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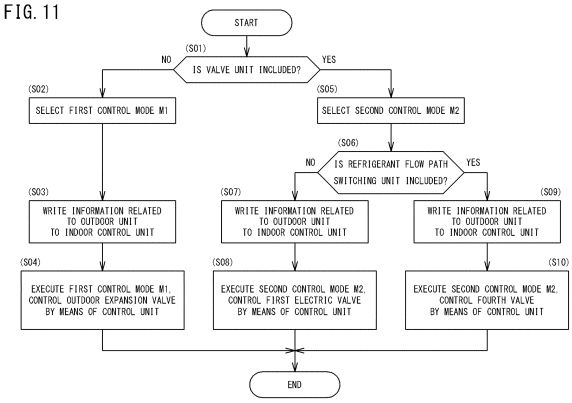
(54) OUTDOOR UNIT, INDOOR UNIT, AND AIR CONDITIONING SYSTEM

(57) An air conditioning system (10) includes a refrigerant circuit (RC1), an outdoor unit (40), and a plurality of indoor units (30) connected in parallel to the outdoor unit (40). The outdoor unit (40) includes: an outdoor expansion valve (84) and the like that adjust the pressure of a refrigerant to be supplied to the indoor units (30); and an outdoor control unit (61) that controls the outdoor expansion valve (84) and the like. If a valve unit (50) that is provided between the indoor units (30) and the outdoor unit (40) and that switches the flow of the refrigerant to the indoor units (30) is not included in the air conditioning system (10), the air conditioning system (10) is operated in a first control mode (M1) in which the pressure of the refrigerant to be supplied to the indoor units (30) is adjusted by controlling the outdoor expansion valve (84) and the like. If the valve unit (50) is included in the air conditioning system (10), the air conditioning system (10) is operated in a second control mode (M2) in which the pressure of the refrigerant to be supplied to the indoor units (30) is adjusted by controlling a first electric valve (52) and the like included in the valve unit (50).

FIG. 11



EP 4 394 274 A1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to an outdoor unit, an indoor unit, and an air conditioning system.

BACKGROUND ART

[0002] Patent Literature 1 discloses an air conditioning system including an outdoor unit (heat source unit), an indoor unit (utilization unit), and a valve unit (refrigerant flow path switching unit). In the air conditioning system, the outdoor unit, the indoor unit, and the valve unit are each provided with a control valve. Patent Literature 1 further discloses an air conditioning system that is configured such that the control valve of an indoor unit is omitted and the refrigerant to be supplied to the indoor unit is controlled by the control valve of the outdoor unit or the valve unit (see paragraph 0190).

CITATION LIST

[PATENT LITERATURE]

[0003] PATENT LITERATURE 1: WO 2019/064566 A

SUMMARY OF THE INVENTION

[TECHNICAL PROBLEM]

[0004] The specifications of the air conditioning system include a first specification (so-called cooling/heating switching specification) in which a plurality of indoor units are all operated by switching to either cooling operation or heating operation and a second specification (so-called cooling/heating free specification) in which the plurality of indoor units can be operated by individually selecting cooling operation or heating operation for each indoor unit, and the specifications of the outdoor unit, the presence or absence of the valve unit, and the presence or absence of the control valve in the outdoor unit vary according to the specifications. In other words, it is necessary to prepare at least two types of indoor units, one with a control valve and the other without a control valve, in the product lineup of the air conditioning system, and this is a factor of increasing the manufacturing and management costs of the air conditioning system.

[0005] An object of the present disclosure is to enable the use of common indoor units regardless of the specifications of an air conditioning system.

[SOLUTION TO PROBLEM]

[0006]

(1)An outdoor unit according to the present disclosure is provided in an air conditioning system including a refrigerant circuit that performs a refrigeration cycle and a plurality of indoor units connected in parallel to the outdoor unit. The outdoor unit includes: a first control valve that adjusts a pressure of a refrigerant to be supplied to the indoor units; and a control unit that controls the first control valve. If a valve unit that is provided between the indoor units and the outdoor unit and that switches a flow of the refrigerant to the indoor units is not included in the air conditioning system, the control unit operates the air conditioning system in a first control mode in which the pressure of the refrigerant to be supplied to the indoor units is adjusted by controlling the first control valve. If the valve unit is included in the air conditioning system, the control unit operates the air conditioning system in a second control mode in which the pressure of the refrigerant to be supplied to the indoor units is adjusted by controlling a second control valve included in the valve unit.

The valves to be controlled by the control unit and the control contents can be switched according to the specifications of the air conditioning system, such as controlling the first control valve of the outdoor unit with the control unit if the air conditioning system is of the first specification in which all of the plurality of indoor units are operated by switching to either cooling operation or heating operation, and controlling the second control valve of the valve unit with the control unit if the air conditioning system is of the second specification in which the plurality of indoor units can be operated by individually selecting cooling operation or heating operation for each of the indoor units. This eliminates the need to provide control valves in the indoor units even if the air conditioning system is of the second specification, and allows the use of common indoor units with a specification that does not have a control valve, regardless of the specifications of the air conditioning system.

(2) An indoor unit according to the present disclosure is provided in an air conditioning system including a refrigerant circuit that performs a refrigeration cycle and an outdoor unit, a plurality of the indoor units being connected in parallel to the outdoor unit. The outdoor unit includes a first control valve that adjusts a pressure of a refrigerant to be supplied to the indoor units. The indoor units each include a control unit that controls the first control valve. If a valve unit that is provided between the indoor units and the outdoor unit and that switches a flow of the refrigerant to the indoor units is not included in the air conditioning system, the control unit operates the air conditioning system in a first control mode in which the pressure of the refrigerant to be supplied to the indoor units is adjusted by controlling the first control valve. If the valve unit is included in the air conditioning system, the control unit operates the air conditioning system in a second control mode in which the pressure of

the refrigerant to be supplied to the indoor units is adjusted by controlling a second control valve included in the valve unit.

The valves to be controlled and the control contents can be switched according to the specifications of the air conditioning system, such as controlling the first control valve of the outdoor unit if the air conditioning system is of the first specification in which all of the plurality of indoor units are operated by switching to either cooling operation or heating operation, and controlling the second control valve of the valve unit if the air conditioning system is of the second specification in which the plurality of indoor units can be operated by individually selecting cooling operation or heating operation for each of the indoor units. This eliminates the need to provide control valves in the indoor units even if the air conditioning system is of the second specification, and allows the use of common indoor units with a specification that does not have a control valve, regardless of the specifications of the air conditioning system.

(3)An air conditioning system according to the present disclosure includes a refrigerant circuit that performs a refrigeration cycle, an outdoor unit, and a plurality of indoor units connected in parallel to the outdoor unit. The air conditioning system includes a control unit that controls operation of the air conditioning system. The outdoor unit includes a first control valve that adjusts a pressure of a refrigerant to be supplied to the indoor units. If a valve unit that is provided between the indoor units and the outdoor unit and that switches a flow of the refrigerant to the indoor units is not included in the air conditioning system, the air conditioning system is operated in a first control mode in which the pressure of the refrigerant to be supplied to the indoor units is adjusted by controlling the first control valve. If the valve unit is included in the air conditioning system, the air conditioning system is operated in a second control mode in which the pressure of the refrigerant to be supplied to the indoor units is adjusted by controlling a second control valve included in the valve unit.

The valves to be controlled and the control contents can be switched according to the specifications of the air conditioning system, such as controlling the first control valve of the outdoor unit if the air conditioning system is of the first specification in which all of the plurality of indoor units are operated by switching to either cooling operation or heating operation, and controlling the second control valve of the valve unit if the air conditioning system is of the second specification in which the plurality of indoor units can be operated by individually selecting cooling operation or heating operation for each of the indoor units. This eliminates the need to provide control valves in the indoor units even if the air conditioning system is of the second specification, and allows the use of common indoor units with a specification that does not have a control valve, regardless of the specifications of the air conditioning system.

(4) In the air conditioning system according to the present disclosure, preferably, the control unit automatically selects the second control mode if the valve unit is included in the air conditioning system.

In this case, the second control mode suitable for the specifications of the air conditioning system can be automatically selected simply by connecting the valve unit to the indoor units and the outdoor unit.

(5) The air conditioning system according to the present disclosure preferably further includes selection means for manually selecting the first control mode and the second control mode.

In this case, the user can manually select the first control mode or the second control mode.

(6)In the air conditioning system according to the present disclosure, if the valve unit is not included in the air conditioning system, the control unit controls the first control valve in the first control mode, and, if the valve unit is included in the air conditioning system, the control unit controls the second control valve in the second control mode.

In this case, the first control mode or the second control mode can be automatically selected by the control unit.

(7)In the air conditioning system according to the present disclosure, if the air conditioning system including the valve unit has a refrigerant leak in any of the indoor units, the second control valve preferably shuts off supply of the refrigerant to the indoor unit.

In this case, if the air conditioning system is of the second specification, the second control valve of the valve unit can be used as a control valve that adjusts the pressure of the refrigerant and as an isolation valve that shuts off the refrigerant. This air conditioning system does not require a separate isolation valve, thereby allowing a reduction in manufacturing cost.

(8)In the air conditioning system according to the present disclosure, preferably, the control unit further includes an indoor control unit that controls operation of the indoor units, the indoor units each having the indoor control unit. When the indoor unit and the outdoor unit are connected to each other, information related to the outdoor unit is preferably written to the indoor control unit. The indoor control unit preferably controls the indoor unit on a basis of the information related to the outdoor unit.

[0007] In this case, the control contents of the indoor units can be automatically switched to those corresponding to the specifications of the outdoor unit simply by connecting the indoor units and the outdoor unit.

BRIEF DESCRIPTION OF DRAWINGS

[0008]

FIG. 1A is a schematic configuration diagram of an air conditioning system according to a first embodiment of the present disclosure.

FIG. 1B is a schematic configuration diagram of an air conditioning system according to a second embodiment of the present disclosure.

FIG. 2A is a schematic configuration diagram of an air conditioning system according to a third embodiment of the present disclosure.

FIG. 2B is a schematic configuration diagram of an air conditioning system according to a fourth embodiment of the present disclosure.

FIG. 3 is a refrigerant circuit diagram of the air conditioning system according to the first embodiment of the present disclosure.

FIG. 4 is a block diagram of the air conditioning system according to the first embodiment of the present disclosure.

FIG. 5 is a refrigerant circuit diagram of the air conditioning system according to the second embodiment of the present disclosure.

FIG. 6 is a block diagram of the air conditioning system according to the second embodiment of the present disclosure.

FIG. 7 is a refrigerant circuit diagram of the air conditioning system according to the third embodiment of the present disclosure.

FIG. 8 is a block diagram of the air conditioning system according to the third embodiment of the present disclosure.

FIG. 9 is a refrigerant circuit diagram of the air conditioning system according to the fourth embodiment of the present disclosure.

FIG. 10 is a block diagram of the air conditioning system according to the fourth embodiment of the present disclosure.

FIG. 11 is a control flowchart of a control unit in an air conditioning system according to the present disclosure.

