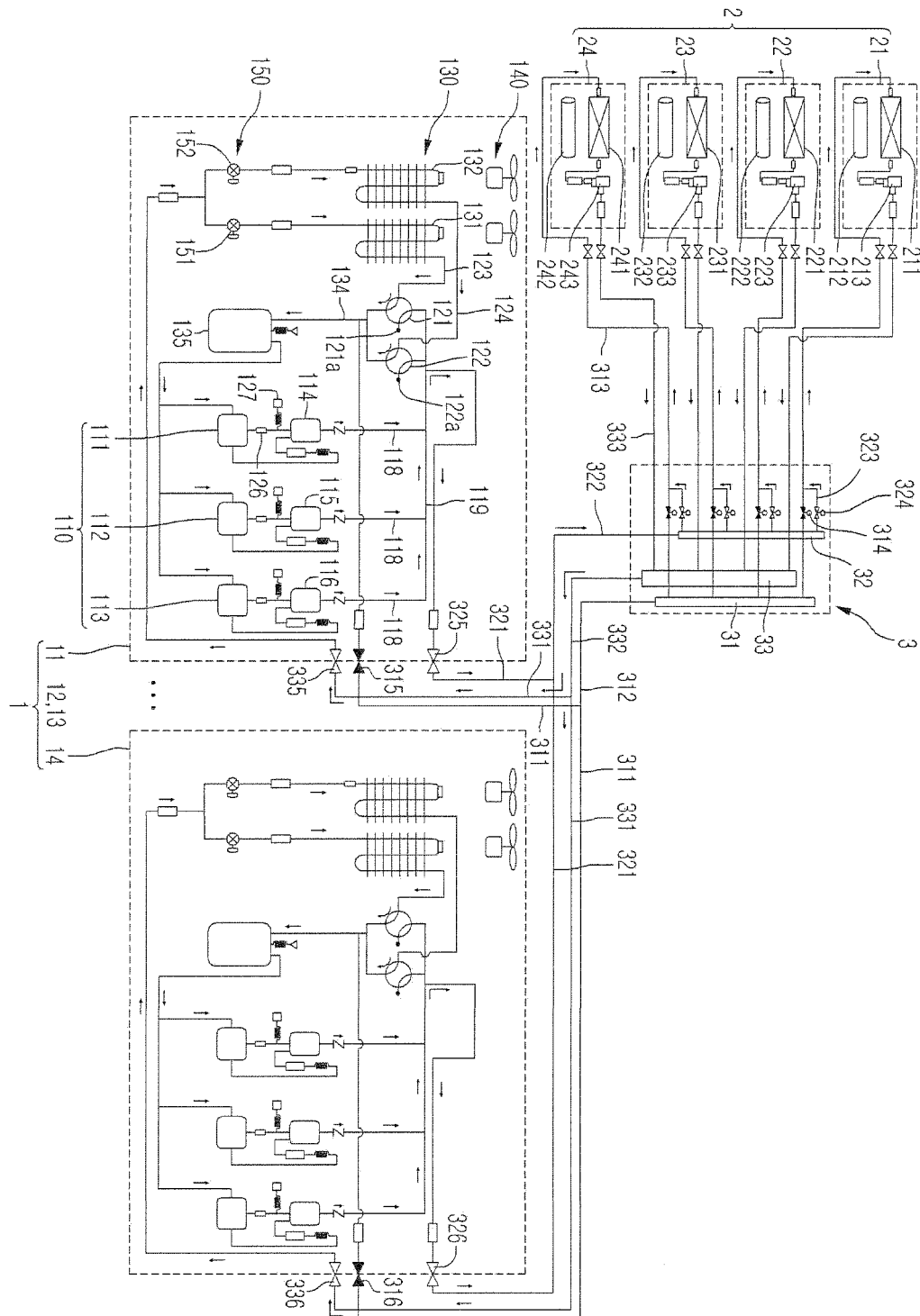


FIG. 3

