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Description

(1) Field of the Invention

[0001] The present invention relates to a refrigeration cycle apparatus formed by connecting a plurality of outdoor units to a plurality of indoor units.

(2) Description of the Related Art

[0002] There is known a simultaneous cooling and heating type VRF(variable refrigerant flow) system as disclosed in, for example, Japanese Patent No. 3289366, in which a plurality of outdoor units and a plurality of indoor units are connected in parallel using a high-pressure gas pipe, a low-pressure gas pipe, and a liquid pipe to form a refrigeration cycle, and a cooling operation and a heating operation can be simultaneously performed in the plurality of indoor units.

[0003] The refrigeration apparatus includes a plurality of heat source units (outdoor units), a plurality of user units (indoor units), a main liquid line, a main high-pressure gas line, a main low-pressure gas line, and a pipe unit.

[0004] Each of the heat source units includes a compressor, a heat source-side heat exchanger one end of which is connected to the discharging side and the intake side of the compressor in a switchable manner and the other end of which is connected to a liquid line, and a heat source-side decompression device provided on the liquid line. In addition, the proximal end of a gas line branched into a high-pressure passage permitting a refrigerant to flow from the compressor in the discharging direction and a low-pressure passage permitting the refrigerant to flow in the intake direction of the compressor is connected to the discharging side and the intake side of the compressor in a switchable manner.

[0005] The respective liquid lines, high-pressure passages, and low-pressure passages are connected to the main liquid line, the main high-pressure gas line, and the main low-pressure gas line so as to connect the respective heat source units in parallel. Each of the user units includes a user-side heat exchanger one end of which is connected to the main liquid line, and a user-side decompression device provided between the user-side heat exchanger and the main liquid line. In addition, the other end of the user-side heat exchanger is connected to the main high-pressure gas line and the main low-pressure gas line in a switchable manner.

[0006] The pipe unit includes a check valve permitting the refrigerant to flow from the heat source units to the main high-pressure gas line, and another check valve permitting the refrigerant to flow from the main low-pressure gas line to the heat source units.

[0007] Further, there is provided an auxiliary gas line one end of which is connected to a gas-side refrigerant pipe of the heat source-side heat exchanger in one heat source unit, the other end of which is connected to the main high-pressure gas line and the main low-pressure gas line, and which includes a high-pressure auxiliary passage permitting the refrigerant to flow from the heat source units to the main high-pressure gas line, and a low-pressure auxiliary passage permitting the refrigerant to flow from the main low-pressure gas line to the heat source units.

[0008] In the above-described refrigeration apparatus, a cooling operation and a heating operation can be simultaneously performed by connecting the heat source units, in parallel, in which the cooling operation and the heating operation can be performed in a switchable manner, and thus there is advantageously no need of dedicated heat source outdoor units in which the cooling operation and the heating operation can be simultaneously performed. However, it is necessary to provide the pipe unit having a complicated structure due to connecting the gas-side refrigerant pipe of each of the heat source units to the main high-pressure gas line and the low-pressure gas line in a switchable manner. In addition, when the refrigeration apparatus is assembled, it is necessary to secure a space for installing the pipe unit, resulting in a problem of an increased installation area. For comparison, when heat source units dedicated for a cooling operation and a heating operation are used, the pipe unit is not needed.

[0009] WO 2008/069066 discloses an apparatus according to the preamble of claim 1.

[0010] In view of the foregoing problem, an object of the present invention is to provide a simultaneous cooling and heating type refrigeration cycle apparatus without arranging a pipe unit outside and with a simple configuration using outdoor units in which a cooling operation and a heating operation can be performed in a switchable manner.

SUMMARY OF THE INVENTION

[0011] The present invention provides a refrigeration cycle apparatus including: a first and a second outdoor units, each including a compressor, an outdoor heat exchanger, a gas connection port, channel switching valves through which channels can be arbitrarily switched so as to communicate one of an intake port and a discharging port of the compressor with the gas connection port and to communicate the other with one end of the outdoor heat exchanger, and a liquid connection port connected to the other end of the outdoor heat exchanger; a plurality of indoor units in which indoor liquid pipes, indoor heat exchangers, and indoor gas pipes are connected in order; and a common liquid pipe through which the liquid connection port of each outdoor unit is communicated with the indoor liquid pipes in the plurality of indoor units, wherein each of the indoor gas pipes in the respective indoor units is branched into a first gas pipe and a second gas pipe, the first gas pipe is connected to the gas connection port of one of the outdoor units, the second gas pipe is connected to the gas connection port of the other of the outdoor units, pipe switching units, each switching the respective channels of the first gas pipe and the second gas pipe in each of the indoor units, and each of the indoor heat exchangers is communicated with only one of the outdoor units by switching the pipe switching units.

[0012] Further, in the above-described refrigeration cycle apparatus, when a cooling operation and a heating operation are simultaneously performed, one of the first and second outdoor units forms an heat absorb cycle by switching the pipe switching units so as to communicate the discharging port of the compressor with the gas connection port, and the other of the outdoor units forms a heat discharge cycle by switching the pipe switching units so as to communicate the discharging port of the compressor with the outdoor heat exchanger, the indoor unit that performs the heating operation is switched by the pipe switching unit so as to be communicated with the outdoor unit of the heat absorb cycle, and the indoor unit that performs the cooling operation is switched by the pipe switching unit so as to be communicated with the outdoor unit of the heat discharge cycle.

[0013] Further, in the above-described refrigeration cycle apparatus, between the first outdoor unit and the second outdoor unit that form the heat absorb cycle or the heat discharge cycle, the cycles can be alternately switched, and the pipe switching units are switched in accordance with the switching of the cycles.

[0014] Further, in the above-described refrigeration cycle apparatus, by alternately switching the cycles between the first outdoor unit and the second outdoor unit, a defrosting operation is performed for the outdoor heat exchanger of the outdoor unit that forms the heat absorb cycle.

[0015] Further, in the above-described refrigeration cycle apparatus, while the capacity of the compressor in the outdoor unit that forms the heat discharge cycle is controlled on the basis of a cooling required load of the indoor unit that performs the cooling operation, the capacity of the compressor in the outdoor unit that forms the heat absorb cycle is controlled on the basis of a heating required load of the indoor unit that performs the heating operation.

[0016] Further, in the above-described refrigeration cycle apparatus, first control valves and second control valves are electric-powered expansion valves.

[0017] Further, in the above-described refrigeration cycle apparatus, when the cooling operation or the heating operation is performed, the outdoor units being communicated with the respective indoor units can be switched by the pipe switching units.

[0018] Further, in the above-described refrigeration cycle apparatus, there is provided a function of switching the indoor units being communicated with the respective outdoor units on the basis of information of the capacity of each indoor unit and the temperature of the intake air.

[0019] According to the present invention, it is possible to provide a simultaneous cooling and heating type refrigeration cycle apparatus with a simple configuration using outdoor units in which a cooling operation and a heating operation can be performed in a switchable manner.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

Fig. 1 is a cycle system diagram showing a flow of a refrigerant when a cooling operation and a heating operation are simultaneously performed according to a first embodiment of the present invention;

Fig. 2 is a cycle system diagram showing a flow of the refrigerant when operations of indoor units are switched according to the first embodiment of the present invention;

Fig. 3 is a cycle system diagram showing a flow of the refrigerant when operations of outdoor units are switched according to the first embodiment of the present invention;

Fig. 4 is a cycle system diagram showing a flow of the refrigerant when the cooling operation is performed according to the first embodiment of the present invention;

Fig. 5 is a cycle system diagram showing a flow of the refrigerant when the cooling operation is performed at different evaporation temperatures according to the first embodiment of the present invention;

Fig. 6 is a cycle system diagram showing a flow of the refrigerant when the heating operation is performed according to the first embodiment of the present invention;

Fig. 7 is a cycle system diagram showing a flow of the refrigerant when the heating operation is performed at different condensation temperatures according to the first embodiment of the present invention;

Fig. 8 is a configuration diagram of a pipe switching unit according to the first embodiment of the present invention; and

Fig. 9 is a cycle system diagram showing a configuration in which three outdoor units are provided according to a second embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENT

[0021] Hereinafter, a simultaneous cooling and heating type refrigeration cycle apparatus according to embodiments of the present invention will be described in detail with reference to Figs. 1 to 9.

[First embodiment]

[0022] A first embodiment of the present invention will be described with reference to Figs. 1 to 3. Fig. 1 is a cycle system diagram showing a configuration of a refrigeration cycle apparatus of the embodiment. In the embodiment, a refrigeration cycle is configured in such a manner that two outdoor units 20a and 20b and three indoor units 21a, 21b, and 21c are connected to each other through three pipes of a common liquid pipe 10, a first gas pipe 11, and a second gas pipe 12. In each of the indoor units 21, an indoor heat exchanger 30 is connected to the common liquid pipe 10 through an indoor liquid pipe (10a, 10b, or 10c) and a decompression unit 31, and an indoor gas pipe 32 is connected to the other end of each indoor heat exchanger 30. Each of the indoor gas pipes 32 is connected to the first gas pipe 11 and the second gas pipe 12 through a pipe switching unit 22.

[0023] In each of the pipe switching units 22 (22a, 22b, and 22c), a pipe connected to the indoor gas pipe 32 is branched into gas pipes (a first gas pipe and a second gas pipe) of two systems. One pipe system in each unit is connected to the first gas pipe 11 through a first control valve 43 and the other pipe system in each unit is connected to the second gas pipe 12 through a second control valve 42. The pipe channels are opened and closed using the first control valves 43 and the second control valves 42, so that communication states between the indoor gas pipes 32 and the first gas pipe 11 or the second gas pipe 12 can be arbitrarily switched.