DETAILED DESCRIPTION

Overview of Air Conditioning System

[0009] FIG. 1A is a schematic configuration diagram of an air conditioning system according to a first embodiment of the present disclosure. FIG. 1B is a schematic configuration diagram of an air conditioning system according to a second embodiment of the present disclosure. FIG. 2A is a schematic configuration diagram of an air conditioning system according to a third embodiment of the present disclosure. FIG. 2B is a schematic configuration diagram of an air conditioning system according to a fourth embodiment of the present disclosure. FIG. 1A, FIG. 1B, FIG. 2A, and FIG. 2B each illustrate a schematic configuration of an air conditioning system 10 according to the present disclosure. Note that in the following description, the air conditioning system 10 (see FIG. 1A) according to the first embodiment will be referred to as a first air conditioning system 11, the air conditioning system 10 (see FIG. 1B) according to the second embodiment will be referred to as a second air conditioning system 12, the air conditioning system 10 (see FIG. 2A) according to the third embodiment will be referred to as a third air conditioning system 13, and the air conditioning system 10 (see FIG. 2B) according to the fourth embodiment will be referred to as a fourth air conditioning system 14. In the following description, when simply referred to as the "air conditioning system 10 ", the configuration common to the first to fourth air conditioning systems 11 to 14 will be described. Note that the "first specification" in the following description is a specification (so-called cooling/heating switching specification) in which, in an air conditioner having a plurality of indoor units, all indoor units are operated by switching to either cooling operation or heating operation, and the "second specification" is a specification (so-called cooling/heating free specification) in which, in an air conditioner having a plurality of indoor units, the indoor units can be operated by individually selecting cooling operation or heating operation for each indoor unit.

[0010] Each of the air conditioning systems 10 illustrated in FIG. 1A, FIG. 1B, FIG. 2A, and FIG. 2B is installed in a building, a factory, or the like to provide air conditioning for a space to be air-conditioned. The air conditioning system 10 includes an air conditioner 20 including an indoor unit 30 and an outdoor unit 40. The air conditioner 20 performs vapor compression refrigeration cycle operation to cool and heat the space to be air-conditioned.

[0011] The air conditioning system 10 illustrated in FIG. 1A and FIG. 1B includes the air conditioner 20 of the first specification. Specifically, the first air conditioning system 11 illustrated in FIG. 1A includes a first air conditioner 21 of the first specification, and the second air conditioning system 12 illustrated in FIG. 1B includes a second air conditioner 22 of the first specification. In the following description, the outdoor unit 40 of each of the first air conditioner 21 and the second air conditioner 22 is referred to as a first outdoor unit 41. In other words, the first air conditioner 21 and the second air conditioner 22 include the common first outdoor unit 41. In the following description, when simply referred to as the "air conditioner 20", the configuration common to the first to fourth air conditioners 21 to 24 will be described.

[0012] The air conditioning system 10 illustrated in FIG. 2A and FIG. 2B includes the air conditioner 20 of the second specification. Specifically, the third air conditioning system 13 illustrated in FIG. 2A includes the third air conditioner 23 of the second specification, and the fourth air conditioning system 14 illustrated in FIG. 2B includes the fourth air conditioner 24 of the second specification. In the following description, the outdoor unit 40 of each of the third air conditioner 23 and the fourth air conditioner 24 is referred to as a second outdoor unit 42. In other words, the third air conditioner 23 and the fourth air con-

ditioner 24 include the common second outdoor unit 42.

[0013] As illustrated in FIG. 1A, FIG. 1B, FIG. 2A, and FIG. 2B, the first to fourth air conditioners 21 to 24 include the common indoor units 30.

[0014] The air conditioner 20 includes a refrigerant pipe 25. The refrigerant pipe 25 of each of the first air conditioner 21 and the second air conditioner 22 includes a liquid pipe 25L and a gas pipe 25G. The refrigerant pipe 25 of each of the third air conditioner 23 and the fourth air conditioner 24 includes the liquid pipe 25L, a high and low-pressure gas pipe 25G1, and a suction gas pipe 25G2.

[0015] As illustrated in FIG. 1B, FIG. 2A, and FIG. 2B, the second air conditioner 22, the third air conditioner 23, and the fourth air conditioner 24 each further include a valve unit 50. The valve unit 50 of the second air conditioner 22 is an isolation valve unit 51 that is provided between the indoor unit 30 and the first outdoor unit 41. The valve unit 50 of the third air conditioner 23 is a refrigerant flow path switching unit 55 that is provided between the indoor unit 30 and the second outdoor unit 42. The valve unit 50 of the fourth air conditioner 24 includes the isolation valve unit 51 and the refrigerant flow path switching unit 55, which are provided between the indoor unit 30 and the second outdoor unit 42.

Regarding First Air Conditioning System

[0016] FIG. 3 is a refrigerant circuit diagram of the air conditioning system according to the first embodiment of the present disclosure. FIG. 4 is a block diagram of the air conditioning system according to the first embodiment of the present disclosure. As illustrated in FIG. 1A, FIG. 3, and FIG. 4, the first air conditioning system 11 includes a first air conditioner 21. The first air conditioner 21 is a multi-type air conditioner with a plurality of indoor units 30 connected in parallel to a first outdoor unit 41. In the example illustrated in FIG. 3, the two or more indoor units 30 are connected to the single first outdoor unit 41. However, the number of the first outdoor units 41 and the indoor units 30 is not limited. The first air conditioner 21 can provide air conditioning for a space to be air-conditioned, by switching between the cooling operation and the heating operation.

[0017] The first air conditioner 21 has a refrigerant circuit RC1. The refrigerant circuit RC1 circulates refrigerant between the first outdoor unit 41 and the indoor units 30. The refrigerant circuit RC1 includes a compressor 81, a four-way switching valve 82, an outdoor heat exchanger 83, an outdoor expansion valve 84, a liquid shutoff valve 85, an indoor heat exchanger 31, a gas shutoff valve 86, and a refrigerant pipe 25 (liquid pipe 25L and gas pipe 25G) connecting these components.

Regarding Indoor Unit

[0018] The indoor unit 30 includes the indoor heat exchanger 31. The indoor heat exchanger 31 constitutes the refrigerant circuit RC1. The indoor heat exchanger 31 is a cross-fin tube type or microchannel type heat exchanger, and is used to exchange heat with indoor air.

[0019] The indoor unit 30 includes an indoor fan 32 and an indoor temperature sensor 33. The indoor fan 32 is configured to draw indoor air into the interior of the indoor unit 30, cause the indoor heat exchanger 31 to exchange heat with the drawn air, and then blow out the air into the room. The indoor fan 32 includes a motor, the operating rotational speed of which can be adjusted by inverter control. The indoor temperature sensor 33 detects the indoor temperature.

[0020] As described above, the indoor unit 30 according to the present disclosure does not have an electric valve (indoor expansion valve) inside. The air conditioning system 10 according to the present disclosure allows the use of the common indoor units 30 regardless of the specifications of the outdoor unit 40 by using the indoor units 30 that do not have electric valves (indoor expansion valve) inside.

Regarding First Outdoor Unit

[0021] As illustrated in FIG. 3, the first outdoor unit 41 includes the compressor 81, the four-way switching valve 82, the outdoor heat exchanger 83, the outdoor expansion valve 84, the liquid shutoff valve 85, the gas shutoff valve 86, and the like.

[0022] The compressor 81 sucks in low-pressure gas refrigerant and discharges high-pressure gas refrigerant. The compressor 81 includes a motor, the operating rotational speed of which can be adjusted by inverter control. The compressor 81 is of a variable displacement type (variable capacity type) that can vary displacement (capacity) through inverter control of the motor. However, the compressor 81 may be of a constant-displacement type.

[0023] The four-way switching valve 82 reverses the flow of refrigerant in the refrigerant pipe, and switches and supplies the refrigerant discharged from the compressor 81 to either the outdoor heat exchanger 83 or the indoor heat exchanger 31. This allows the first air conditioner 21 to switch between cooling operation and heating operation.

[0024] The outdoor heat exchanger 83 is, for example, a cross-fin tube type or microchannel type heat exchanger, and is used to exchange heat with a refrigerant using air as a heat source. The outdoor expansion valve 84 is an electric valve capable of adjusting the flow rate and pressure of the refrigerant. In the first air conditioner 21, the pressure of the refrigerant to be supplied to the indoor heat exchanger 31 is adjusted by controlling the opening degree of the outdoor expansion valve 84.

[0025] The liquid shutoff valve 85 is a manual on-off valve. The gas shutoff valve 86 is also a manual on-off valve. The liquid shutoff valve 85 and the gas shutoff valve 86, when closed, shut off the flow of the refrigerant in the liquid pipe 25L and the gas pipe 25G, and when

open, allow the flow of the refrigerant in the liquid pipe 25L and the gas pipe 25G.

[0026] The first outdoor unit 41 further includes an outdoor fan 87. The outdoor fan 87 includes a motor, the operating rotational speed of which can be adjusted by inverter control. The outdoor fan 87 is configured to draw outdoor air into the interior of the first outdoor unit 41, cause the outdoor heat exchanger 83 to exchange heat with the drawn air, and then blow the air to the outside of the first outdoor unit 41. Note that the first outdoor unit 41 further includes a plurality of refrigerant pressure sensors, a plurality of refrigerant temperature sensors, an outside air temperature sensor, and the like (not illustrated).

[0027] When the first air conditioner 21 having the above configuration is in cooling operation, the four-way switching valve 82 is held in the state indicated by solid lines in FIG. 3. The high-temperature and high-pressure gas refrigerant discharged from the compressor 81 flows into the outdoor heat exchanger 83 through the four-way switching valve 82, and is condensed and liquefied by heat exchange with outdoor air under the operation of the outdoor fan 87. The liquefied refrigerant passes through the outdoor expansion valve 84 that is in a fully open state, and flows into each of the indoor units 30. In the indoor unit 30, the refrigerant is evaporated by heat exchange with indoor air in the indoor heat exchanger 31. The indoor air cooled by the evaporation of the refrigerant is blown into the room by the indoor fan 32 to cool the room. The refrigerant evaporated in the indoor heat exchanger 31 returns to the first outdoor unit 41 through the gas pipe 25G and is sucked into the compressor 81 through the four-way switching valve 82.

[0028] When the first air conditioner 21 is in heating operation, the four-way switching valve 82 is held in the state indicated by broken lines in FIG. 3. The high-temperature and high-pressure gas refrigerant discharged from the compressor 81 passes through the four-way switching valve 82 and flows into the indoor heat exchanger 31 of each of the indoor units 30. In the indoor heat exchanger 31, the refrigerant is condensed and liquefied by heat exchange with indoor air. The indoor air heated by the condensation of the refrigerant is blown into the room by the indoor fan 32 to heat the room. The refrigerant liquefied in the indoor heat exchanger 31 returns to the first outdoor unit 41 through the liquid pipe 25L, is decompressed to a predetermined low pressure by the outdoor expansion valve 84, and then evaporated by heat exchange with outdoor air in the outdoor heat exchanger 83. The refrigerant evaporated and vaporized in the outdoor heat exchanger 83 is sucked into the compressor 81 through the four-way switching valve 82.

Regarding Control Unit

[0029] The air conditioning system 10 includes a control unit 60 that controls the operation of the air conditioning system 10. The control unit 60 includes an outdoor control unit (first control unit) 61 disposed in the outdoor unit 40 and an indoor control unit (third control unit) 62 disposed in the indoor unit 30. The outdoor control unit 61 and the indoor control unit 62 are communicably connected to each other via a transmission line.

[0030] The outdoor control unit 61 is a device that controls the operation of the outdoor unit 40, and includes, for example, a microcomputer including a processor such as a CPU, and memory such as RAM and ROM. The outdoor control unit 61 may be implemented as hardware using LSI, ASIC, FPGA, or the like. The outdoor control unit 61 exerts a predetermined function when the processor executes a program installed in the memory. In the following description, the outdoor control unit 61 provided in the first outdoor unit 41 is referred to as a first outdoor control unit 61A. The detection values of the sensors provided in the first outdoor unit 41 are input to the first outdoor control unit 61A. The first outdoor control unit 61A controls the operation of the outdoor expansion valve 84, the compressor 81, the outdoor fan 87, and the like on the basis of the detection values of the sensors, and the like.