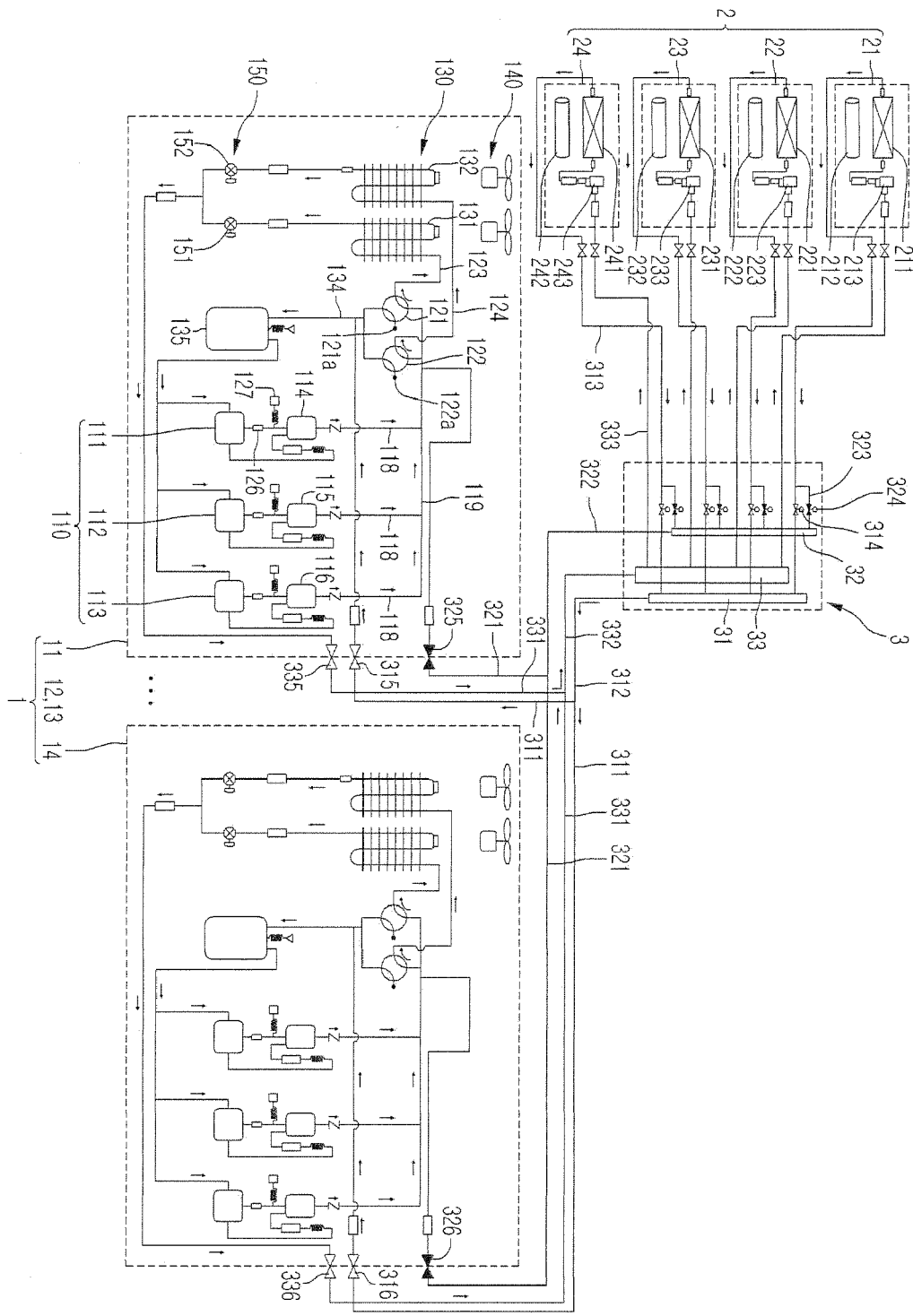


FIG. 4