[0024] The first gas pipe 11 and the second gas pipe 12 are connected to a gas connection port 5a of the first outdoor unit 20a and a gas connection port 5b of the second outdoor unit 20b, respectively. In addition, both of liquid connection ports 6a and 6b of the respective outdoor units 20a and 20b are connected to the common liquid pipe 10.

[0025] Each of the outdoor units 20 is provided with a compressor 1 and an outdoor heat exchanger 2, one end of the outdoor heat exchanger 2 is connected to the liquid connection port 6, and a decompression device 4 is provided on the pipe route. The other end of each outdoor heat exchanger 2 is connected to a four-way valve 3 serving as a channel switching valve, and the four-way valve 3 allows the other end of the outdoor heat exchanger 2 to be selectively communicated with one of an intake port and a discharging port of the compressor 1. Further, the other of the intake port and the discharging port of each compressor 1 can be communicated with the gas connection port 5 through the four-way valve 3. The four-way valve 3a of the first outdoor unit 20a and the four-way valve 3b of the second outdoor unit 20b are configured to arbitrarily switch the channels.

[0026] Next, operations when simultaneous cooling and heating operations (one cooler and two heaters) are performed in the embodiment will be shown. In Fig. 1, the arrows show an example of flow directions of a refrigerant (not shown) in the case where a cooling operation is performed in the indoor unit 21c and a heating operation is performed in the indoor units 21a and 21b. The four-way valve 3a is in a connection state shown by the solid lines. In the outdoor unit 20a, the discharging port of the compressor 1a is allowed to be communicated with the outdoor heat exchanger 2a to form a heat discharge cycle in which a liquid refrigerant condensed by using the outdoor heat exchanger 2a as a condenser is supplied to the common liquid pipe 10 through the liquid connection port 6a. On the other hand, in the outdoor unit 20b, the channels are configured as shown by the solid lines in the four-way valve 3b, so that the discharging port of the compressor 1b is communicated with the gas connection port 5b. The liquid refrigerant flowing into the outdoor unit 20b from the liquid connection port 6b is decompressed by an expansion valve 4b to lower its temperature and pressure, and then flows into the compressor 1b after being evaporated by the outdoor heat exchanger 2b. As described above, the outdoor unit 20b forms an heat absorb cycle in which heat is taken from the outdoor air.

[0027] The liquid refrigerant is supplied from the common liquid pipe 10 to the indoor unit 21c that performs the cooling operation. The liquid refrigerant is decompressed by an indoor expansion valve 31c to lower its low temperature and pressure, and is evaporated after taking heat from the indoor air in the indoor heat exchanger 30c. The temperature of the indoor air is lowered by the action to perform the cooling operation. The refrigerant evaporated by the indoor heat exchanger 30c passes through the indoor gas pipe 32c, and flows into the pipe switching unit 22c. In the embodiment, by opening the first control valve 43c and by closing the second control valve 42c, the refrigerant is allowed to flow from the first gas pipe 11 to the first outdoor unit 20a. Thereafter, the refrigerant is compressed by the first outdoor unit 20a that forms the heat discharge cycle, and the heat is released to the outdoor air by the outdoor heat exchanger 2a for devolatilization. Then, the devolatilized refrigerant returns to the common liquid pipe 10.

[0028] On the other hand, a high-temperature and high-pressure gas refrigerant is supplied from the second gas pipe 12 to the indoor units 21a and 21b that perform the heating operation. The refrigerant compressed by the compressor 1b of the second outdoor unit 20b is supplied to the second gas pipe 12. By closing the first control valve 43a and by opening the second control valve 42a in the pipe switching unit 22a, the high-temperature and high-pressure gas refrigerant is introduced to the indoor heat exchanger 30a from the second gas pipe 12 to perform the heating operation. At this time, the expansion valve 31a is fully opened, and the refrigerant condensed and devolatilized by the indoor heat exchanger 30a flows out to the common liquid pipe 10. In addition, the same operation is performed also in the indoor unit 21b and the pipe switching unit 22b, and the heating operation is performed.

[0029] As described above, the liquid refrigerant flows into the common liquid pipe 10 from the indoor units 21a and 21b that perform the heating operation and from the first outdoor unit 20a that forms the heat discharge cycle, and separately flows out to the indoor unit 21c that performs the cooling operation and to the second outdoor unit 20b that forms the heat absorb cycle. Accordingly, the flow direction of the refrigerant within the common liquid pipe 10 is sequentially changed by the cooling load and the heating load in each of the indoor units.

[0030] Next, operations in the case where only the indoor unit 21b that performs the heating operation in Fig. 1 is switched to the cooling operation (two coolers and one heater) will be described using Fig. 2. The operations of the outdoor units 20a and 20b and the indoor units 21a and 21c are the same as those in the embodiment shown in Fig. 1, and the operations of the indoor unit 21a and the pipe switching unit 22b are changed to those same as the indoor unit 21c and the pipe switching unit 22c.

[0031] Specifically, the refrigerant supplied from the common liquid pipe 10 is decompressed using an expansion valve 31b, and is evaporated by the indoor heat exchanger 30b. Thereafter, the resultant refrigerant is allowed to flow out to the first gas pipe 11 through the first control valve 43b being opened. At this time, the second control valve 42b is closed. Then, the operation capacities (operation frequencies) of the respective compressors 1a and 1b are changed in accordance with changes in the heating load capacity and the cooling load capacity. As described above, the manipulation of the respective valves 31b, 42b, and 43b of the indoor unit 21b are changed, so that the heating operation and the cooling operation can be arbitrarily switched for each indoor unit.

[0032] In the above-described embodiment, two outdoor units in which the cooling operation and the heating operation can be performed in a switchable manner are used, so that it is possible to configure the simultaneous cooling and heating type refrigeration cycle apparatus in which the cooling operation and the heating operation can be performed for each indoor unit in an arbitrarily switchable manner. Further, in the embodiment, the respective indoor heat exchangers are connected to (communicated with) one of the first outdoor unit 20a and the second outdoor unit 20b by the switching the pipe switching units 22. In addition, while the liquid connection ports 6a and 6b of the respective outdoor units 20a and 20b are coupled to each other through the common liquid pipe 10, it is not necessary to connect the first gas pipe 11 and the second gas pipe 12 to each other. Accordingly, there is no need of the dedicated and complicated pipe unit described in the related art used for connecting pipes, thus not only preventing an increase in an installation area, but also improving installation workability. Especially, the first gas pipe 11 and the second gas pipe 12 are poor in activity due to their large diameters as compared to the liquid pipe 10. Accordingly, eliminating the connection of these pipes leads to improvement in installation workability.

[0033] In the embodiment shown in Fig. 1, the indoor unit 21c that performs the cooling operation is communicated with the outdoor unit 20a that performs the heat discharge operation through the first gas pipe 11. Thus, the cooling capability is controlled by the operation capacity of the compressor 1a provided in the first outdoor unit 20a. On the other hand, the indoor units 21a and 21b that perform the heating operation are communicated with the outdoor unit 20b that performs the heat absorb operation through the second gas pipe 12. Thus, the heating capability is controlled by the operation capacity of the compressor 1b provided in the second outdoor unit 20b. Further, in the embodiment shown in Fig. 2, since the indoor unit 21b is switched from the heating operation to the cooling operation, the operation capacity of the compressor 1a may be controlled by the operation frequency in accordance with the cooling loads of the indoor units 21b and 21c that perform the cooling operation, and the operation capacity of the compressor 1b may be controlled by the operation frequency in accordance with the heating load of the indoor unit 21a that performs the heating operation.

[0034] In the case where the cooling and heating operations are simultaneously performed using one outdoor unit, the heat is released or absorbed from the outdoor heat exchanger in a conventional technique, resulting in complicated control. In addition, even in the case where the outdoor unit is used as a heat radiator, it is necessary to control the balance between the heat discharge to the outdoor air and the heat discharge to the heating indoor unit. However, the cooling capability and the heating capability can be easily controlled because they can be separately controlled by the operation capacities of the compressors 1a and 1b in the embodiment.

[0035] It should be noted that the cooling and heating loads of the indoor units are obtained on the basis of information of the capacities of the indoor units and the temperature of the intake air, and function to switch the indoor units being communicated with the respective outdoor units. As described above, the operation capacities of the compressor 1a and the compressor 1b are determined in accordance with the cooling load and the heating load, and the respective compressors are accordingly operated at different operation frequencies.

[0036] Incidentally, each compressor holds an oil therein, a part of the held oil flows out during the cycle together with the heat discharged refrigerant, and then returns to the compressor together with the intake refrigerant. However, when a plurality of outdoor units are used as in the case of the embodiment, there is a possibility that the oil is disproportionately held by the respective compressors 1a and 1b. Thus, if the amount of the oil is insufficient, there is a risk of such a problem that the compressors are damaged, and it is important to avoid oil shortage.

[0037] Further, a ratio of the amount of the oil flowing out from the compressors during the cycle to the flowing amount of the refrigerant tends to increase as the operation capacity increases. Accordingly, in the case where the compressors 1a and 1b are operated at different frequencies as in the case of the embodiment, the amount of the refrigerant held by the compressor 1b with a high operation frequency (large capacity) is disadvantageously likely to decrease. In order to solve the problem, the operations can be appropriately switched between the outdoor units 20a and 20b as shown in Fig. 3 in the embodiment.

[0038] Specifically, while the four-way valve 3a of the first outdoor unit 20a that forms the discharge cycle in Fig. 1 is switched to a connection state shown by the solid lines, so that the heat discharge cycle is switched to the heat absorb cycle, the four-way valve 3b of the second outdoor unit 20b that forms the heat absorb cycle is switched to a connection state shown by the solid lines, so that the heat absorb cycle is switched to the heat discharge cycle.