[0031] The indoor control unit 62 is a device that controls the operation of the indoor unit 30, and includes, for example, a microcomputer including a processor such as a CPU, and memory such as RAM and ROM. The indoor control unit 62 may be implemented as hardware using LSI, ASIC, FPGA, or the like. The indoor control unit 62 exerts a predetermined function when the processor executes a program installed in the memory. The detection values of the sensors provided in the indoor unit 30 are input to the indoor control unit 62. The indoor control unit 62 controls the operation of the indoor unit 30 on the basis of the detection values of the sensors, and the like. The indoor control unit 62 is connected to a remote controller 36 that allows a user to operate/stop the indoor unit 30, change the set temperature, and the like.

Regarding Operating Mode of Air Conditioner

[0032] The air conditioner 20 has a first control mode M1 and a second control mode M2 as control modes M selectable by the control unit 60. The first control mode M1 is the control mode M selected by the control unit 60 when the air conditioning system 10 does not include the valve unit 50. The second control mode M2 is the control mode M selected by the control unit 60 when the air conditioning system 10 includes the valve unit 50. Note that the air conditioner 20 may include additional control modes M other than the first control mode M1 and the second control mode M2 as the control modes M selectable by the control unit 60.

Regarding Selection Means

[0033] The control unit 60 has selection means 37 for manually selecting the control modes M. The user of the

air conditioning system 10 can manually select the control modes M by operating the selection means 37 instead of the control unit 60 selecting the control modes M. In the air conditioner 20 according to the present disclosure, a dip switch is provided on the control board (not illustrated) of the outdoor control unit 61, and is used as the selection means 37. Note that the selection means 37 may be omitted in the air conditioning system 10. In the present disclosure, the case where the selection means 37 is provided in the outdoor control unit 61 is exemplified, but the selection means 37 may be provided in the indoor control unit 62.

Regarding Second Air Conditioning System

[0034] FIG. 5 is a refrigerant circuit diagram of the air conditioning system according to the second embodiment of the present disclosure. FIG. 6 is a block diagram of the air conditioning system according to the second embodiment of the present disclosure. As illustrated in FIG. 1B, FIG. 5, and FIG. 6, the second air conditioning system 12 includes a second air conditioner 22. The second air conditioner 22 includes an indoor unit 30, an outdoor unit 40, and a valve unit 50 (isolation valve unit 51). Since the second air conditioner 22 uses a flammable refrigerant (for example, R32, which is slightly combustible) as a refrigerant, the isolation valve unit 51 that shuts off the refrigerant to be supplied to the indoor unit 30 is provided. The second air conditioner 22 differs from the first air conditioner 21 in that the second air conditioner 22 includes the isolation valve unit 51. In other words, the second air conditioner 22 has the same configuration as the first air conditioner 21 except for the isolation valve unit 51. In the second air conditioner 22 illustrated in FIG. 5 and FIG. 6, parts having the same configuration as the first air conditioner 21 are denoted by the same reference signs, and the description of such common parts will be omitted unless otherwise specified.

Regarding Isolation Valve Unit

[0035] As illustrated in FIG. 5 and FIG. 6, the isolation valve unit 51 includes a first electric valve 52 and a second electric valve 53. The first electric valve 52 and the second electric valve 53 are electric valves. The first electric valve 52 is provided in the liquid pipe 25L, and by adjusting the opening degree of the first electric valve 52, the pressure of liquid refrigerant flowing through the liquid pipe 25L can be adjusted. The first electric valve 52 can shut off the flow of liquid refrigerant in the liquid pipe 25L when fully closed. The second electric valve 53 is provided in the gas pipe 25G, and by fully closing the opening degree of the second electric valve 53, the flow of gas refrigerant in the gas pipe 25G can be shut off. In other words, the isolation valve unit 51 is the valve unit 50 that switches the flow of the refrigerant to the indoor unit 30 to "open" or "close".

Regarding Control Unit of Second Air Conditioning System

[0036] In the second air conditioning system 12, the control unit 60 includes the first outdoor control unit 61A, the indoor control unit 62, and an isolation valve control unit 63. The first outdoor control unit 61A, the indoor control unit 62, and the isolation valve control unit 63 are communicably connected to each other via a transmission line.

Regarding Isolation Valve Control Unit

[0037] The isolation valve control unit (second control unit) 63 is a device that controls the operation of the isolation valve unit 51, and includes, for example, a microcomputer including a processor such as a CPU, and memory such as RAM and ROM. The isolation valve control unit 63 may be implemented as hardware using LSI, ASIC, FPGA, or the like. The isolation valve control unit 63 exerts a predetermined function when the processor executes a program installed in the memory. The first electric valve 52 and the second electric valve 53 are connected to the isolation valve control unit 63. The isolation valve control unit 63 controls the operation of the first electric valve 52 and the second electric valve 53 on the basis of the detection values of the sensors (not illustrated) of the indoor unit 30 and the first outdoor unit 41, and the like. Note that the isolation valve control unit 63 may be omitted in the second air conditioning system 12. In this case, the operation of the first electric valve 52 and the second electric valve 53 are controlled by the first outdoor control unit 61A and/or the indoor control unit 62.

[0038] In the second air conditioning system 12, if a refrigerant sensor (not illustrated) provided in the indoor unit 30 detects the refrigerant, the isolation valve control unit 63 closes the first electric valve 52 and the second electric valve 53 to shut off the supply of the refrigerant to the indoor unit 30.

[0039] In the second air conditioning system 12, the first electric valve 52 is used as a control valve for adjusting the pressure of the refrigerant to be supplied to the indoor unit 30. The isolation valve control unit 63 controls the pressure of the refrigerant to be supplied to the indoor unit 30 by adjusting the opening degree of the first electric valve 52 on the basis of the detection values of the sensors (not illustrated) of the indoor unit 30 and the first outdoor unit 41, and the like. In the second air conditioning system 12, the first electric valve 52 of the isolation valve unit 51 (valve unit 50) is used as a control valve that adjusts the pressure of the refrigerant to be supplied to the indoor unit 30, thereby enabling the use of the indoor unit 30 that does not have an electric valve (indoor expansion valve) inside. Note that in the present embodiment, the case where the main component that controls the control valve for adjusting the pressure of the refrigerant to be supplied to the indoor unit 30 is the

isolation valve control unit 63 of the control unit 60 is exemplified, but the present invention is not limited thereto, and may be the first outdoor control unit 61A and the indoor control unit 62.

Regarding Third Air Conditioning System

[0040] FIG. 7 is a refrigerant circuit diagram of the air conditioning system according to the third embodiment of the present disclosure. FIG. 8 is a block diagram of the air conditioning system according to the third embodiment of the present disclosure. As illustrated in FIG. 2A, FIG. 7, and FIG. 8, the third air conditioning system 13 includes a third air conditioner 23.

[0041] The third air conditioner 23 includes an indoor unit 30, a second outdoor unit 42, and a valve unit 50. The valve unit 50 of the third air conditioner 23 is a refrigerant flow path switching unit 55. The third air conditioner 23 has a refrigerant circuit RC2. The refrigerant circuit RC2 circulates refrigerant between the second outdoor unit 42 and the indoor unit 30. The refrigerant circuit RC2 includes a heat source-side refrigerant circuit RC2A, a utilization-side refrigerant circuit RC2B, and an intermediate refrigerant circuit RC2C, which will be described later. In the third air conditioner 23, two or more indoor units 30 are connected to the single second outdoor unit 42. Each of the indoor units 30 is connected to the second outdoor unit 42 via the refrigerant flow path switching unit 55. The third air conditioner 23 can freely select cooling operation or heating operation for each of the indoor units 30 by the refrigerant flow path switching unit 55 to provide air conditioning for a space to be air-conditioned.

Configuration of Second Outdoor Unit

[0042] As shown in FIG. 7, various devices are arranged in the second outdoor unit 42, and these devices are connected via the refrigerant pipe to constitute the heat source-side refrigerant circuit RC2A. The heat source-side refrigerant circuit RC2A is connected to the intermediate refrigerant circuit RC2C in the refrigerant flow path switching unit 55 via the refrigerant pipe 25 (liquid pipe 25L, high and low-pressure gas pipe 25G1, and suction gas pipe 25G2).

[0043] The heat source-side refrigerant circuit RC2A includes a liquid-side shutoff valve 101, a gas-side first shutoff valve 102, a gas-side second shutoff valve 103, an accumulator 104, a compressor 105, a first flow path switching valve 106, a second flow path switching valve 107, a third flow path switching valve 108, an outdoor heat exchanger 109, a first outdoor expansion valve 110, and a second outdoor expansion valve 111. An outdoor fan 112, the outdoor control unit 61 (see FIG. 8), and the like are further arranged in the second outdoor unit 42.

[0044] The liquid-side shutoff valve 101, the gas-side first shutoff valve 102, and the gas-side second shutoff valve 103 are manual valves that are opened and closed when filling with refrigerant, pumping down, and the like. One end of the liquid-side shutoff valve 101 is connected to the liquid pipe 25L. The other end of the liquid-side shutoff valve 101 is connected to a refrigerant pipe that extends to the first outdoor expansion valve 110 and the second outdoor expansion valve 111. One end of the gas-side first shutoff valve 102 is connected to the high and low-pressure gas pipe 25G1. The other end of the gas-side first shutoff valve 102 is connected to a refrigerant pipe that extends to the second flow path switching valve 107. One end of the gas-side second shutoff valve 103 is connected to the suction gas pipe 25G2. The other end of the gas-side second shutoff valve 103 is connected to a refrigerant pipe that extends to the accumulator 104.

[0045] The accumulator 104 is a container for temporarily storing low-pressure refrigerant to be sucked into the compressor 105 and separating gas refrigerant and liquid refrigerant.

[0046] The compressor 105 has a hermetic structure incorporating a compressor motor, and is of a positive-displacement type such as a scroll type or a rotary type. The compressor 105 compresses the low-pressure refrigerant sucked in from a suction pipe 105b, and then discharges the compressed refrigerant from a discharge pipe 105a. Refrigeration oil is contained inside the compressor 105. This refrigeration oil may circulate in the refrigerant circuit along with the refrigerant. The second outdoor unit 42 according to the present embodiment includes the single compressor 105, but may include two or more compressors 105 connected in parallel.

[0047] The first flow path switching valve 106, the second flow path switching valve 107, and the third flow path switching valve 108 are four-way switching valves. The first flow path switching valve 106, the second flow path switching valve 107, and the third flow path switching valve 108 switch the flow of the refrigerant according to the operating conditions of the third air conditioner 23. The discharge pipe 105a or a branch pipe extending from the discharge pipe 105a is connected to one refrigerant inflow port of each of the first flow path switching valve 106, the second flow path switching valve 107, and the third flow path switching valve 108. A branch pipe extending from a refrigerant pipe 105c that interconnects the gas-side second shutoff valve 103 and the accumulator 104 is connected to one refrigerant inflow port of each of the first flow path switching valve 106, the second flow path switching valve 107, and the third flow path switching valve 108. The first flow path switching valve 106, the second flow path switching valve 107, and the third flow path switching valve 108 are each configured to shut off the flow of the refrigerant in one refrigerant flow path during operation, and effectively functions as a three-way valve.

[0048] The outdoor heat exchanger 109 is a cross-fin type or microchannel type heat exchanger. The outdoor heat exchanger 109 includes a first heat exchange part 109a and a second heat exchange part 109b. The first

heat exchange part 109a is provided in the upper portion of the outdoor heat exchanger 109, and the second heat exchange part 109b is provided below the first heat exchange part 109a.

[0049] The gas-side end of the first heat exchange part 109a is connected to a refrigerant pipe that extends to the third flow path switching valve 108. The liquid-side end of the first heat exchange part 109a is connected to a refrigerant pipe that extends to the first outdoor expansion valve 110.