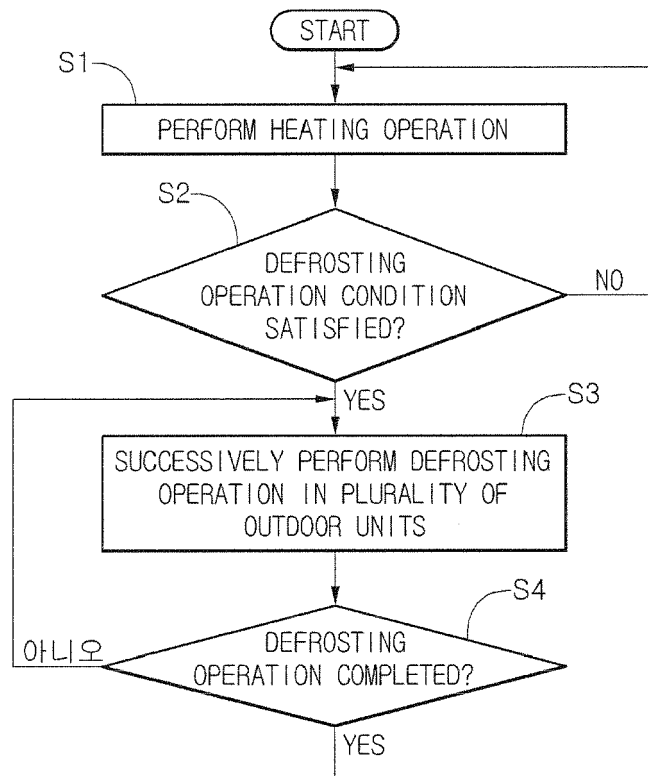


FIG. 5

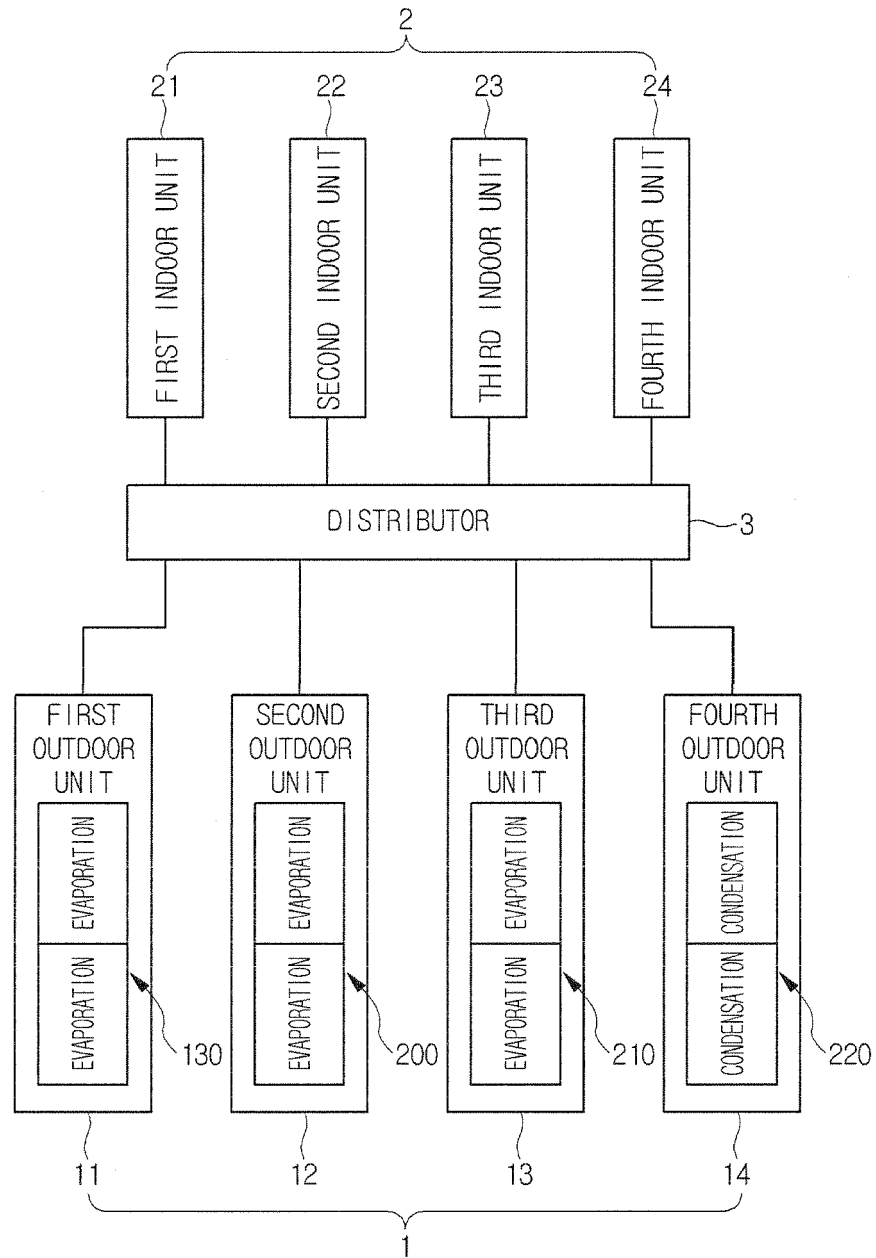