[0039] Further, while the first control valve 43c of the pipe switching unit 22c connected to the indoor unit 21c that performs the cooling operation is closed, the second control valve 42c is opened. Accordingly, the indoor heat exchanger 30c is allowed to be communicated with the second outdoor unit that forms the heat discharge cycle. In the pipe switching units 22a and 22b connected to the indoor units 21a and 21b, respectively, that perform the heating operation, the first control valves 43a and 43b are opened, and the second control valves 42a and 42b are closed. Accordingly, the indoor heat exchangers 30a and 30b are allowed to be communicated with the first outdoor unit 20a that forms the heat absorb cycle.

[0040] In the embodiment, the opening/closing states of the first control valves 43 and the second control valves 42 of the pipe switching units can be switched in accordance with the operations of the respective outdoor units 20a and 20b, so that the indoor unit that performs the cooling operation is communicated with the outdoor unit that forms the heat discharge cycle and the indoor unit that performs the heating operation is communicated with the outdoor unit that forms the heat absorb cycle. Thus, the operations of the outdoor units can be appropriately switched with ease.

[0041] Therefore, in the case where it is determined that there is a possibility of a disproportionate balance in the amount of the oil as described above, such a trouble can be avoided by appropriately switching the operations of the outdoor units. When a state in which a difference between the operation capacities of the both compressors is larger than a predetermined value is continued for a long time, the switching operations of the outdoor units may be performed, or the outdoor units may be periodically switched depending on an operation time.

[0042] It should be noted that the purpose for switching the operations of the outdoor units is not limited to avoiding the disproportionate balance in the amount of the oil, but may be for rotation in which, for example, the cumulated operation times of the respective compressors are equalized.

[0043] Further, as one of conditions under which the switching operation is performed, the switching operation may be started at the same timing when a defrosting operation for melting frost grown on a surface of the outdoor heat exchanger of the outdoor unit that forms the heat absorb cycle is started. If the switching operation is not started at the same timing, there is a problem that the high-temperature refrigerant can not be supplied to the indoor unit that performs the heating operation during the defrosting operation. Therefore, the switching operation is started at the same timing as the defrosting operation, so that the outdoor unit that forms the heat discharge cycle, namely, the outdoor unit to which the frost is not attached can be used while forming the heat absorb cycle. Thus, it is not necessary to stop the heating operation in the indoor unit by the defrosting operation and the comfort can be improved.

[0044] It should be noted that the outdoor unit that performs the defrosting operation still forms the heat discharge cycle as a condenser even after the frost is melted and the defrosting operation is terminated. The heat released in such a manner can be used as heat for melting the frost, and thus energy saving can be improved as compared to a case in which the defrosting operation is performed without switching the operations between the outdoor units.

[0045] Next, operations when the cooling operation is performed will be shown using Fig. 4. In the embodiment, the arrows show the flow of the refrigerant in the case where the cooling operation is performed in all of three indoor units 21. Both of the outdoor units 20a and 20b form the heat discharge cycle, and allow the compressors 1 to suck and compress the gas refrigerant in the first gas pipe 11 and the second gas pipe 12. After the heat of the compressed refrigerant is released for devolatilization by the outdoor heat exchangers 2, the liquid refrigerant is supplied to the common liquid pipe 10. In the respective indoor units 21, after the refrigerant is decompressed by the respective expansion valves 31, the resultant refrigerant is evaporated and gasified by the respective indoor heat exchangers 30. Thereafter, by opening the both of the first control valves 43 being communicated with the first gas pipe 11 and the second control valves 42 being communicated with the second gas pipe 12, the refrigerant is returned to the respective outdoor units 20 using the first gas pipe 11 and the second gas pipe 12. Since two gas pipes are used, a pressure loss can be reduced and energy saving can be advantageously improved as compared to a case in which only one gas pipe is used.

[0046] Further, it is not necessary to always operate the both of the outdoor units 20a and 20b. If the cooling load is small, only one outdoor unit may be operated. For example, in the case where only the first outdoor unit 20a is operated, the compressor 1b is stopped and the expansion valve 20a is closed. Further, the second control valves 42 for connecting the second gas pipe 12 being communicated with the second outdoor unit 20b to the respective indoor units 21 are closed. Such an operation enables the cooling operation using only one outdoor unit 20a.

[0047] It should be noted that while the first outdoor unit 20a may be stopped, the second outdoor unit 20b may be operated. In this case, the operations of the respective outdoor units are switched, the first control valves 43 connected to the first gas pipe are closed, and the second control valves 42 connected to the second gas pipe are opened. As described above, the opening/closing states of the first control valves and the second control valves are switched in accordance with the operations of the outdoor units 20a and 20b, so that in addition to stopping of the cooling or heating operation, the operation states of the outdoor units 20a and 20b can be switched. By switching the operations, the cumulated operation times of the compressors 1a and 1b can be equalized, and the reliability can be enhanced.

[0048] Incidentally, the respective indoor units are installed under different room-temperature environments in some cases. In general, an evaporation temperature may be high under a high room-temperature environment whereas an evaporation temperature needs to be lowered under a low room-temperature environment. If the evaporation temperature is high, the energy saving is improved. However, the pressures of the refrigerants in the respective indoor units become substantially the same, namely, the same evaporation temperature because the indoor units are communicated with each other through the first gas pipe 11 and the second gas pipe 12. Therefore, in the case where the indoor units are installed under different room-temperature environments, the evaporation temperature is changed in accordance with the low room-temperature environment, thus reducing the energy saving as the whole refrigeration cycle apparatus.

[0049] In order to solve the problem, the outdoor units being communicated with the indoor units can be arbitrarily switched in accordance with the loads of the respective rooms as shown in Fig. 5 in the embodiment. it is assumed that on the basis of information of the intake air temperatures in the rooms, only the indoor unit 21c is low in the room temperature and it is determined that the evaporation temperature of the indoor unit 21c needs to be kept low as compared to the indoor units 21a and 21b. In such a case, both of the first control valves 43 and the second control valves 42 are opened in Fig. 4. However, only one valve in each indoor unit is opened in Fig. 5, so that the outdoor units being communicated with the respective indoor units can be arbitrarily switched.

[0050] Specifically, in the indoor units 21a and 21b where the evaporation temperature may be high, the first control valves 43 are closed and the second control valves 42 are opened. Accordingly, the evaporated gas is introduced to the second outdoor unit 20b through the second gas pipe 12. On the other hand, in the indoor unit 21c where the evaporation temperature is low, the first control valve 43 is opened and the second control valve 42 is closed. Accordingly, the refrigerant is returned to the first outdoor unit 20a through the first gas pipe 11.

[0051] Since the common liquid pipe 10 is shared by the first outdoor unit 20a and the second outdoor unit 20b, the respective compressors 1a and 1b are the same in the discharging pressure. However, the intake pressure of the compressor 1a is determined on the basis of the evaporation temperature of the indoor unit 20c, and the intake pressure of the compressor 1b is determined on the basis of the evaporation temperatures of the indoor units 20a and 20b. Accordingly, the compressors 1a and 1b may be different in the intake pressure. Thus, while the intake pressure of the compressor 1b can be increased, the compression power of the compressor 1b can be suppressed, as compared to a case in which the both of the compressors 1a and 1b are operated with a low intake pressure in accordance with the evaporation temperature of the indoor unit 20c, thus improving the energy saving.

[0052] Next, operations when the heating operation is performed will be described using Fig. 6. The outdoor units 20a and 20b form the heat absorb cycle at the time of the heating operation. After the refrigerant supplied from the common liquid pipe 10 is evaporated by the outdoor heat exchangers 2 and the resultant refrigerant is compressed by the compressors 1, the high-temperature and high-pressure refrigerant is supplied to the respective indoor units 20 using the first gas pipe 11 and the second gas pipe 12. Only one of the outdoor units may be operated in accordance with the heating load, or two units may be operated at the same time. At this time, among the first control valves 43 and the second control valves 42 of the indoor units, the valves being communicated with the outdoor unit 20 being operated are appropriately opened and closed in accordance with the operation of the outdoor unit 20.

[0053] Further, as shown in Fig. 7, one of the first control valve 43 and the second control valve 42 is opened and the other is closed in each indoor unit. Accordingly, the outdoor units 20 being communicated with the respective indoor units 21 may be arbitrarily switched as similar to the cooling operation. In the cycle of the embodiment, the compressors 1a and 1b can be operated at different condensation temperatures, namely, different discharging pressures under the condition where the room temperatures are largely changed. Thus, the compressors 1a and 1b are effective in improving the energy saving.

[0054] It should be noted that in the case where the cooling or heating operation is switched to only one of the outdoor units being communicated, if the total capacity of the indoor units being communicated with the one outdoor unit exceeds the rated capacity of the outdoor unit, there is a possibility of such a problem that the cooling capability or the heating capability becomes insufficient. Further, since the compressors 1 of the respective outdoor units 20 are operated at different operation capacities, there is a possibility of the disproportionate balance in the amount of the oil between the compressors 1 as described above. Therefore, it is desirable that the operations between the outdoor units 20, and the outdoor units 20 connected to the respective indoor units 21 are appropriately switched.

[0055] Only when the larger total capacity of the indoor units between the total capacity of the indoor units connected to the first outdoor unit 20a and the total capacity of the indoor units connected to the second outdoor unit 20b is smaller than the smaller capacity of the outdoor unit, the indoor units being communicated with the outdoor unit can be switched. Therefore, even when the operations are switched between the outdoor units and even when the outdoor units 20a and 20b are different from each other in the rated capacity, it is possible to avoid the problem of the insufficient cooling capability or heating capability and to prevent the deterioration in reliability due to the disproportionate balance in the amount of the oil.