[0050] The gas-side end of the second heat exchange part 109b is connected to a refrigerant pipe that extends to the first flow path switching valve 106. The liquid-side end of the second heat exchange part 109b is connected to a refrigerant pipe that extends to the second outdoor expansion valve 111.

[0051] The refrigerant passing through the first heat exchange part 109a and the second heat exchange part 109b exchanges heat with the air flow generated by the outdoor fan 112. The outdoor fan 112 is, for example, a propeller fan, and is driven by an outdoor fan motor (not shown). The outdoor fan 112 generates an air flow that flows into the second outdoor unit 42, passes through the outdoor heat exchanger 109, and flows out of the second outdoor unit 42.

[0052] The first outdoor expansion valve 110 and the second outdoor expansion valve 111 are, for example, electric valves with adjustable opening degrees. One end of the first outdoor expansion valve 110 is connected to the refrigerant pipe that extends from the first heat exchange part 109a. The other end of the first outdoor expansion valve 110 is connected to a refrigerant pipe that extends to the liquid-side shutoff valve 101.

[0053] One end of the second outdoor expansion valve 111 is connected to the refrigerant pipe that extends from the second heat exchange part 109b. The other end of the second outdoor expansion valve 111 is connected to a refrigerant pipe that extends to the liquid-side shutoff valve 101. The opening degrees of the first outdoor expansion valve 110 and the second outdoor expansion valve 111 are adjusted according to the operating conditions, and the refrigerant passing therethrough is decompressed according to the opening degrees.

[0054] The operation of the compressor 105, the outdoor fan 112, the first outdoor expansion valve 110, the second outdoor expansion valve 111, the first flow path switching valve 106, the second flow path switching valve 107, and the third flow path switching valve 108 is controlled by the outdoor control unit 61 (see FIG. 8). Note that in the following description, the outdoor control unit 61 of the second outdoor unit 42 is referred to as a second outdoor control unit 61B.

Indoor Unit

[0055] The third air conditioner 23 has the same indoor unit 30 as the first and second air conditioners 21 and 22. Detailed description of the indoor units 30 in the third air conditioner 23 is omitted. The utilization-side refrigerant circuit RC2B is provided in each of the indoor units 30. The utilization-side refrigerant circuit RC2B is configured by the indoor heat exchanger 31 being connected to the liquid pipe 25L and the gas pipe 25G.

Refrigerant Flow Path Switching Unit

[0056] As illustrated in FIG. 7 and FIG. 8, the third air conditioner 23 has the refrigerant flow path switching unit 55. The refrigerant flow path switching unit 55 is provided between the second outdoor unit 42 and the plurality of indoor units 30. The refrigerant flow path switching unit 55 has a casing 56. The refrigerant flow path switching unit 55 switches the flow of the refrigerant flowing into the second outdoor unit 42 and each of the indoor units 30. The refrigerant flow path switching unit 55 is the valve unit 50 that switches the flow of the refrigerant to the indoor units 30, for each of the indoor units 30. As illustrated in FIG. 7, a plurality of header pipes 155,156,157,158 and a plurality of switching units 57 are accommodated in the casing 56.

Header Pipe

[0057] As illustrated in FIG. 7, the plurality of header pipes 155,156,157,158 include a first header pipe 155, a second header pipe 156, a third header pipe 157, and a fourth header pipe 158. The first header pipe 155 is connected to the liquid pipe 25L. The second header pipe 156 is connected to the high and low-pressure gas pipe 25G1. The third header pipe 157 is connected to the suction gas pipe 25G2.

Switching Unit

[0058] The refrigerant flow path switching unit 55 includes the plurality of switching units 57. Each of the switching units 57 forms the intermediate refrigerant circuit RC2C of the refrigerant flow path switching unit 55. One indoor unit 30 is connected to each of the switching units 57. However, the indoor unit 30 does not need to be connected to all the switching units 57 of the refrigerant flow path switching unit 55, and the switching unit 57 to which the indoor unit 30 is not connected may be present in the refrigerant flow path switching unit 55.

Regarding Intermediate Refrigerant Circuit

[0059] The plurality of switching units 57 all have the same structure, and the intermediate refrigerant circuit RC2C of each of the switching units 57 includes a plurality of valves EV1, EV2, EV3, and EV4 and a plurality of refrigerant pipes.

[0060] In the switching units 57, the plurality of valves EV1, EV2, EV3, and EV4 include a first valve EV1, a second valve EV2, a third valve EV3, and a fourth valve EV4. These valves EV1, EV2, EV3, and EV4 are electric

valves with adjustable opening degrees. The second valve EV2, the third valve EV3, and the fourth valve EV4 is controlled in operation by a flow path switching control unit 64 (see FIG. 8) so as to take any one of a fully closed state, a fully open state, and an adjusted open state. The first valve EV1 is controlled in operation by the flow path switching control unit 64 (see FIG. 8) so as to take any one of a minimum open state, a fully open state, a fully closed state, and an adjusted open state.

[0061] Each of the switching units 57 includes a first refrigerant pipe P1 that interconnects the second header pipe 156 and the first valve EV1. A filter F1 is provided at a point in the first refrigerant pipe P1. The switching unit 57 includes a second refrigerant pipe P2. One end of the second refrigerant pipe P2 is connected to the first valve EV1. The switching unit 57 includes a utilization-side gas pipe 161. One end of the utilization-side gas pipe 161 is connected to the gas pipe 25G of the indoor unit 30. The other end of the utilization-side gas pipe 161 is connected to the second valve EV2. The other end of the second refrigerant pipe P2 is connected to the utilization-side gas pipe 161. A filter F2 is provided in the utilization-side gas pipe 161.

[0062] The switching unit 57 includes a third refrigerant pipe P3. One end of the third refrigerant pipe P3 is connected to the second valve EV2. The other end of the third refrigerant pipe P3 is connected to the third header pipe 157. A filter F3 is provided at a point in the third refrigerant pipe P3.

[0063] The switching unit 57 includes a utilization-side liquid pipe 162. One end of the utilization-side liquid pipe 162 is connected to the liquid pipe 25L of the indoor unit 30. The other end of the utilization-side liquid pipe 162 is connected to a subcooling heat exchanger 159. The fourth valve EV4 is provided at a point in the utilization-side liquid pipe 162. A first heat transfer tube 159a and a second heat transfer tube 159b are provided inside the subcooling heat exchanger 159. The subcooling heat exchanger 159 exchanges heat between the refrigerant flowing through the first heat transfer tube 159a and the refrigerant flowing through the second heat transfer tube 159b. The other end of the utilization-side liquid pipe 162 is connected to one end of the first heat transfer tube 159a.

[0064] The switching unit 57 includes a fourth refrigerant pipe P4. One end of the fourth refrigerant pipe P4 is connected to the other end of the first heat transfer tube 159a. The other end of the fourth refrigerant pipe P4 is connected to the first header pipe 155.

[0065] The switching unit 57 includes a fifth refrigerant pipe P5 that branches from a point in the fourth refrigerant pipe P4. One end of the fifth refrigerant pipe P5 is connected to one end of the third valve EV3. A filter F4 is provided at a point in the fifth refrigerant pipe P5.

[0066] The switching unit 57 includes a sixth refrigerant pipe P6 and a seventh refrigerant pipe P7. One end of the sixth refrigerant pipe P6 is connected to the third valve EV3. The other end of the sixth refrigerant pipe P6 is connected to one end of the second heat transfer tube 159b of the subcooling heat exchanger 159. One end of the seventh refrigerant pipe P7 is connected to the second heat transfer tube 159b of the subcooling heat exchanger 159. The other end of the seventh refrigerant pipe P7 is connected to the fourth header pipe 158. The fourth header pipe 158 is connected to the third header pipe 157 via the connecting pipe 163.

[0067] The refrigerant flows into the fourth header pipe 158 from the first header pipe 155 through the fourth refrigerant pipe P4, the fifth refrigerant pipe P5, the third valve EV3, the sixth refrigerant pipe P6, the subcooling heat exchanger 159, and the seventh refrigerant pipe P7. Further, the refrigerant flowing into the fourth header pipe 158 flows through the connecting pipe 163 into the third header pipe 157.

Regarding Control Unit of Third Air Conditioning System

[0068] The control unit 60 in the third air conditioning system 13 includes the second outdoor control unit 61B, the indoor control unit 62, and the flow path switching control unit 64 of the refrigerant flow path switching unit 55. The second outdoor control unit 61B, the indoor control unit 62, and the flow path switching control unit 64 are communicably connected to each other via a transmission line.

[0069] The second outdoor control unit 61B is a device that controls the operation of the second outdoor unit 42. The detection values of the sensors provided in the second outdoor unit 42 are input to the second outdoor control unit 61B. The second outdoor control unit 61B controls the operation of the compressor 105, the outdoor fan 112, the first outdoor expansion valve 110, the second outdoor expansion valve 111, the first flow path switching valve 106, the second flow path switching valve 107, the third flow path switching valve 108, and the like on the basis of the detection values of the sensors, and the like.

[0070] The flow path switching control unit (second control unit) 64 is a device that controls the operation of the refrigerant flow path switching unit 55, and includes, for example, a microcomputer including a processor such as a CPU, and memory such as RAM and ROM. The flow path switching control unit 64 may be implemented as hardware using LSI, ASIC, FPGA, or the like. The flow path switching control unit 64 exerts a predetermined function when the processor executes a program installed in the memory. The flow path switching control unit 64 controls the operation of the first valve EV1, the second valve EV2, the third valve EV3, and the fourth valve EV4 on the basis of the detection values of the sensors of the second outdoor unit 42 and the indoor unit 30, and the like. Note that the flow path switching control unit 64 may be omitted in the third air conditioning system 13. In this case, the operation of each of the valves EV1 to EV4 is controlled by the second outdoor control unit 61B and/or the indoor control unit 62.

[0071] For example, if a flammable refrigerant is used

in the third air conditioning system 13 and a refrigerant sensor (not illustrated) provided in the indoor unit 30 detects the refrigerant, the flow path switching control unit 64 may shut off the supply of the refrigerant to the indoor unit 30 by fully closing the first valve EV1, the second valve EV2, and the fourth valve EV4. In this case, the amount of refrigerant leakage from the indoor unit 30 can be suppressed without the isolation valve unit 51 (see FIG. 1B).

[0072] In the third air conditioning system 13, the fourth valve EV4 is used as a control valve for adjusting the pressure of the refrigerant to be supplied to the indoor unit 30. The flow path switching control unit 64 controls the pressure of the refrigerant to be supplied to the indoor unit 30 by adjusting the opening degree of the fourth valve EV4 on the basis of the detection values of the sensors (not illustrated) of the indoor unit 30 and the second outdoor unit 42, and the like. In the third air conditioning system 13, the fourth valve EV4 of the refrigerant flow path switching unit 55 (valve unit 50) is used as a control valve that adjusts the pressure of the refrigerant to be supplied to the indoor unit 30, thereby enabling the use of the indoor unit 30 that do not have an electric valve (indoor expansion valve) inside. Note that in the present embodiment, the case where the main component that controls the control valve for adjusting the pressure of the refrigerant to be supplied to the indoor unit 30 is the flow path switching control unit 64 of the control unit 60 is exemplified, but the present invention is not limited thereto, and may be the second outdoor control unit 61B and the indoor control unit 62.

Regarding Operation of Third Air Conditioning System

[0073] The following describes the cases where all the indoor units 30 in operation perform cooling (hereinafter, also referred to as "full cooling operation"), all the indoor units 30 in operation perform heating (hereinafter, also referred to as "full heating operation"), and some of the indoor units 30 in operation perform cooling and the others perform heating (hereinafter, also referred to as "cooling/heating mixed operation") by the third air conditioning system 13.