FIG. 6

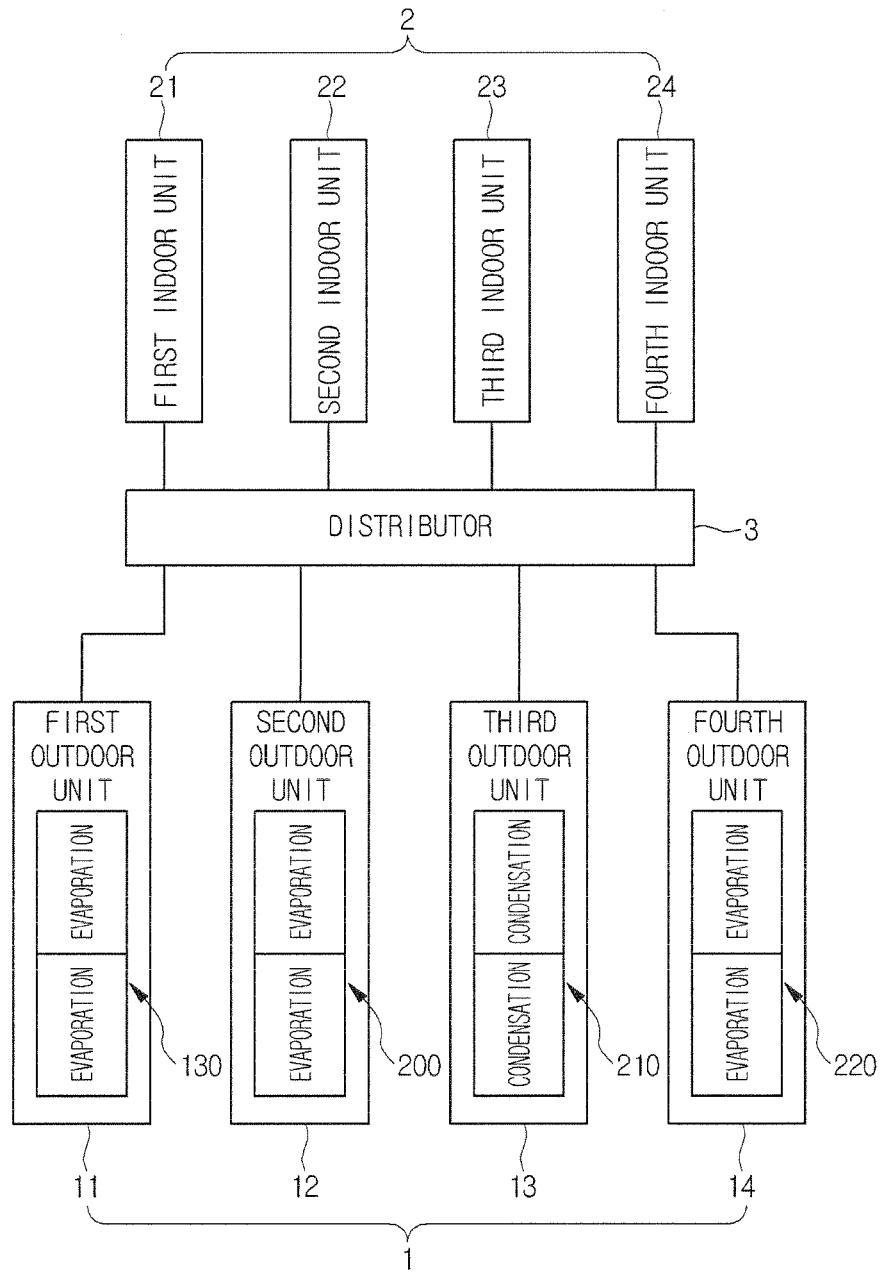