[0056] Incidentally, if the first control valves 43 are opened in the embodiment, the refrigerant flows from the first gas pipe 11 to the indoor units 21 at the time of the heating operation, and the refrigerant flows from the indoor units 21 to the first gas pipe 11 at the time of the cooling operation. As described above, the refrigerant flows in the opposite directions in the cooling and heating operations, and thus there is a need of control valves through which the refrigerant can flow in the both directions. Typical opening/closing valves are directional, and it is necessary to arrange two opening/closing valves in parallel in order to flow the refrigerant in the both directions. Accordingly, the pipe switching units 22 become disadvantageously large in size. Thus, as the first control valves 43 and the second control valves 42 of the pipe switching units, electric-powered expansion valves which are similar to those used for the expansion valves 31 and 4 and require small spaces are used in the embodiment. Thus, the opening/closing operations can be performed in the both directions.

[0057] Further, in the case where the operations of the indoor units 20 are switched between the heating and cooling operations, the refrigerant within the indoor heat exchangers 30 is drastically changed between a high pressure and a low pressure and noise caused by the flow of the refrigerant is generated, thus possibly bringing a discomfort feeling to users. Since the electric-powered expansion valves whose opening degrees can be arbitrarily adjusted are used in the embodiment, pressure changes can be prevented, as compared to the case in which the opening/closing valves are used, by gradually increasing the opening degrees in such a case. Thus, it is possible to prevent the generation of the noise caused by the flow of the refrigerant.

[0058] Further, Fig. 8 shows a configuration example of a pipe switching unit using a first pressure adjusting valve 45, a second pressure adjusting valve 44, and a capillary 46, in addition to the first control valve 43 and the second control valve 42 configured by the electric-powered expansion valves. In the embodiment, by opening the first pressure adjusting valve 45 before increasing the opening degree of the first control valve 43, the pressures of the indoor heat exchangers 30 and the first gas pipe 11 can be gradually equalized through the capillary circuit 46. Since the gas refrigerant flows to the first control valve 43, a pressure loss tends to increase as compared to the liquid refrigerant. Thus, it is necessary to use large-sized electric-powered expansion valves with a small flow resistance. Therefore, there is a possibility that the pressures change too fast in the equalization operation of the pressures. However, the capillary circuit 46 and the first pressure adjusting valve 45 are provided to flow a small amount of refrigerant, and thus the pressures can be gradually equalized by using the first pressure adjusting valve 45. It should be noted that the electric-powered expansion valve is used for the first pressure adjusting valve 45 because the refrigerant flows in the both directions.

[0059] For the second control valve 42, the noise of the refrigerant flow caused by the pressure changes can be similarly prevented by opening the second control valve 42 after gradually equalizing the pressures using the second pressure adjusting valve 44. It should be noted that the capillary circuit 46 is shared for downsizing in the embodiment.

[Second embodiment]

[0060] A second embodiment of the present invention will be described using Fig. 9. The second embodiment is different from the first embodiment shown in Fig. 1 in that three outdoor units are arranged in parallel. However, the second embodiment is the same as the first embodiment shown in Fig. 1 in that respective outdoor units 20a, 20b, and 20c are communicated with each other through a common liquid pipe 10. A first gas pipe 11, a second gas pipe 12, and a third gas pie 13 connected to the respective outdoor units are separately connected to respective pipe switching units 22. In each of the pipe switching units 22, a first control valve 43, a second control valve 42, and a third control valve 41 are provided at circuits communicated with the first gas pipe 11, the second gas pipe 12, and the third gas pipe 13, respectively, and the respective gas pipes 11, 12, and 13 are connected to indoor units 21 through the respective control valves 43, 42, and 41, respectively.

[0061] Two indoor units 21a and 21b are connected to perform a heating operation in the indoor unit 21a and to perform a cooling operation in the indoor unit 21b in the embodiment. Further, four-way valves 3 of the respective outdoor units 20 are switched so as to form a heat discharge cycle in the first outdoor unit 20a and to form an heat absorb cycle in the second outdoor unit 20b and the third outdoor unit 20c.

[0062] A gas refrigerant supplied from the second outdoor unit 20b that forms the heat absorb cycle is supplied from the second gas pipe 12 to the indoor unit 21a through the second control valve 42. Further, the gas refrigerant supplied from the outdoor unit 20c that forms the heat absorb cycle is supplied from the third gas pipe 13 to the indoor unit 21a through the third control valve 41. The gas refrigerants supplied from the respective outdoor units 20b and 20c are joined, and then condensed and devolatilized by an indoor heat exchanger 30a before flowing to the common pipe 10.

[0063] In the indoor unit 21b that performs the cooling operation, after the refrigerant supplied from the common liquid pipe 10 is decompressed by an expansion valve 31, the resultant refrigerant is evaporated by an indoor heat exchanger 30b to perform the cooling operation. The gasified refrigerant reaches the outdoor unit 20a that forms the heat discharge cycle through the first control valve 43 and the first gas pipe 11.

[0064] In the refrigeration cycle of the embodiment, the refrigerant compressed by the compressors 1a, 1b, and 1c is condensed by the first outdoor unit 20a that performs the heat discharge operation and the indoor unit 21a that performs the heating operation. Thereafter, the condensed refrigerant is evaporated and gasified by the second outdoor unit 20b and the third outdoor unit 20c that perform the heat absorb operation and the indoor unit 21b that performs the heating operation before returning to the compressors.

[0065] In the indoor unit 21a that performs the heating operation, by opening the first control valve 42a and the second control valve 43a and by closing the third control valve 41a, the indoor unit 21a is communicated with only the second outdoor unit 20b and the third outdoor unit 20c through the second gas pipe 12 and the third gas pipe 13. On the other hand, in the indoor unit 21b that performs the cooling operation, by opening the third control valve 41b and by closing the first control valve 42b and the second control valve 43b, only the indoor gas pipe 32b and the first outdoor unit 20a are communicated with each other.

[0066] As described above, the opening/closing states of the respective control valves 41, 42, and 43 in the pipe switching units 22 are switched in accordance with the operations of the outdoor units, so that it is possible to provide the simultaneous cooling and heating type refrigeration cycle apparatus using the outdoor units in which the cooling operation and the heating operation can be performed in a switchable manner.

Claims

1. A refrigeration cycle apparatus comprising:

   a first and a second outdoor units (20a; 20b), each including a compressor (1), an outdoor heat exchanger (2), a gas connection port (5), channel switching valves (3) through which channels can be arbitrarily switched so as to communicate one of an intake port and a discharging port of the compressor with the gas connection port (5) and to communicate the other with one end of the outdoor heat exchanger (2), and a liquid connection port (6) connected to the other end of the outdoor heat exchanger (2);

   a plurality of indoor units (21a; 21 b; 21c) in which indoor liquid pipes, indoor heat exchangers (30), and indoor gas pipes (32) are connected in order; and

   a common liquid pipe (10) through which the liquid connection port of each outdoor unit (20a; 20b) is communicated with the indoor liquid pipes in the plurality of indoor units (21a; 21 b; 21c), wherein

   each of the indoor gas pipes (32) in the respective indoor units (21a; 21 b; 21c) is branched into a first gas pipe (11) and a second gas pipe (12), the first gas pipe (11) is connected to the gas connection port of one of the outdoor units (20a), the second gas pipe (12) is connected to the gas connection port of the other of the outdoor units (20b), pipe switching units (22), each switching the respective channels of the first gas pipe (11) and the second gas pipe (12) in each of the indoor units (21a; 21b; 21c), **characterised in that** each of the indoor heat exchangers (30) is communicated with only one of the outdoor units (20a; 20b) by switching the pipe switching units (22).

2. The refrigeration cycle apparatus according to claim 1, wherein
   when a cooling operation and a heating operation are simultaneously performed, one of the outdoor units (20a; 20b) forms a heat absorb cycle by switching the pipe switching units (3) so as to communicate the discharging port of the compressor (1) with the gas connection port (5), and the other of the outdoor units (20b; 20a) forms a heat discharge cycle by switching the pipe switching units (3) so as to communicate the discharging port of the compressor (1) with the outdoor heat exchanger (2),
   the indoor unit (21a; 21 b; 21c) that performs the heating operation is switched by the pipe switching unit (3) so as to be communicated with the outdoor unit (20a; 20b) of the heat absorb cycle, and
   the indoor unit (21a; 21b; 21c) that performs the cooling operation is switched by the pipe switching unit (3) so as to be communicated with the outdoor unit (20a; 20b) of the heat discharge cycle.

3. The refrigeration cycle apparatus according to claim 2, wherein
   between the first outdoor unit (20a) and the second outdoor unit (20b) that form the heat absorb cycle or the heat discharge cycle, the cycles can be alternately switched, and the pipe switching units (3) are switched in accordance with the switching of the cycles.

4. The refrigeration cycle apparatus according to claim 3, wherein

by alternately switching the cycles between the first outdoor unit (20a) and the second outdoor unit (20b), a defrosting operation is performed for the outdoor heat exchanger (2) of the outdoor unit that forms the heat absorb cycle.

5. The refrigeration cycle apparatus according to any one of claims 2 to 4, wherein while the capacity of the compressor (1) in the outdoor unit that forms the heat discharge cycle is controlled on the basis of a cooling required load of the indoor unit (21a; 21b; 21c) that performs the cooling operation, the capacity of the compressor (1) in the outdoor unit (20a; 20b) that forms the heat absorb cycle is controlled on the basis of a heating required load of the indoor unit (21a; 21b; 21c) that performs the heating operation.

6. The refrigeration cycle apparatus according to any one of claims 2 to 5, wherein first control valves (43) and second control valves (42) are electric-powered expansion valves.

7. The refrigeration cycle apparatus according to claim 1, wherein when the cooling operation or the heating operation is performed, the outdoor units (20a; 20b) being communicated with the respective indoor units (21a; 21b; 21c) can be switched by the pipe switching units.

8. The refrigeration cycle apparatus according to claim 7, wherein there is provided a function of switching the indoor units (21a; 21 b; 21c) being communicated with the respective outdoor units (20a; 20b) on the basis of information of the capacity of each indoor unit (21a; 21b; 21c) and the temperature of the intake air.