Full Cooling Operation

[0074] During the full cooling operation, the control unit 60 adjusts the valves as follows. In the switching units 57, the first valve EV1 is fully closed, the second valve EV2 is fully open, the third valve EV3 and the fourth valve EV4 are adjusted in opening degree, and the first and second outdoor expansion valves 110 and 111 are fully open. The first flow path switching valve 106 of the second outdoor unit 42 is switched so as to connect the discharge pipe 105a of the compressor 105 to the gas-side end of the second heat exchange part 109b. The second flow path switching valve 107 is switched so as to connect the discharge pipe 105a to the high and low-pressure gas pipe 25G1. The third flow path switching valve 108 is switched so as to connect the discharge pipe 105a to the gas-side end of the first heat exchange part 109a.

[0075] When the compressor 105 is driven, the high-pressure gas refrigerant obtained by compression in the compressor 105 flows through the discharge pipe 105a, the first flow path switching valve 106, the third flow path switching valve 108, and the like, into the outdoor heat exchanger 109 and is condensed. The refrigerant condensed in the outdoor heat exchanger 109 flows through the first and second outdoor expansion valves 110 and 111, the liquid-side shutoff valve 101, and the like, into the liquid pipe 25L.

[0076] The refrigerant flowing into the liquid pipe 25L flows through the first header pipe 155 of the refrigerant flow path switching unit 55 and into the fourth refrigerant pipe P4 of each of the switching units 57. The refrigerant flowing into the fourth refrigerant pipe P4 flows into the first heat transfer tube 159a of the subcooling heat exchanger 159, is further decompressed by the fourth valve EV4 on the utilization-side liquid pipe 162, and flows into the indoor unit 30.

[0077] The refrigerant flowing into the fourth refrigerant pipe P4 also branches and flows into the fifth refrigerant pipe P5, is decompressed according to the opening degree of the third valve EV3, and flows into the second heat transfer tube 159b of the subcooling heat exchanger 159. In the subcooling heat exchanger 159, heat is exchanged between the refrigerant flowing through the first heat transfer tube 159a and the refrigerant flowing through the second heat transfer tube 159b, and the refrigerant flowing through the first heat transfer tube 159a is subcooled and flows into the indoor unit 30.

[0078] The refrigerant flowing through the second heat transfer tubes 159b of the subcooling heat exchanger 159 flows from the seventh refrigerant pipe P7 into the fourth header pipe 158, and then through the connecting pipe 163 into the third header pipe 157. The refrigerant flowing into the indoor unit 30 evaporates in the indoor heat exchanger 31.

[0079] In the indoor unit 30, the refrigerant evaporated in the indoor heat exchanger 31 flows from the gas pipe 25G into the utilization-side gas pipe 161, mainly passes through the second valve EV2, and flows into the third header pipe 157. The refrigerant flowing into the third header pipe 157 flows through the suction gas pipe 25G2 and the gas-side second shutoff valve 103 into the accumulator 104, and is sucked into the compressor 105.

Regarding Full Heating Operation

[0080] During the full heating operation, the control unit 60 adjusts the valves as follows. The first valve EV1 of the switching unit 57 is fully open, the second valve EV2 is fully closed, the third valve EV3 is fully closed, the fourth valve EV4 is fully open, and the first and second outdoor expansion valves 110,111 are adjusted in opening degree. The first flow path switching valve 106 of the

second outdoor unit 42 is switched so as to connect the refrigerant pipe 105c to the gas-side end of the second heat exchange part 109b. The second flow path switching valve 107 is switched so as to connect the discharge pipe 105a to the high and low-pressure gas pipe 25G1. The third flow path switching valve 108 is switched so as to connect the refrigerant pipe 105c to the gas-side end of the first heat exchange part 109a.

[0081] When the compressor 105 is driven, the high-pressure gas refrigerant obtained by compression in the compressor 105 flows through the discharge pipe 105a, the second flow path switching valve 107, and the like, into the high and low-pressure gas pipe 25G1. The refrigerant flowing into the high and low-pressure gas pipe 25G1 passes through the second header pipe 156 of the refrigerant flow path switching unit 55 and the first refrigerant pipe P1 of the switching unit 57, passes through the first valve EV1, and flows into the gas pipe 25G of the indoor unit 30 from the utilization-side gas pipe 161.

[0082] The refrigerant flowing into the gas pipe 25G flows into the indoor heat exchanger 31 of the indoor unit 30 and condenses. The condensed refrigerant flows through the liquid pipe 25L, and flows through the fourth valve EV4 into the utilization-side liquid pipe 162 of the switching unit 57. The refrigerant flowing into the utilization-side liquid pipe 162 flows through the subcooling heat exchanger 159 and the fourth refrigerant pipe P4 into the first header pipe 155.

[0083] The refrigerant flowing into the first header pipe 155 flows through the liquid pipe 25L into the second outdoor unit 42, and is decompressed in the first and second outdoor expansion valves 110 and 111. The decompressed refrigerant evaporates when passing through the outdoor heat exchanger 109, flows through the first flow path switching valve 106, the third flow path switching valve 108, and the like, into the accumulator 104, and is sucked into the compressor 105.

Cooling/Heating Mixed Operation

[0084] During the cooling/heating mixed operation, the control unit 60 adjusts the valves as follows. In the switching unit 57 (hereinafter, also referred to as "cooling-side switching unit 57") corresponding to the indoor unit 30 (hereinafter, also referred to as "cooling-side indoor unit 30") that performs the cooling operation among the indoor units 30 in operation, the first valve EV1 is set to the minimum opening degree, the second valve EV2 is fully open, and the third valve EV3 and the fourth valve EV4 are adjusted in opening degree. The first flow path switching valve 106 of the second outdoor unit 42 is switched so as to connect the refrigerant pipe 105c to the gas-side end of the second heat exchange part 109b. The second flow path switching valve 107 is switched so as to connect the discharge pipe 105a to the high and low-pressure gas pipe 25G1. The third flow path switching valve 108 is switched so as to connect the discharge pipe 105a to the gas-side end of the first heat exchange part 109a.

[0085] In the switching unit 57 (hereinafter, also referred to as "heating-side switching unit 57") corresponding to the indoor unit 30 (hereinafter, also referred to as "heating-side indoor unit 30") that performs the heating operation among the indoor units 30 in operation, the first valve EV1 is fully open, the second valve EV2 is fully closed, the third valve EV3 is fully closed, and the fourth valve EV4 is fully open.

[0086] When the compressor 105 is driven, some of the high-pressure gas refrigerant obtained by compression in the compressor 105 flows through the discharge pipe 105a and the second flow path switching valve 107 into the high and low-pressure gas pipe 25G1. The other part of the high-pressure gas refrigerant obtained by compression in the compressor 105 passes through the discharge pipe 105a and the third flow path switching valve 108, is condensed in the first heat exchange part 109a, passes through the first outdoor expansion valve 110, and flows partly into the liquid pipe 25L and the rest into the second outdoor expansion valve 111. The refrigerant condensed in the first heat exchange part 109a evaporates in the second heat exchange part 109b through the second outdoor expansion valve 111, and is sucked into the compressor 105 through the first flow path switching valve 106.

[0087] The refrigerant flowing into the high and low-pressure gas pipe 25G1 flows into the second header pipe 156 of the refrigerant flow path switching unit 55 and flows through the first refrigerant pipe P1, first valve EV1, and utilization-side gas pipe 161 of the heating-side switching unit 57, and into the gas pipe 25G.

[0088] The refrigerant flowing into the gas pipe 25G condenses in the indoor heat exchanger 31 of the heating-side indoor unit 30. The condensed refrigerant flows into utilization-side liquid pipe 162 of the heating-side switching unit 57 from the liquid pipe 25L through the fourth valve EV4 that is fully open, and flows through the subcooling heat exchanger 159 and the fourth refrigerant pipe P4, and into the first header pipe 155.

[0089] The refrigerant flowing into the liquid pipe 25L from the second outdoor unit 42 also flows into the first header pipe 155. The refrigerant flowing into the first header pipe 155 passes through the fourth refrigerant pipe P4, subcooling heat exchanger 159, and utilization-side liquid pipe 162 of the cooling-side switching unit 57, is decompressed by the fourth valve EV4, the opening degree of which has been adjusted, and then flows into the cooling-side indoor unit 30 through the liquid pipe 25L. At this time, the refrigerant that has passed through the subcooling heat exchanger 159 is subcooled by the refrigerant that has branched from the fourth refrigerant pipe P4, flowed through the fifth refrigerant pipe P5, and been decompressed by the third valve EV3.

[0090] The refrigerant flowing into the cooling-side indoor unit 30 evaporates in the indoor heat exchanger 31 to cool the room. The evaporated refrigerant flows through the gas pipe 25G into the utilization-side gas pipe

161 of the cooling-side switching unit 57, flows through the second valve EV2 into the third refrigerant pipe P3 and the third header pipe 157, flows through the suction gas pipe 25G2 into the accumulator 104, and is sucked into the compressor 105.

Regarding Fourth Air Conditioning System

[0091] FIG. 9 is a refrigerant circuit diagram of the air conditioning system according to the fourth embodiment of the present disclosure. FIG. 10 is a block diagram of the air conditioning system according to the fourth embodiment of the present disclosure. As illustrated in FIG. 2B, FIG. 9, and FIG. 10, the fourth air conditioning system 14 includes a fourth air conditioner 24. The fourth air conditioner 24 includes an indoor unit 30, an outdoor unit 40, and a plurality of valve units 50 (isolation valve unit 51 and refrigerant flow path switching unit 55). Since the fourth air conditioner 24 uses a flammable refrigerant (for example, R32, which is slightly combustible) as a refrigerant, the isolation valve unit 51 that shuts off the refrigerant to be supplied to the indoor unit 30 is provided. The fourth air conditioner 24 differs from the third air conditioner 23 in that the fourth air conditioner 24 includes the isolation valve unit 51. In other words, the fourth air conditioner 24 has the same configuration as the third air conditioner 23 except for the isolation valve unit 51. In the fourth air conditioner 24 illustrated in FIG. 9 and FIG. 10, parts having the same configuration as the third air conditioner 23 are denoted by the same reference signs, and the description of such common parts will be omitted unless otherwise specified.

Regarding Control Unit of Fourth Air Conditioning System

[0092] In the fourth air conditioning system 14, the control unit 60 includes the second outdoor control unit 61B, the indoor control unit 62, the isolation valve control unit 63, and the flow path switching control unit 64. The second outdoor control unit 61B, the indoor control unit 62, the isolation valve control unit 63, and the flow path switching control unit 64 are communicably connected to each other via a transmission line.

[0093] In the fourth air conditioning system 14, if a refrigerant sensor (not illustrated) provided in the indoor unit 30 detects the refrigerant, the isolation valve control unit 63 closes the first electric valve 52 and the second electric valve 53 to shut off the supply of the refrigerant to the indoor unit 30.

[0094] In the fourth air conditioning system 14, the fourth valve EV4 is used as a control valve for adjusting the pressure of the refrigerant to be supplied to the indoor unit 30. In the present embodiment, the flow path switching control unit 64 of the control unit 60 controls the pressure of the refrigerant to be supplied to the indoor unit 30 by adjusting the opening degree of the fourth valve EV4 on the basis of the detection values of the sensors (not illustrated) of the indoor unit 30 and the first outdoor unit 41, and the like.