FIG. 7

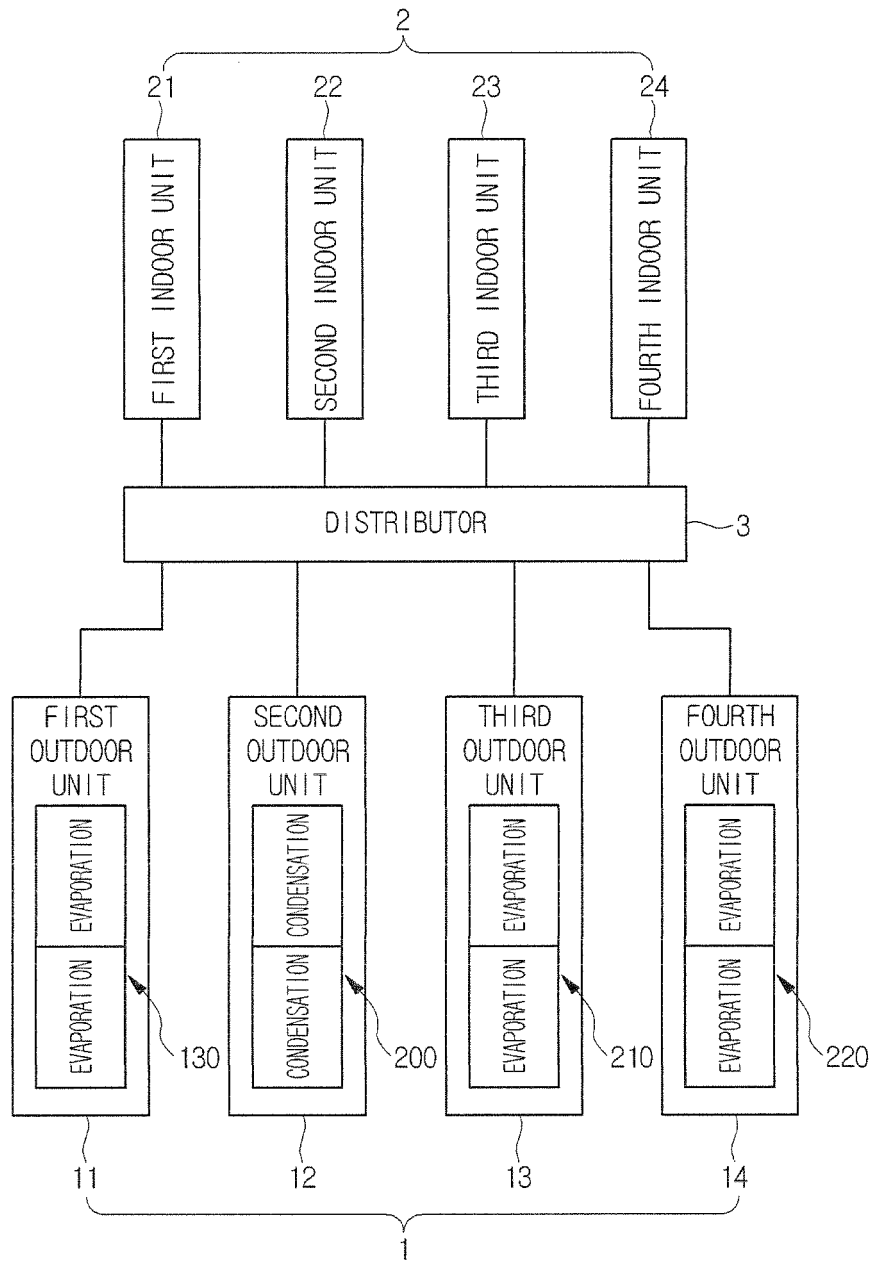