Patentansprüche

1. Kältekreislaufvorrichtung mit:

einer ersten und einer zweiten sich im Freien befindenden Einheit (Außeneinheit 20a, 20b), die jeweils einen Kompressor (1), einen Außenwärmetauscher (2), einen Gasanschlussstutzen (5), Kanalumschaltventile (3), durch die Kanäle beliebig geschaltet werden können, um einen Einlassstutzen oder einen Auslassstutzen des Kompressors mit dem Gasanschlussstutzen (5) zu verbinden, und den anderen mit einem Ende des Außenwärmetauschers (2) zu verbinden, und einen Flüssigkeitsanschlussstutzen (6), der mit dem anderen Ende des Außenwärmetauschers (2) verbunden ist, aufweisen,

einer Mehrzahl von sich im Inneren eines Hauses befindenden Einheiten (Inneneinheiten 21 a, 21 b, 21c), in denen in dieser Reihenfolge Innen-Flüssigkeitsleitungen, Innen-Wärmetauscher (30) und Innen-Gasleitungen (32) miteinander verbunden sind, und

einer gemeinsamen Flüssigkeitsleitung (10), durch die der Flüssigkeitsanschlussstutzen einer jeden Außeneinheit (20a, 20b) mit den Innen-Flüssigkeitsleitungen in der Mehrzahl von Inneneinheiten (21 a, 21b, 21c) verbunden ist, wobei

jede der Innen-Gasleitungen (32) in den jeweiligen Inneneinheiten (21a, 21 b, 21c) in eine erste Gasleitung (11) und eine zweite Gasleitung (12) verzweigt ist, wobei die erste Gasleitung (11) mit dem Gasanschlussstutzen einer der Außeneinheiten (20a) verbunden ist, die zweite Gasleitung (12) mit dem Gasanschlussstutzen der anderen Außeneinheit (20b) verbunden ist, und

Leitungsschalteinheiten (22), die jeweils die entsprechenden Kanäle der ersten Gasleitung (11) und der zweiten Gasleitung (12) in jeder der Inneneinheiten (21a, 21b, 21c) schalten,

dadurch gekennzeichnet, dass jeder der Innen-Wärmetauscher (30) mit nur einer der Außeneinheiten (20a, 20b) durch Schalten der Leitungsschalteinheiten (22) verbunden ist.

2. Kältekreislaufvorrichtung nach Anspruch 1, wobei, wenn ein Kühlvorgang und ein Heizvorgang gleichzeitig ausgeführt werden, eine der Außeneinheiten (20a, 20b) einen Wärmeabsorptionskreislauf bildet durch Schalten der Leitungsschalteinheiten (3) derart, dass der Auslassstutzen des Kompressors (1) mit dem Gasanschlussstutzen (5) verbunden ist, und die andere der Außeneinheiten (20b, 20a) einen Wärmeabgabekreislauf bildet durch Schalten der Leitungsschalteinheiten (3) derart, dass der Auslassstutzen des Kompressors (1) mit dem Außen-Wärmetauscher (2) verbunden ist,
wobei die Inneneinheit (21a, 21b, 21c), die den Heizvorgang ausführt durch die Leitungsschalteinheit (3) so geschaltet wird, dass sie mit der Außeneinheit (20a, 20b) des Wärmeabsorptionskreislaufs verbunden ist, und
wobei die Inneneinheit (21 a, 21 b, 2 1 c), die den Kühlvorgang ausführt, durch die Leitungsschalteinheit (3) so geschaltet ist, dass sie mit der Außeneinheit (20a, 20b) des Wärmeabgabekreislaufs verbunden ist.

3. Kältekreislaufvorrichtung nach Anspruch 2, wobei zwischen der ersten Außeneinheit (20a) und der zweiten Außeneinheit (20b), die den Wärmeabsorptionskreislauf oder den Wärmeabgabekreislauf bilden, die Kreisläufe alternativ geschaltet werden können, und wobei die Leitungsschalteinheiten (3) entsprechend dem Schalten der Kreisläufe geschaltet werden.

4. Kältekreislaufvorrichtung nach Anspruch 3, wobei durch abwechselndes Schalten der Kreisläufe zwischen der ersten Außeneinheit (20a) und der zweiten Außeneinheit (20b) ein Entfrostungsvorgang für den Außenwärmetauscher (2) der Außeneinheit durchgeführt wird, die den Wärmeabsorptionskreislauf bildet.

5. Kältekreislaufvorrichtung nach einem der Ansprüche 2 bis 4, wobei, während die Kapazität des Kompressors (1) in der Außeneinheit, die den Wärmeabgabekreislauf bildet, auf der Grundlage einer zur Kühlung der Inneneinheit (21a, 21 b, 21c), die den Kühlvorgang durchführt, erforderlichen Last gesteuert wird, die Kapazität des Kompressors (1) in der Außeneinheit (20a, 20b), die den Wärmeabsorptionskreislauf bildet, auf der Grundlage einer zur Heizung der Inneneinheit (21a, 21 b, 21c), die den Heizvorgang durchführt, erforderlichen Last gesteuert wird.

6. Kältekreislaufvorrichtung nach einem der Ansprüche 2 bis 5, wobei erste Steuerventile (43) und zweite Steuerventile (42) elektrisch angetriebene Regelventile sind.

7. Kältekreislaufvorrichtung nach Anspruch 1, wobei, wenn der Kühlvorgang oder der Heizvorgang durchgeführt wird, die Außeneinheiten (20a, 20b), die mit den jeweiligen Inneneinheiten (21a, 21 b, 21c) verbunden sind, durch die Leitungsschalteinheiten geschaltet werden können.

8. Kältekreislaufvorrichtung nach Anspruch 7, wobei eine Funktion des Schaltens der Inneneinheiten (21a, 21b, 21c) vorgesehen ist, die mit den entsprechenden Außeneinheiten (20a, 20b) verbunden sind, auf der Grundlage von Informationen über die Kapazität einer jeden Inneneinheit (21a, 21 b, 21c) und die Temperatur der Ansaugluft.

Revendications

1. Appareil à cycle de réfrigération comprenant :

une première et une deuxième unités extérieures (20a ; 20b), chacune incluant un compresseur (1), un échangeur thermique extérieur (2), un orifice de connexion de gaz (5), des vannes de commutation de canaux (3) par l'intermédiaire desquelles des canaux peuvent être arbitrairement commutés de façon à mettre en communication un parmi un orifice d'admission et un orifice de décharge du compresseur avec l'orifice de connexion de gaz (5) et à mettre en communication l'autre avec une extrémité de l'échangeur thermique extérieur (2), et un orifice de connexion de liquide (6) connecté à l'autre extrémité de l'échangeur thermique extérieur (2) ;
une pluralité d'unités intérieures (21a ; 21b ; 21c) dans lesquelles des tuyaux intérieurs de liquide, des échangeurs thermiques intérieurs (30), et des tuyaux intérieurs de gaz (32) sont connectés dans cet ordre ; et
un tuyau commun de liquide (10) par l'intermédiaire duquel l'orifice de connexion de liquide de chaque unité extérieure (20a ; 20b) est mis en communication avec les tuyaux intérieurs de liquide dans la pluralité d'unités intérieures (21a ; 21b ; 21c), dans lequel
chacun des tuyaux intérieurs de gaz (32) dans les unités intérieures (21a ; 21b ; 21c) respectives est ramifié en un premier tuyau de gaz (11) et un deuxième tuyau de gaz (12), le premier tuyau de gaz (11) est connecté à l'orifice de connexion de gaz d'une des unités extérieures (20a), le deuxième tuyau de gaz (12) est connecté à l'orifice de connexion de gaz de l'autre des unités extérieures (20b), des unités de commutation de tuyaux (22), chacune commutant les canaux respectifs du premier tuyau de gaz (11) et du deuxième tuyau de gaz (12) dans chacune des unités intérieures (21a ; 21b ; 21c), **caractérisé en ce que** chacun des échangeurs thermiques intérieurs (30) est mis en communication avec une seule des unités extérieures (20a ; 20b) en commutant les unités de commutation de tuyaux (22).

2. Appareil à cycle de réfrigération selon la revendication 1, dans lequel
lorsqu'une opération de refroidissement et une opération de chauffage sont simultanément exécutées, une des unités extérieures (20a ; 20b) forme un cycle d'absorption de chaleur en commutant les unités de commutation de tuyaux (3) de façon à mettre en communication l'orifice de décharge du compresseur (1) avec l'orifice de connexion de gaz (5), et l'autre des unités extérieures (20a ; 20b) forme un cycle de décharge de chaleur en commutant les unités de commutation de tuyaux (3) de façon à mettre en communication l'orifice de décharge du compresseur (1) avec l'échangeur thermique extérieur (2),
l'unité intérieure (21a ; 21b ; 21c) qui exécute l'opération de chauffage est commutée par l'unité de commutation de tuyaux (3) de façon à ce qu'elle soit mise en communication avec l'unité extérieure (20a ; 20b) du cycle d'absorption de chaleur, et
l'unité intérieure (21a ; 21b ; 21c) qui exécute l'opération de refroidissement est commutée par l'unité

de commutation de tuyaux (3) de façon à ce qu'elle soit mise en communication avec l'unité extérieure (20a ; 20b) du cycle de décharge de chaleur.

3. Appareil à cycle de réfrigération selon la revendication 2, dans lequel
entre la première unité extérieure (20a) et la deuxième unité extérieure (20b) qui forment le cycle d'absorption de chaleur ou le cycle de décharge de chaleur, les cycles peuvent être commutés de façon alternée, et les unités de commutation de tuyaux (3) sont commutées en fonction de la commutation des cycles.