[0095] In the second air conditioning system 12, the first electric valve 52 may be used as a control valve for adjusting the pressure of the refrigerant to be supplied to the indoor unit 30. In this case, the isolation valve control unit 63 controls the pressure of the refrigerant to be supplied to the indoor unit 30 by adjusting the opening degree of the first electric valve 52 on the basis of the detection values of the sensors (not illustrated) of the indoor unit 30 and the first outdoor unit 41, and the like. In the fourth air conditioning system 14, the fourth valve EV4 of the refrigerant flow path switching unit 55 or the first electric valve 52 of the isolation valve unit 51 is used as a control valve that adjusts the pressure of the refrigerant to be supplied to the indoor unit 30, thereby enabling the use of the indoor unit 30 that does not have an electric valve (indoor expansion valve) inside. Note that in the present embodiment, the case where the main component that controls the control valve for adjusting the pressure of the refrigerant to be supplied to the indoor unit 30 is the isolation valve control unit 63 or flow path switching control unit 64 of the control unit 60 is exemplified, but the present invention is not limited thereto, and may be the second outdoor control unit 61B and the indoor control unit 62.

Regarding Control Mode Selection Operation by Control Unit

[0096] FIG. 11 is a control flowchart of a control unit in an air conditioning system according to the present disclosure. When the air conditioning system 10 according to the present disclosure is first turned on after the completion of installation, the control unit 60 performs the operation illustrated in FIG. 11. In the air conditioning system 10 according to the present disclosure, the outdoor control unit 61 performs the operation illustrated in FIG. 11. Note that the timing for performing the operation illustrated in FIG. 11 is not limited to the first power-on.

[0097] When the operation shown in FIG. 11 is started, the control unit 60 first executes step (S01). In the step (S01), the control unit 60 determines whether or not the air conditioning system 10 has the valve unit 50. If the air conditioning system 10 does not have the valve unit 50 (No), the control unit 60 next executes step (S02). If the air conditioning system 10 has the valve unit 50 (Yes), the control unit 60 next executes step (S05). Note that in the second air conditioning system 12 described above, the electric valves 52 and 53 of the isolation valve unit 51 may be used exclusively for shutting off the refrigerant. If the electric valves 52 and 53 are used exclusively for refrigerant shutoff in the second air conditioning system 12, the control unit 60 does not determine that the isolation valve unit 51 is the valve unit 50 in the step (S01).

[0098] In the step (S02), the control unit 60 selects the first control mode M1 as the control mode M for the air conditioner 20, and then executes step (S03).

[0099] In the step (S03), the control unit 60 writes in-

formation related to the outdoor unit 40 to the indoor control unit 62. In this case, the control unit 60 writes information that the outdoor unit 40 is the first outdoor unit 41 (in other words, information that the air conditioning system 10 is of the first specification) to the indoor control unit 62. After executing the step (S02), the control unit 60 then executes step (S04).

[0100] In the step (S04), the control unit 60 controls the air conditioner 20 according to the first control mode M1. In this case, the outdoor control unit 61 controls the outdoor expansion valve 84 to adjust the pressure of the refrigerant to be supplied to the indoor unit 30. Note that the step (S04) is executed in the case where the air conditioning system 10 is the first air conditioning system 11 (see FIG. 3 and FIG. 4). In the first air conditioning system 11, the indoor control unit 62 controls the operation of the indoor unit 30 on the basis of the information related to the first outdoor unit 41 written in the indoor control unit 62.

[0101] In the step (S05), the control unit 60 selects the second control mode M2 as the control mode M for the air conditioner 20, and then executes step (S06).

[0102] In the step (S06), the control unit 60 determines whether or not the air conditioning system 10 has the refrigerant flow path switching unit 55. If the air conditioning system 10 does not have the refrigerant flow path switching unit 55 (No), the control unit 60 next executes step (S07). If the air conditioning system 10 has the refrigerant flow path switching unit 55 (Yes), the control unit 60 next executes step (S09).

[0103] In the step (S07), the control unit 60 writes information related to the outdoor unit 40 to the indoor control unit 62. In this case, the control unit 60 writes information that the outdoor unit 40 is the first outdoor unit 41 (in other words, information that the air conditioning system 10 is of the first specification) to the indoor control unit 62. After executing the step (S07), the control unit 60 then executes step (S08).

[0104] In the step (S08), the control unit 60 controls the air conditioner 20 according to the second control mode M2. In this case, the isolation valve control unit 63 controls the first electric valve 52 to adjust the pressure of the refrigerant to be supplied to the indoor unit 30. Note that the step (S08) is executed in the case where the air conditioning system 10 is the second air conditioning system 12 (see FIG. 5 and FIG. 6). In the second air conditioning system 12, the indoor control unit 62 controls the operation of the indoor unit 30 on the basis of the information related to the first outdoor unit 41 written in the indoor control unit 62.

[0105] In the step (S09), the control unit 60 writes information related to the outdoor unit 40 to the indoor control unit 62. In this case, the control unit 60 writes information that the outdoor unit 40 is the second outdoor unit 42 (in other words, information that the air conditioning system 10 is of the second specification) to the indoor control unit 62. After executing the step (S09), the control unit 60 then executes step (S10).

[0106] In the step (S10), the control unit 60 controls the air conditioner 20 according to the second control mode M2. In this case, the flow path switching control unit 64 controls the fourth valve EV4 to adjust the pressure of the refrigerant to be supplied to the indoor unit 30. Note that the step (S10) is executed in the case where the air conditioning system 10 is the third air conditioning system 13 (see FIG. 7 and FIG. 8) and the fourth air conditioning system 14 (see FIG. 9 and FIG. 10). In the third air conditioning system 13 and the fourth air conditioning system 14, the indoor control unit 62 controls the operation of the indoor unit 30 on the basis of the information related to the second outdoor unit 42 written in the indoor control unit 62.

[0107] In the air conditioning system 10 according to the present disclosure, after the operation of the above steps (S01) to (S10), the control unit 60 determines the specifications (presence or absence of the valve unit 50, and air conditioning method) of the air conditioning system 10. In the air conditioning system 10, the control unit 60 selects the control mode M for the air conditioner 20 according to the specifications, thereby allowing the use of the common indoor units 30.

[0108] Note that in the present embodiment, the outdoor control unit 61 of the outdoor unit 40 performs the operation of the above steps (S01) to (S10), but the indoor control unit 62 of the indoor unit 30 may perform the operation described above. Furthermore, the operation of the above steps (S01) to (S10) may be performed by the control unit 60 other than the outdoor control unit 61 and the indoor control unit 62. For example, if the air conditioning system 10 has a central monitoring device (not illustrated), a management server connected via the Internet, or the like, the central monitoring device, the management server, or the like may be included in the control unit 60, and the operation of the above steps (S01) to (S10) may be performed by the central monitoring device, the management server, or the like.

[Operation and Effect of Embodiments]

[0109]

(1)The outdoor unit 40 according to the present disclosure is provided in the air conditioning system 10 including the refrigerant circuit RC1, RC2 that performs a refrigeration cycle and the plurality of indoor units 30. The plurality of indoor units 30 are connected in parallel to the outdoor unit 40. The outdoor unit 40 includes: the first control valve (outdoor expansion valve 84, or first outdoor expansion valve 110 and second outdoor expansion valve 111) that adjusts the pressure of the refrigerant to be supplied to the indoor units 30; and the outdoor control unit 61 that controls the first control valve (outdoor expansion valve 84, or first outdoor expansion valve 110 and second outdoor expansion valve 111). If the valve unit 50 that is provided between the indoor

units 30 and the outdoor unit 40 and that switches the flow of the refrigerant to the indoor units 30 is not included in the air conditioning system 10, the outdoor control unit 61 operates the air conditioning system 10 in the first control mode M1 in which the pressure of the refrigerant to be supplied to the indoor units 30 is adjusted by controlling the outdoor expansion valve 84. If the valve unit 50 is included in the air conditioning system 10, the air conditioning system 10 is operated in the second control mode M2 in which the pressure of the refrigerant to be supplied to the indoor units 30 is adjusted by controlling the second control valve (first electric valve 52 or fourth valve EV4) included in the valve unit 50.

In a case where the outdoor unit 40 having this configuration is used, the control modes M of the air conditioner 20 can be switched by the control unit 60 according to the specifications of the air conditioning system 10, such as controlling the outdoor expansion valve 84 of the outdoor unit 40 with the control unit 60 if the air conditioning system 10 is of the first specification, and controlling the fourth valve EV4 of the refrigerant flow path switching unit 55 with the control unit 60 if the air conditioning system 10 is of the second specification. This eliminates the need to provide control valves in the indoor units 30 even if the air conditioning system 10 is of the second specification, and allows the use of the common indoor units 30 with a specification that does not have a control valve, regardless of the specifications of the air conditioning system 10.

(2)The indoor unit 30 according to the present disclosure is provided in the air conditioning system 10 including the refrigerant circuit RC1, RC2 that performs a refrigeration cycle and the outdoor unit 40. The plurality of the indoor units are connected in parallel to the outdoor unit 40. The outdoor unit 40 includes the first control valve (outdoor expansion valve 84, or first outdoor expansion valve 110 and second outdoor expansion valve 111) that adjusts the pressure of the refrigerant to be supplied to the indoor units 30. The indoor units 30 each include the indoor control unit 62 that controls the first control valve (outdoor expansion valve 84, or first outdoor expansion valve 110 and second outdoor expansion valve 111). If the valve unit 50 that is provided between the indoor units 30 and the outdoor unit 40 and that switches the flow of the refrigerant to the indoor units 30 is not included in the air conditioning system 10, the indoor control unit 62 operates the air conditioning system 10 in the first control mode M1 in which the pressure of the refrigerant to be supplied to the indoor units 30 is adjusted by controlling the outdoor expansion valve 84. If the valve unit 50 is included in the air conditioning system 10, the indoor control unit 62 operates the air conditioning system 10 in the second control mode M2 in which the pressure of the refrigerant to be supplied to the indoor units 30 is adjusted by controlling the second control valve (first electric valve 52 or fourth valve EV4) included in the valve unit 50.

In a case where the indoor units 30 having this configuration are used, the control modes M of the air conditioner 20 can be switched by the indoor control unit 62 according to the specifications of the air conditioning system 10, such as controlling the outdoor expansion valve 84 of the outdoor unit 40 with the control unit 60 if the air conditioning system 10 is of the first specification, and controlling the fourth valve EV4 of the refrigerant flow path switching unit 55 with the control unit 60 if the air conditioning system 10 is of the second specification. This eliminates the need to provide control valves in the indoor units 30 even if the air conditioning system 10 is of the second specification, and allows the use of the common indoor units 30 with a specification that does not have a control valve, regardless of the specifications of the air conditioning system 10.

(3)The air conditioning system 10 according to the present disclosure includes the refrigerant circuit RC1, RC2 that performs a refrigeration cycle, the outdoor unit 40, and the plurality of indoor units 30 connected in parallel to the outdoor unit 40. The air conditioning system 10 includes the control unit 60 that controls the operation of the air conditioning system 10. The outdoor unit 40 includes the first control valve (outdoor expansion valve 84, or first outdoor expansion valve 110 and second outdoor expansion valve 111) that adjusts the pressure of the refrigerant to be supplied to the indoor units 30. If the valve unit 50 that is provided between the indoor units 30 and the outdoor unit 40 and that switches the flow of the refrigerant to the indoor units 30 is not included in the air conditioning system 10, the air conditioning system 10 is operated in the first control mode M1 in which the pressure of the refrigerant to be supplied to the indoor units 30 is adjusted by controlling the outdoor expansion valve 84. If the valve unit 50 is included in the air conditioning system 10, the air conditioning system 10 is operated in the second control mode M2 in which the pressure of the refrigerant to be supplied to the indoor units 30 is adjusted by controlling the second control valve (first electric valve 52 or fourth valve EV4) included in the valve unit 50.