FIG. 8

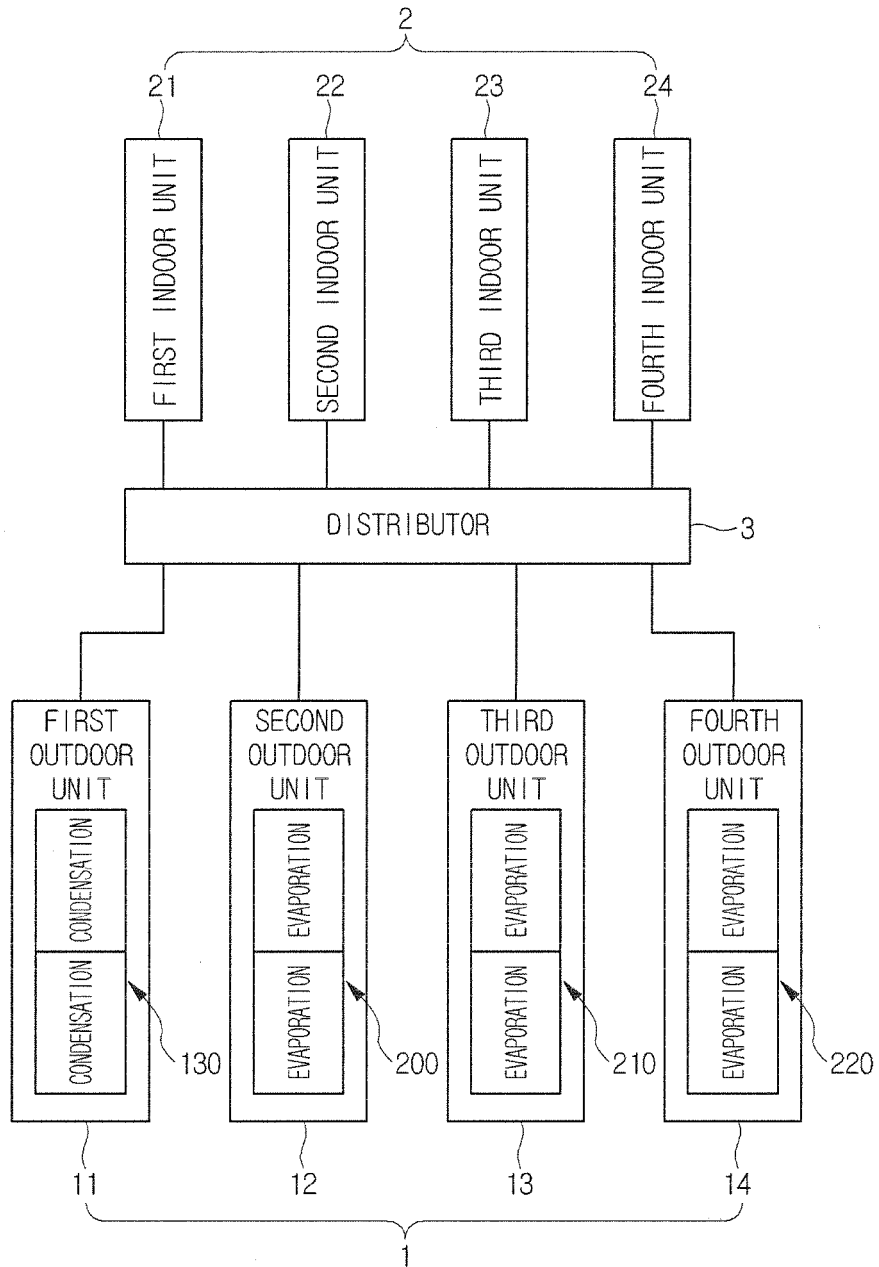