4. Appareil à cycle de réfrigération selon la revendication 3, dans lequel
en commutant de façon alternée les cycles entre la première unité extérieure (20a) et la deuxième unité extérieure (20b), une opération de dégivrage est exécutée pour l'échangeur thermique extérieur (2) de l'unité extérieure qui forme le cycle d'absorption de chaleur.

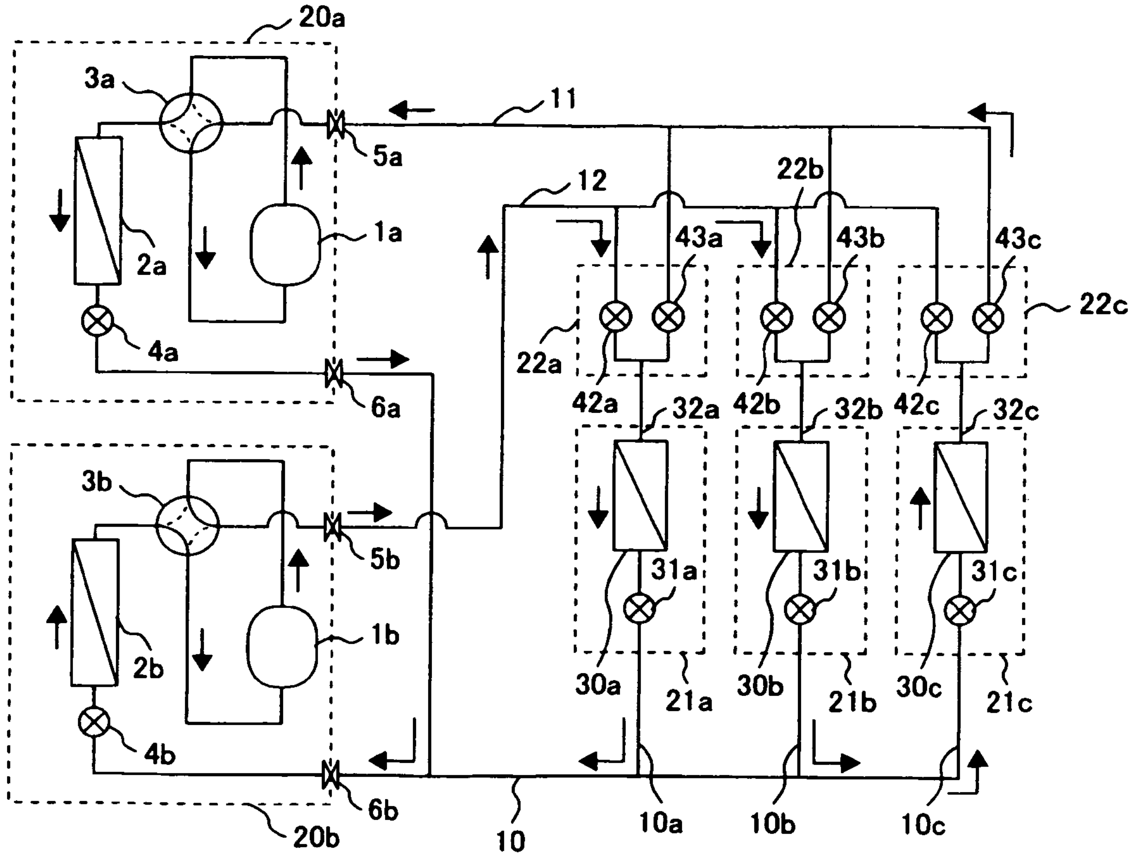
5. Appareil à cycle de réfrigération selon l'une quelconque des revendications 2 à 4, dans lequel
tandis que la capacité du compresseur (1) dans l'unité extérieure qui forme le cycle de décharge de chaleur est commandée sur la base d'une charge de refroidissement requise de l'unité intérieure (21a ; 21b ; 21c) qui exécute l'opération de refroidissement, la capacité du compresseur (1) dans l'unité extérieure (20a ; 20b) qui forme le cycle d'absorption de chaleur est commandée sur la base d'une charge de chauffage requise de l'unité intérieure (21a ; 21b ; 21c) qui exécute l'opération de chauffage.

6. Appareil à cycle de réfrigération selon l'une quelconque des revendications 2 à 5, dans lequel
des premières vannes de commande (43) et des deuxièmes vannes de commande (42) sont des détendeurs à commande électrique.

7. Appareil à cycle de réfrigération selon la revendication 1, dans lequel
lorsque l'opération de refroidissement ou l'opération de chauffage est exécutée, les unités extérieures (20a ; 20b) étant mises en communication avec les unités intérieures (21a ; 21b ; 21c) respectives peuvent être commutées par les unités de commutation de tuyaux.

8. Appareil à cycle de réfrigération selon la revendication 7, dans lequel
il est prévu une fonction de commutation des unités intérieures (21a ; 21b ; 21c) étant mises en communication avec les unités extérieures (20a ; 20b) respectives sur la base d'une information de la capacité de chaque unité intérieure (21a ; 21b ; 21c) et de la température de l'air d'admission.

FIG. 1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43c
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42c
32a
32b
32c
3b
5b
31a
31b
31c
2b
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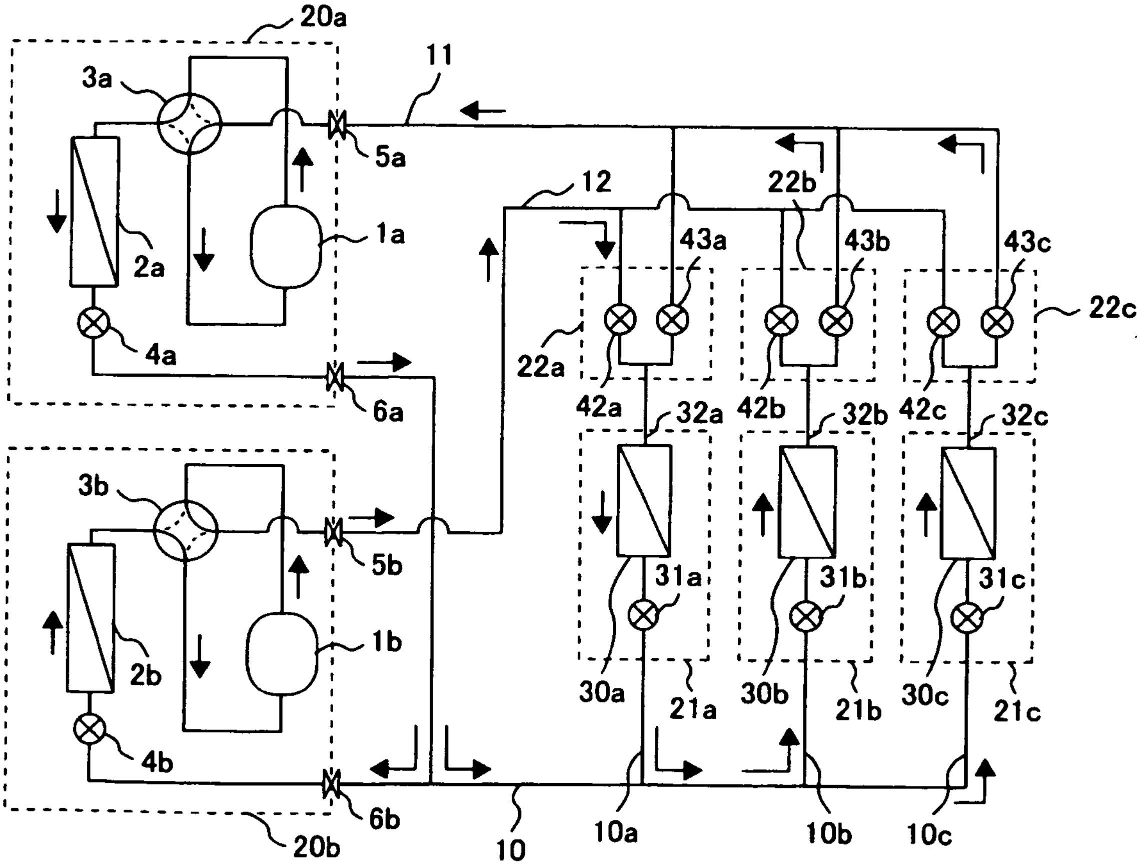
FIG. 2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42b
32b
42c
32c
3b
5b
31a
31b
31c
2b
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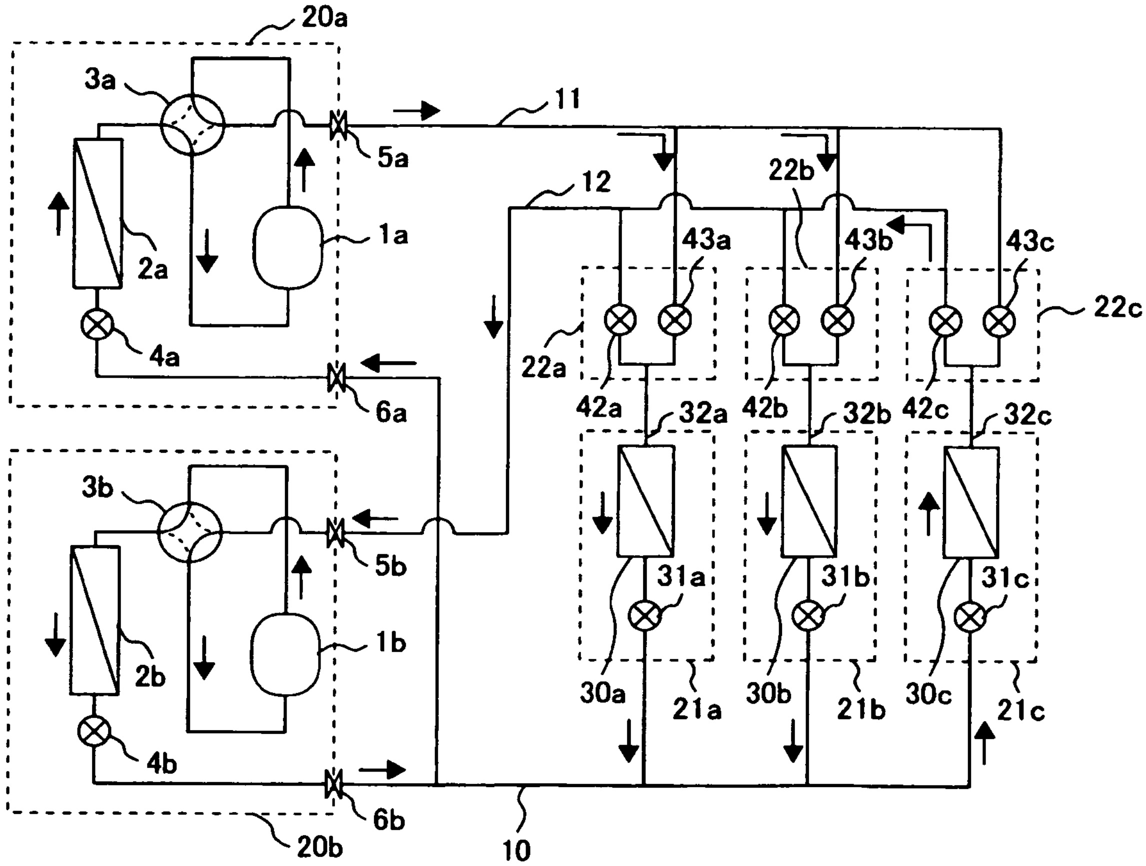
FIG. 3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42c
32a
32b
32c
3b
5b
1b
2b
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31c
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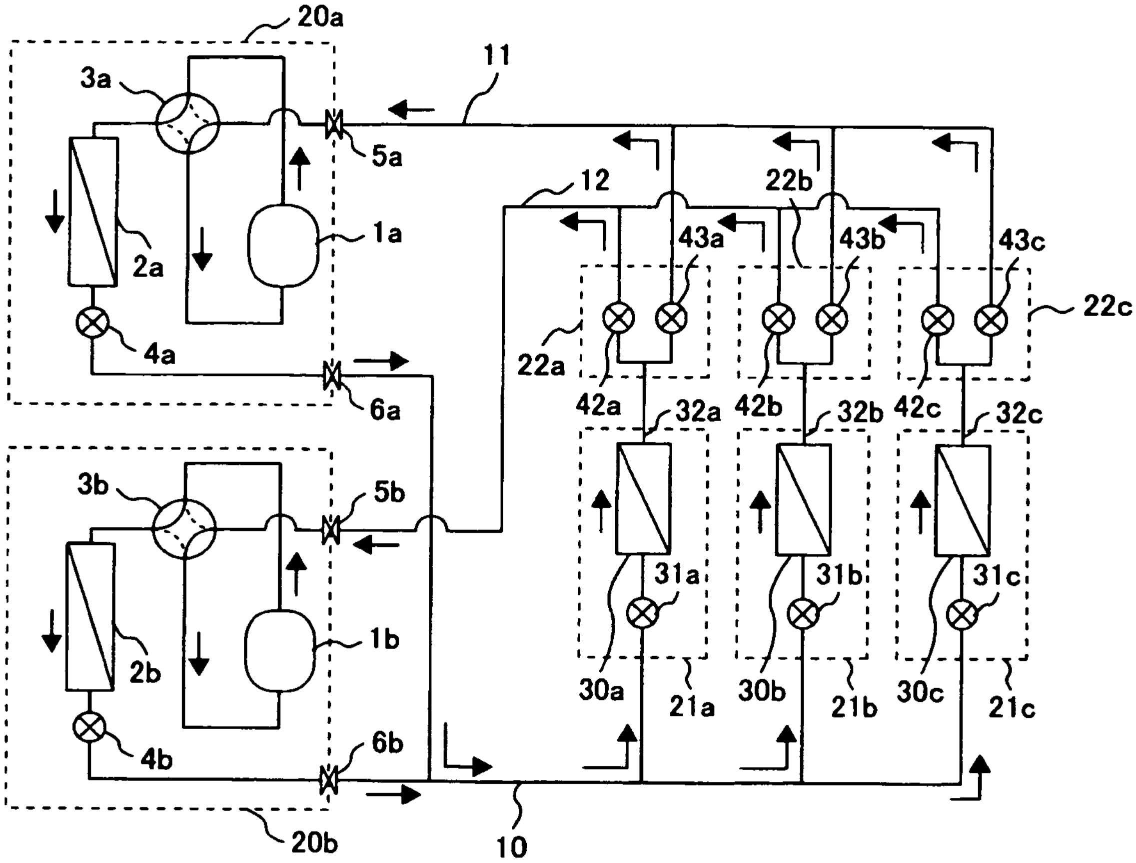
21c
10