In the case of the air conditioning system 10 having this configuration, the control modes M of the air conditioner 20 can be switched by the outdoor control unit 61 according to the specifications of the air conditioning system 10, such as controlling the outdoor expansion valve 84 of the outdoor unit 40 with the control unit 60 if the air conditioning system 10 is of the first specification, and controlling the fourth valve EV4 of the refrigerant flow path switching unit 55 with the control unit 60 if the air conditioning system 10 is of the second specification. This eliminates the

need to provide control valves in the indoor units 30 even if the air conditioning system 10 is of the second specification, and allows the use of the common indoor units 30 with a specification that does not have a control valve, regardless of the specifications of the air conditioning system 10.

(4)In the air conditioning system 10 according to the present disclosure, the control unit 60 automatically selects the second control mode M2 if the valve unit 50 is included in the air conditioning system 10. In this case, the second control mode M2 suitable for the specifications of the air conditioning system 10 can be automatically selected simply by connecting the valve unit 50 to the indoor units 30 and the outdoor unit 40.

(5)The air conditioning system 10 according to the present disclosure further includes the selection means 37 for manually selecting the first control mode M1 and the second control mode M2. In this case, the user can manually select the first control mode M1 or the second control mode M2.

(6)In the air conditioning system 10 according to the present disclosure, if the valve unit 50 is not included in the air conditioning system 10, the control unit 60 (outdoor control unit 61) controls the outdoor expansion valve 84 in the first control mode M1. If the valve unit 50 is included in the air conditioning system 10, the control unit 60 (isolation valve control unit 63 and/or flow path switching control unit 64) controls the first electric valve 52 or the fourth valve MV4 in the second control mode M2. In this case, the first control mode M1 or the second control mode M2 can be automatically selected by the control unit 60.

(7)In the air conditioning system 10 according to the present disclosure, if the third air conditioning system 13 including the valve unit 50 has a refrigerant leak in any of the indoor units 30, the fourth valve EV4 shuts off the supply of the refrigerant to the indoor unit 30. In this case, the fourth valve EV4 can be used as a control valve that adjusts the pressure of the refrigerant and as an isolation valve that shuts off the refrigerant. This air conditioning system 10 does not require a separate isolation valve, thereby allowing a reduction in manufacturing cost.

(8)In the air conditioning system 10 according to the present disclosure, the control unit 60 further includes the indoor control unit 62 that controls the operation of the indoor units 30, and the indoor units 30 each have the indoor control unit 62. When the indoor unit 30 and the outdoor unit 40 are connected to each other, information related to the outdoor unit 40 is written to the indoor control unit 62, and the indoor control unit 62 controls the indoor unit 30 on the basis of the information related to the outdoor unit 40. In this case, the control contents of the indoor units 30 can be automatically switched to those corresponding to the specifications of the outdoor unit 40 simply by connecting the indoor units 30 and the outdoor unit 40.

[0110] Note that the present disclosure is not limited to the above exemplification, but is defined by the claims, and is intended to include all modifications within the meaning and scope equivalent to those of the claims.

REFERENCE SIGNS LIST

[0111]

10	air conditioning system
11	first air conditioning system
12	second air conditioning system
13	third air conditioning system
14	fourth air conditioning system
20	air conditioner
30	indoor unit
40	outdoor unit
50	valve unit
51	isolation valve unit (valve unit)
52	first electric valve (second control valve)
55	refrigerant flow path switching unit (valve unit)
60	control unit
62	indoor control unit
84	outdoor expansion valve (first control valve)
110	first outdoor expansion valve (first control valve)
111	second outdoor expansion valve (first control valve)
EV4	fourth valve (second control valve)
RC1	refrigerant circuit
RC2	refrigerant circuit
M	control mode
M1	first control mode
M2	second control mode

Claims

1. An outdoor unit (40) provided in an air conditioning system (10) including a refrigerant circuit (RC1, RC2) that performs a refrigeration cycle and a plurality of indoor units (30) connected in parallel to the outdoor unit (40),

the outdoor unit (40) comprising: a first control valve (84,110,111) that adjusts a pressure of a refrigerant to be supplied to the indoor units (30); and a control unit (60) that controls the first control valve (84,110,111), wherein

if a valve unit (50) that is provided between the indoor units and the outdoor unit and that switches a flow of the refrigerant to the indoor units (30) is not included in the air conditioning system (10), the control unit (60) operates the air conditioning system (10) in a first control mode (M1) in which the pressure of the refrigerant to be supplied to the indoor units (30) is adjusted by

controlling the first control valve (84); and
if the valve unit (50) is included in the air conditioning system (10), the control unit (60) operates the air conditioning system (10) in a second control mode (M2) in which the pressure of the refrigerant to be supplied to the indoor units (30) is adjusted by controlling a second control valve (52, EV4) included in the valve unit (50).

2. An indoor unit (30) provided in an air conditioning system (10) including a refrigerant circuit (RC1, RC2) that performs a refrigeration cycle and an outdoor unit (40), a plurality of the indoor units (30) being connected in parallel to the outdoor unit (40),

the outdoor unit (40) including a first control valve (84,110,111) that adjusts a pressure of a refrigerant to be supplied to the indoor units (30),
the indoor units (30) each comprising a control unit (60) that controls the first control valve (84,110,111), wherein
if a valve unit (50) that is provided between the indoor units and the outdoor unit and that switches a flow of the refrigerant to the indoor units (30) is not included in the air conditioning system (10), the control unit (60) operates the air conditioning system (10) in a first control mode (M1) in which the pressure of the refrigerant to be supplied to the indoor units (30) is adjusted by controlling the first control valve (84); and
if the valve unit (50) is included in the air conditioning system (10), the control unit (60) operates the air conditioning system (10) in a second control mode (M2) in which the pressure of the refrigerant to be supplied to the indoor units (30) is adjusted by controlling a second control valve (52, MV4) included in the valve unit (50).

3. An air conditioning system (10) including a refrigerant circuit (RC1, RC2) that performs a refrigeration cycle, an outdoor unit (40), and a plurality of indoor units (30) connected in parallel to the outdoor unit (40),

the air conditioning system (10) comprising a control unit (60) that controls operation of the air conditioning system (10),
the outdoor unit (40) including a first control valve (84,110,111) that adjusts a pressure of a refrigerant to be supplied to the indoor units (30),
the air conditioning system (10) including: a first control mode (M1) in which, if a valve unit (50) that is provided between the indoor units and the outdoor unit and that switches a flow of the refrigerant to the indoor units (30) is not included in the air conditioning system (10), the pressure of the refrigerant to be supplied to the indoor units (30) is adjusted by controlling the first control valve (84,110,111); and
a second control mode (M2) in which, if the valve unit (50) is included in the air conditioning system (10), the pressure of the refrigerant to be supplied to the indoor units (30) is adjusted by controlling a second control valve (52, MV4) included in the valve unit (50).

4. The air conditioning system (10) according to claim 3, wherein the control unit (60)
automatically selects the second control mode (M2) if the valve unit (50) is included in the air conditioning system (10).

5. The air conditioning system (10) according to claim 3 or 4, further comprising selection means (37) for manually selecting the first control mode (M1) and the second control mode (M2).

6. The air conditioning system (10) according to claim 3, wherein if the valve unit (50) is not included in the air conditioning system (10), the control unit (60) controls the first control valve (84) in the first control mode (M1), and
if the valve unit (50) is included in the air conditioning system (10), the control unit (60) controls the second control valve (52, MV4) in the second control mode (M2).

7. The air conditioning system (10) according to any one of claims 3 to 6, wherein if the air conditioning system (13) including the valve unit (50) has a refrigerant leak in any of the indoor units (30), the second control valve (MV4) shuts off supply of the refrigerant to the indoor unit (30).

8. The air conditioning system (10) according to any one of claims 3 to 7, wherein

the control unit (60) includes an indoor control unit (62) that controls operation of the indoor units (30), the indoor units (30) each having the indoor control unit (62),
when the indoor unit (30) and the outdoor unit (40) are connected to each other, information related to the outdoor unit (40) is written to the indoor control unit (62), and
the indoor control unit (62) controls the indoor unit (30) on a basis of the information related to the outdoor unit (40).

FIG. 1A

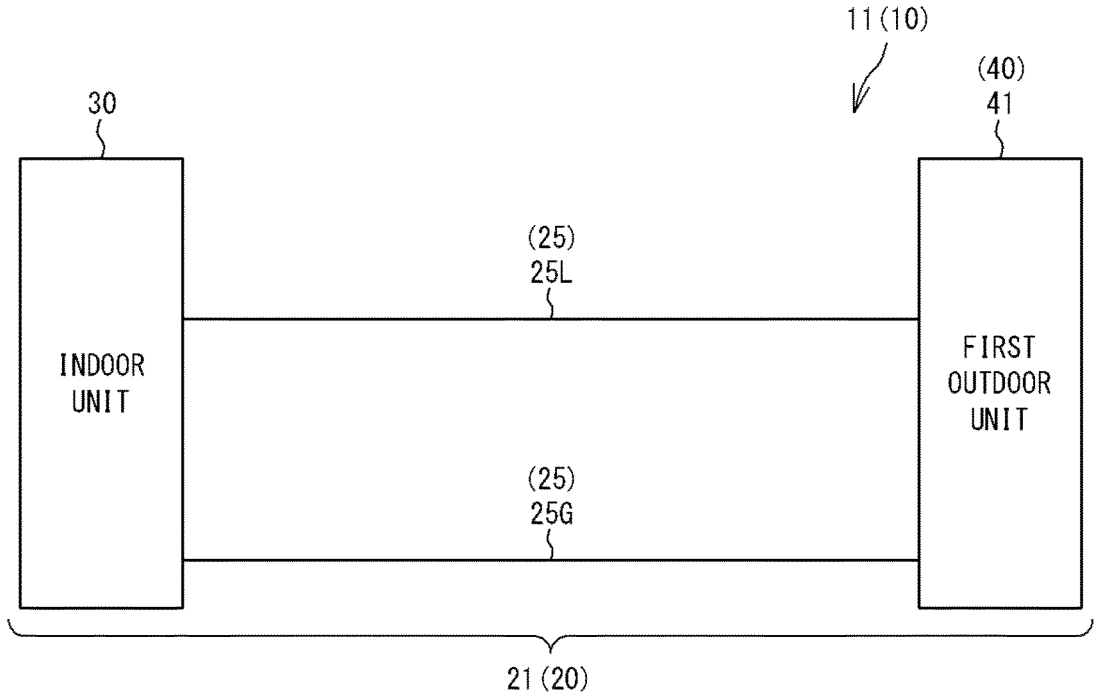

11(10)
(40)
41
30
(25)
25L
INDOOR
UNIT
FIRST
OUTDOOR
UNIT
(25)
25G
21(20)