FIG. 9

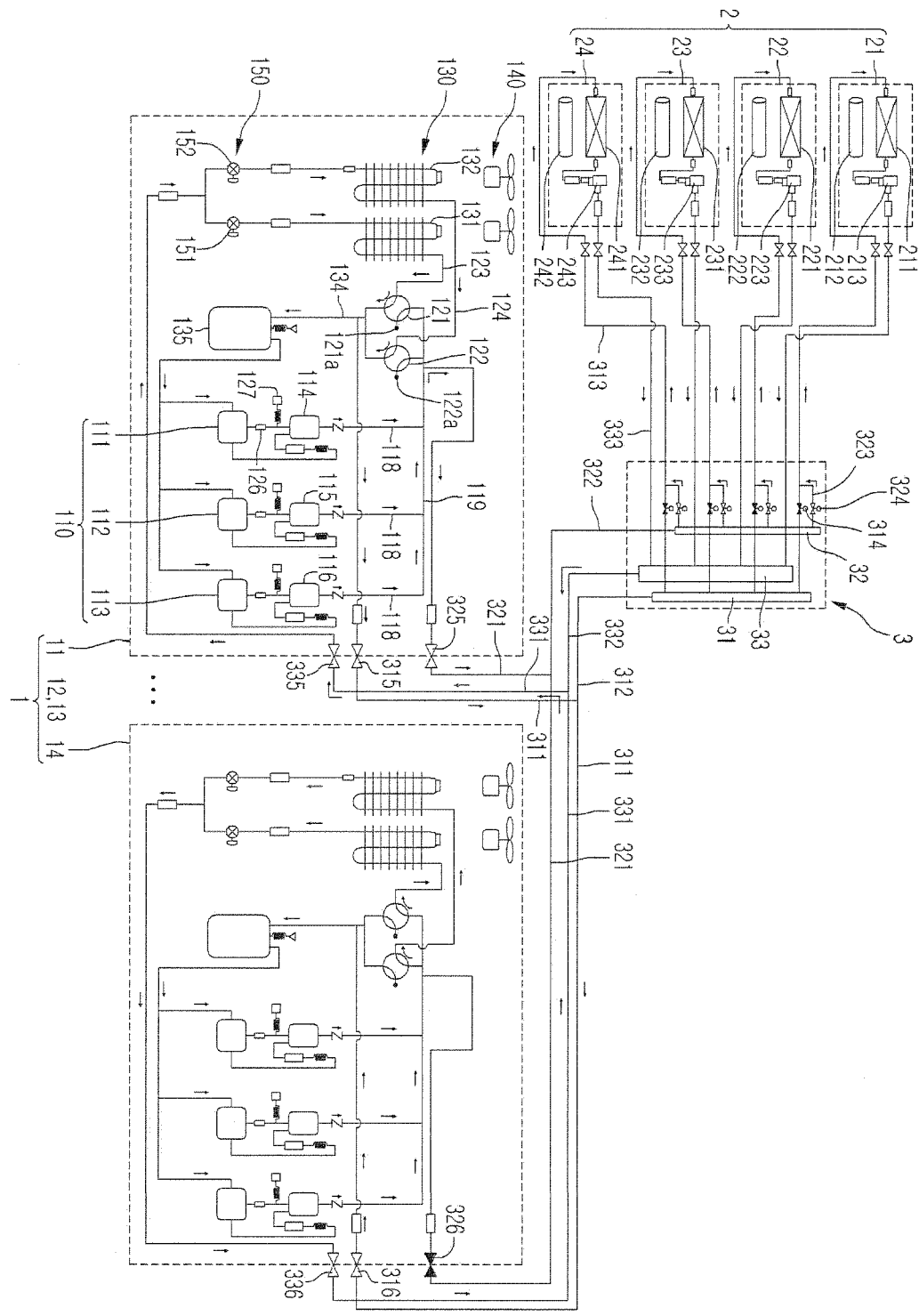


FIG. 10