FIG. 4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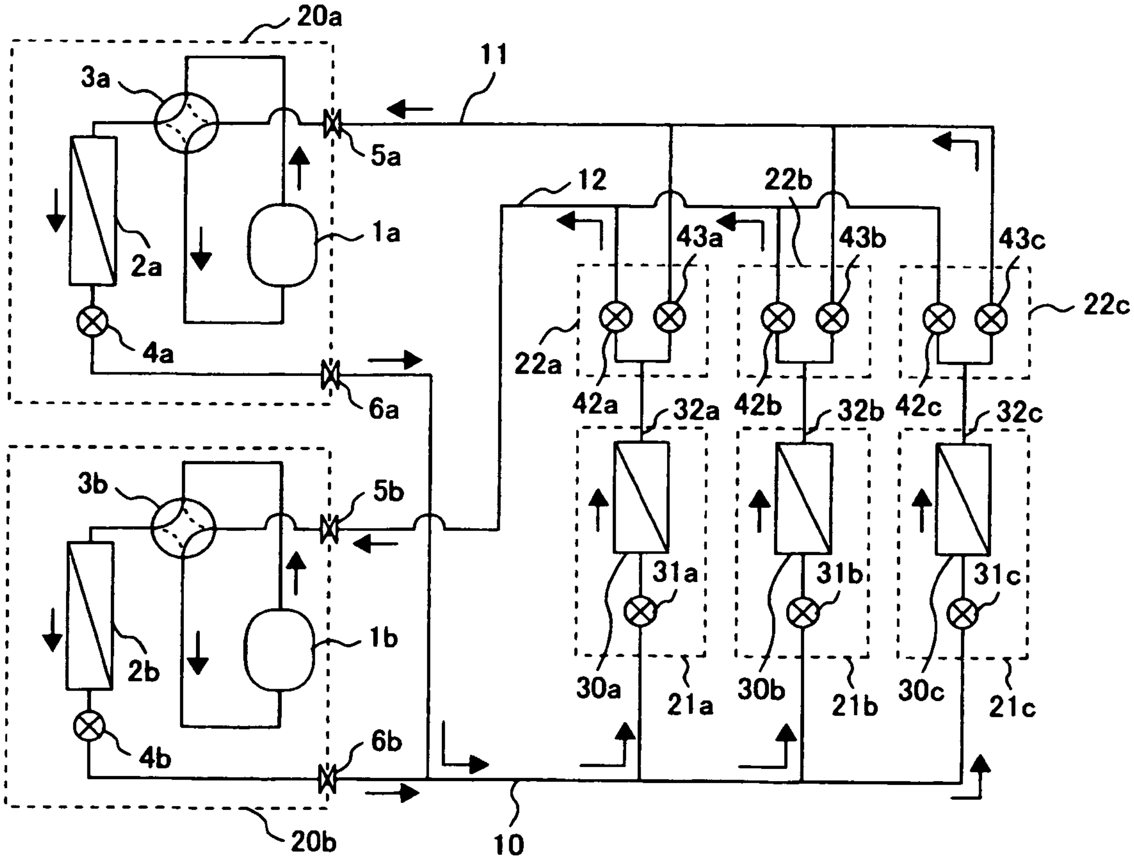
42b
32b
42c
32c
3b
5b
31a
31b
31c
2b
1b
30a
21a
30b
21b
30c
21c
4b
6b
20b
10

FIG. 5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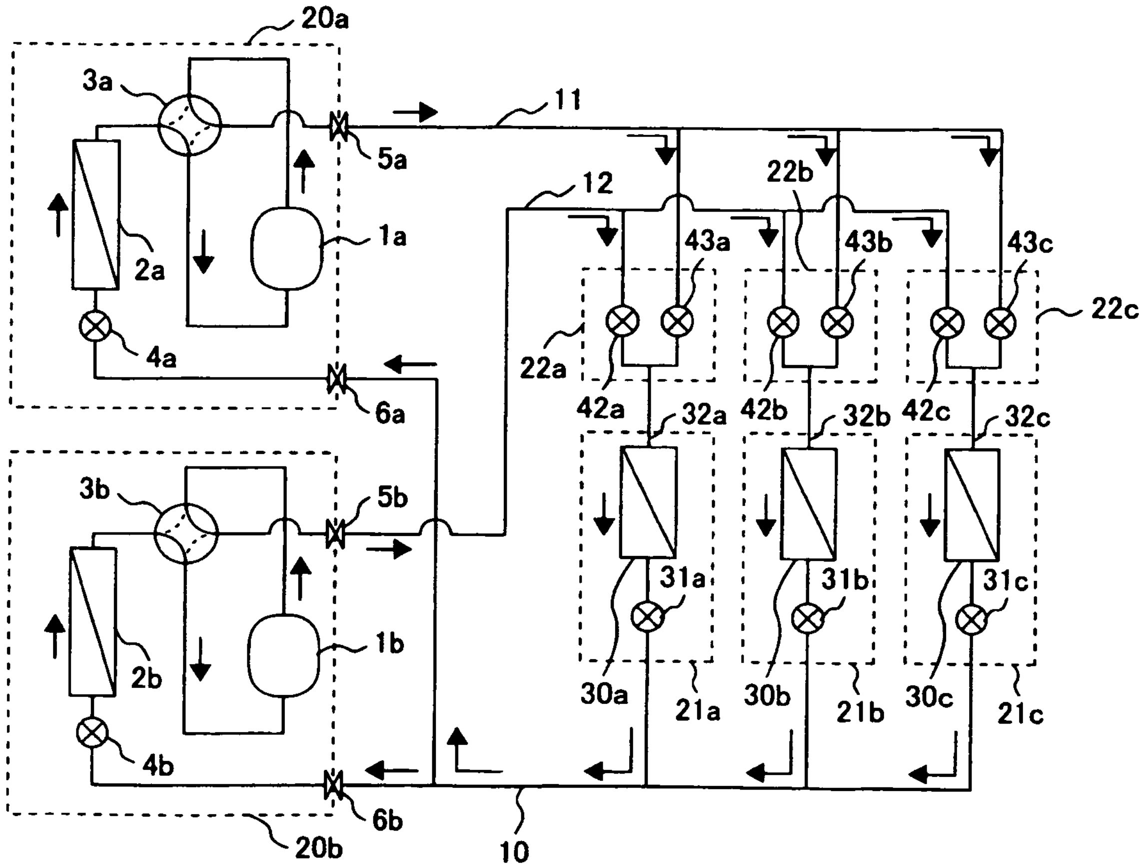
42b
32b
42c
32c
3b
5b
31a
31b
31c
1b
2b
30a
21a
30b
21b
30c
21c
4b
6b
20b
10

FIG. 6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5a
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22b
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43a
43b
43c
4a
22a
22c
6a
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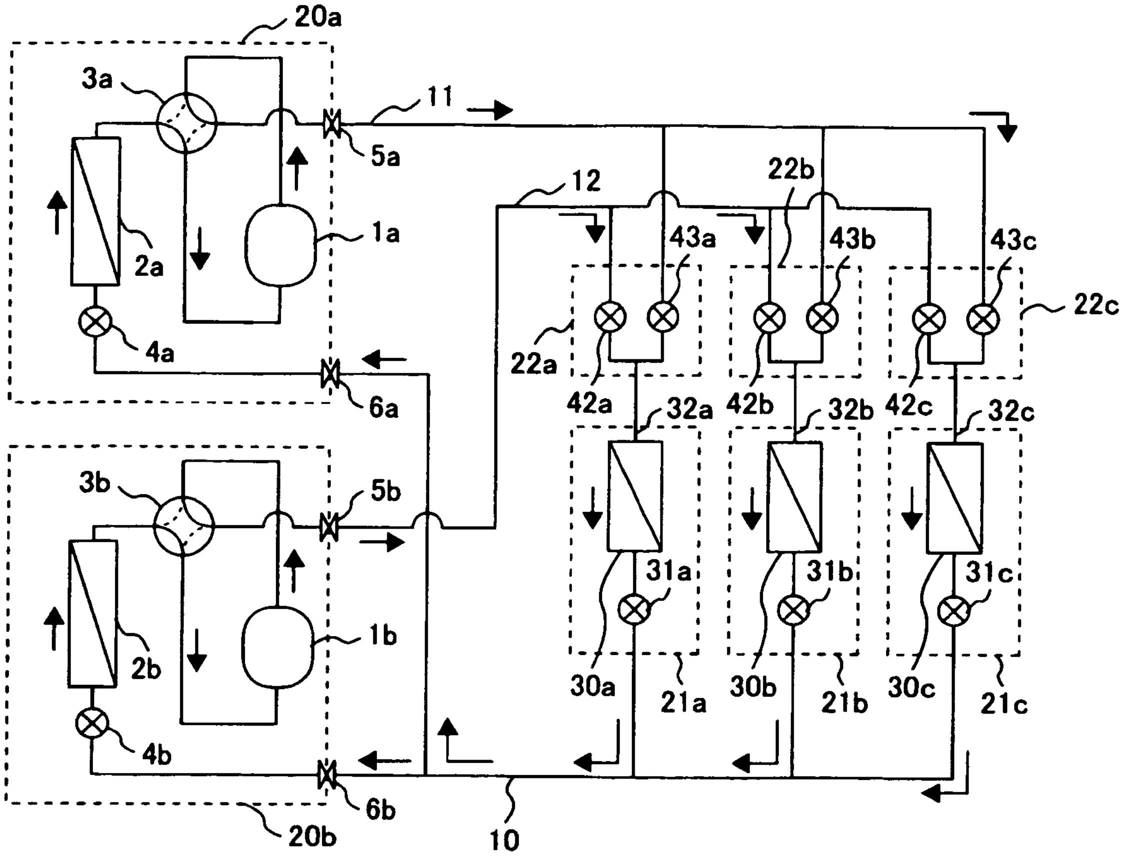
42b
32b
42c
32c
3b
5b
31a
31b
31c
2b
1b
30a
21a
30b
21b
30c
21c
4b
6b
20b
10

FIG. 7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4a
22a
6a
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42b
32b
42c
32c
3b
5b
31a
31b
31c
2b
1b
30a
21a
30b
21b
30c
21c
4b
6b
20b
10

FIG. 8

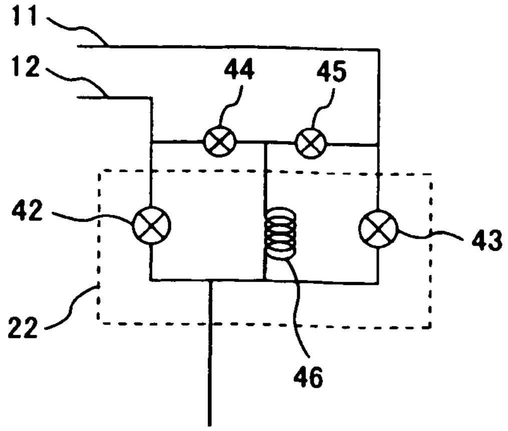
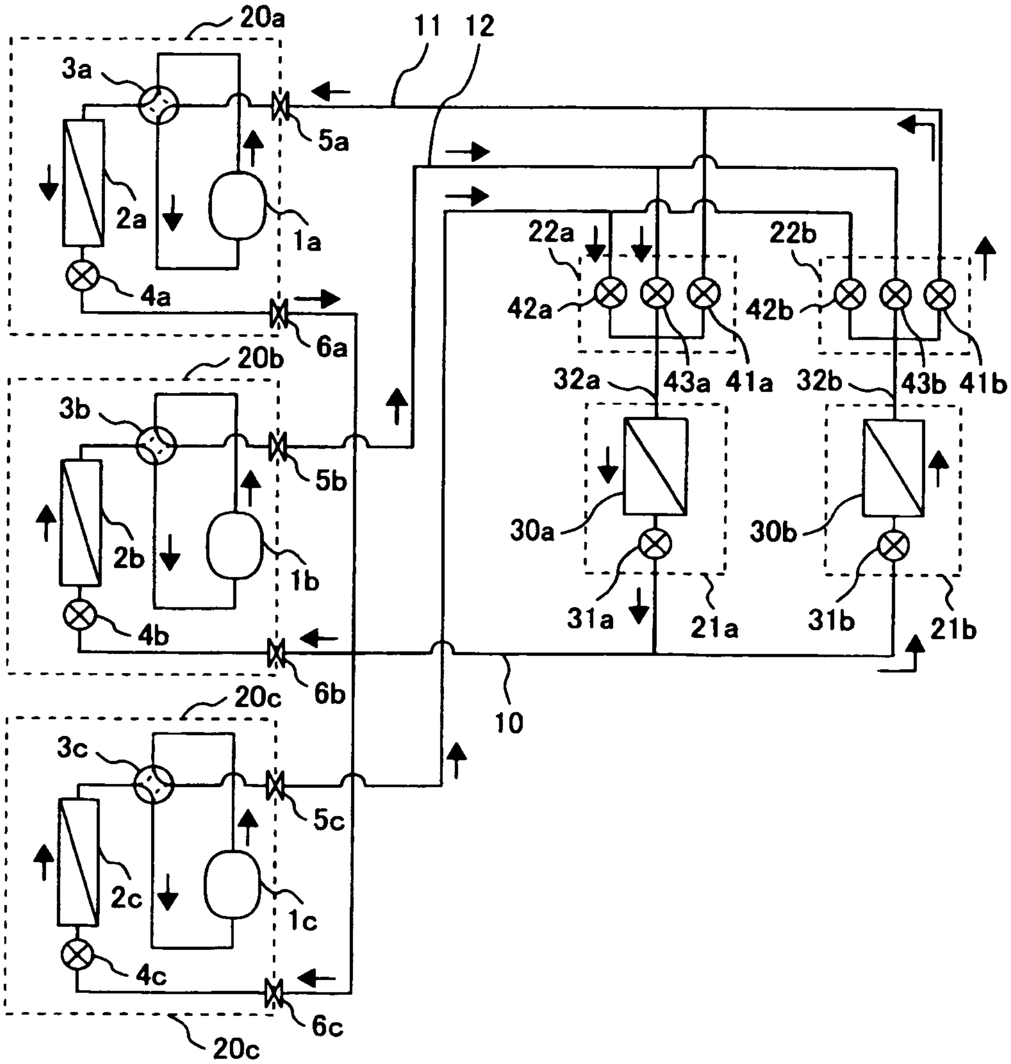

11
12
44
45
42
43
22
46

FIG. 9


20a
3a
2a
1a
4a
5a
6a
20b
3b
2b
1b
4b
5b
6b
20c
3c
2c
1c
4c
5c
6c
20c
11
12
10
22a
42a
43a
41a
22b
42b
43b
41b
32a
32b
30a
30b
31a
31b
21a
21b

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- WO 2008069066 A **[0009]**