FIG. 1B

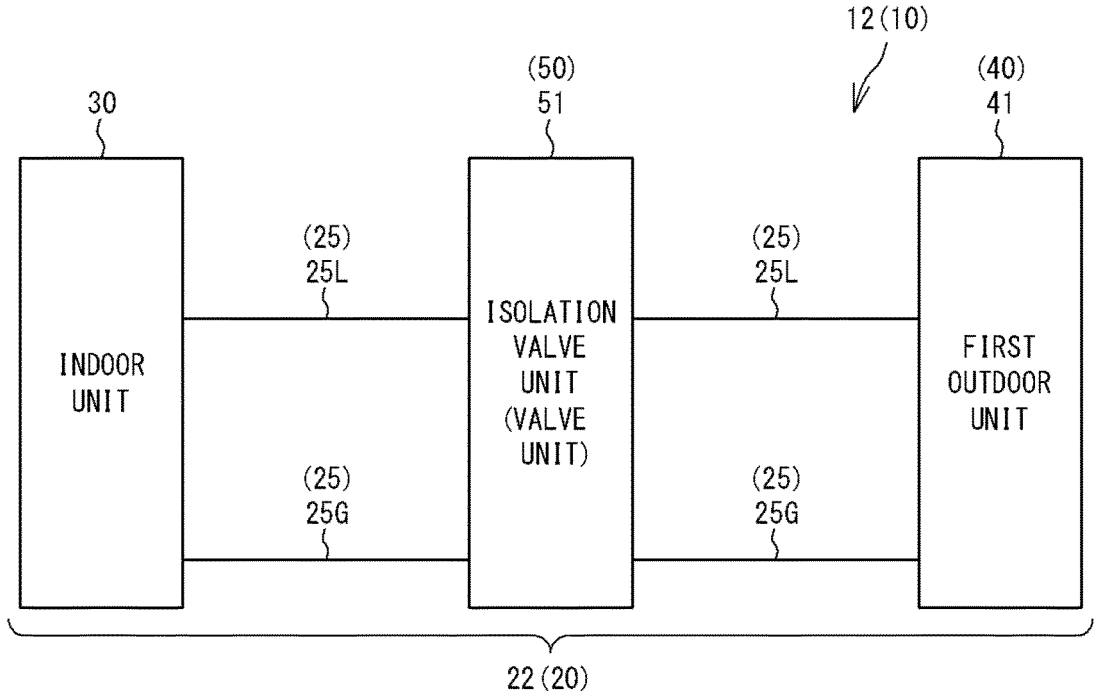

12(10)
(50)
51
(40)
41
30
(25)
25L
(25)
25L
INDOOR
UNIT
ISOLATION
VALVE
UNIT
(VALVE
UNIT)
FIRST
OUTDOOR
UNIT
(25)
25G
(25)
25G
22(20)

FIG. 2A

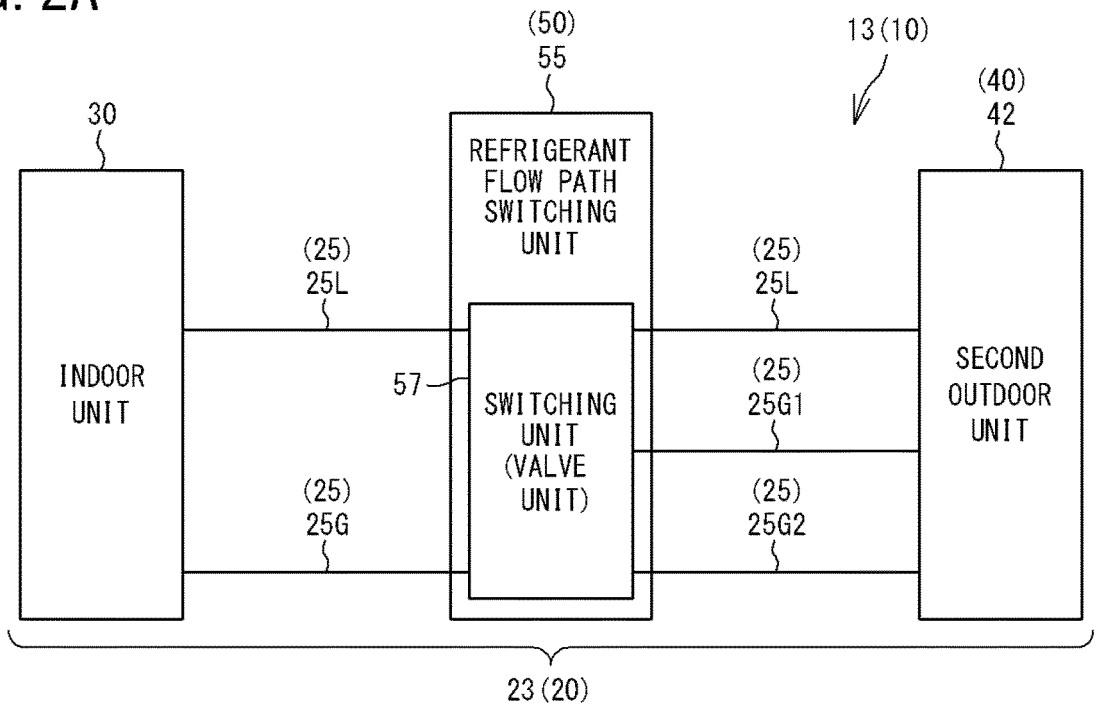
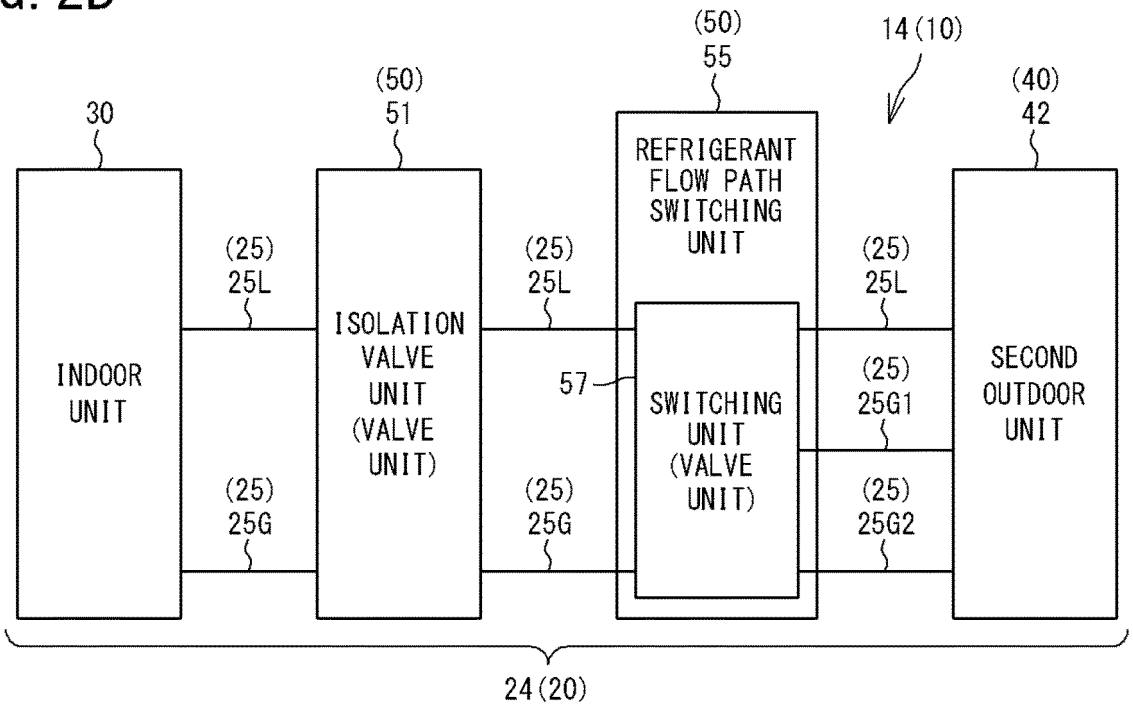

(50)
55
13(10)
(40)
42
30
REFRIGERANT
FLOW PATH
SWITCHING
UNIT
(25)
25L
(25)
25L
INDOOR
UNIT
57
SWITCHING
UNIT
(VALVE
UNIT)
(25)
25G1
SECOND
OUTDOOR
UNIT
(25)
25G
(25)
25G2
23(20)

FIG. 2B


(50)
55
14(10)
(50)
51
(40)
42
30
REFRIGERANT
FLOW PATH
SWITCHING
UNIT
(25)
25L
(25)
25L
(25)
25L
ISOLATION
VALVE
UNIT
(VALVE
UNIT)
INDOOR
UNIT
57
SWITCHING
UNIT
(VALVE
UNIT)
(25)
25G1
SECOND
OUTDOOR
UNIT
(25)
25G
(25)
25G
(25)
25G2
24(20)

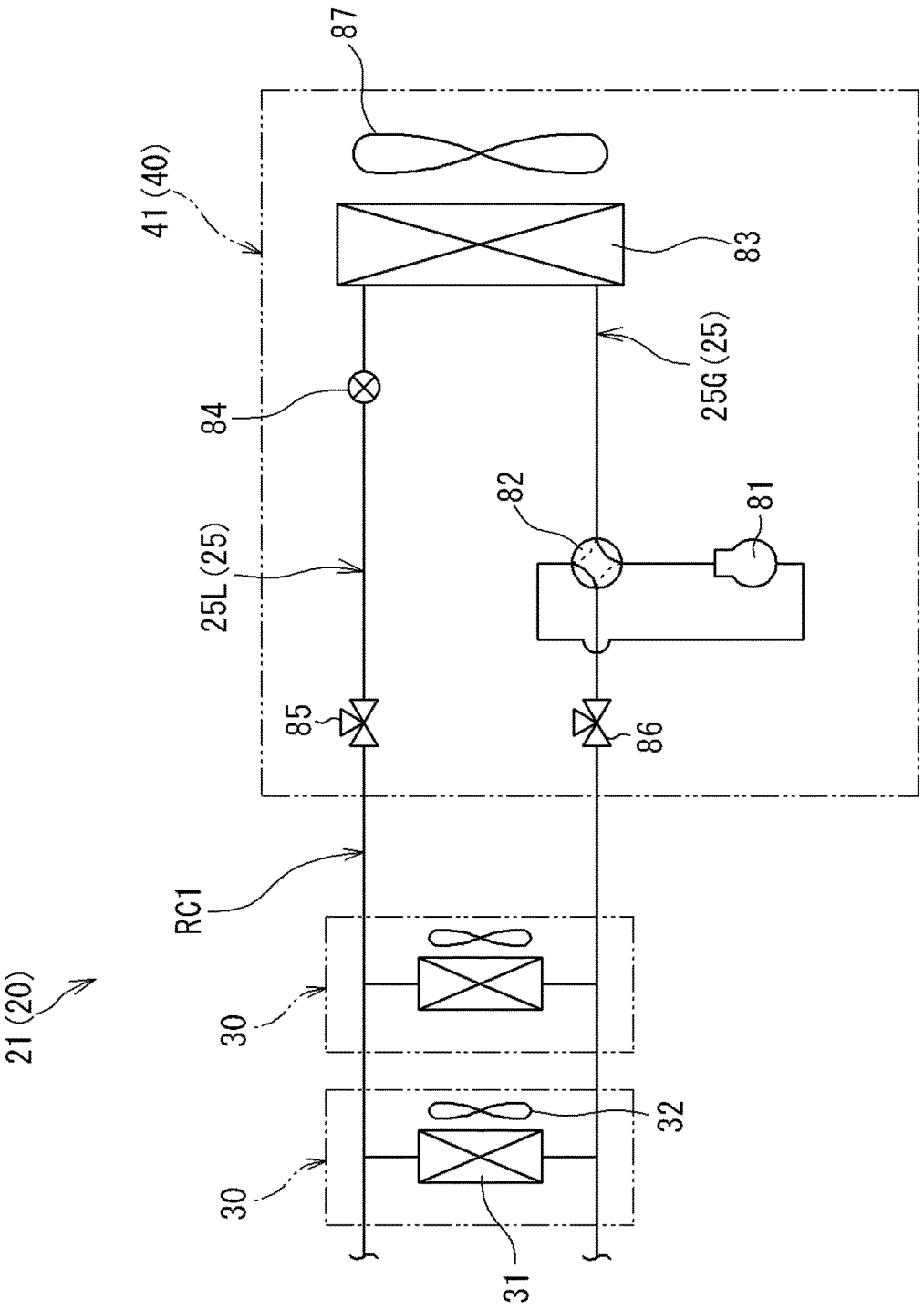


FIG. 3

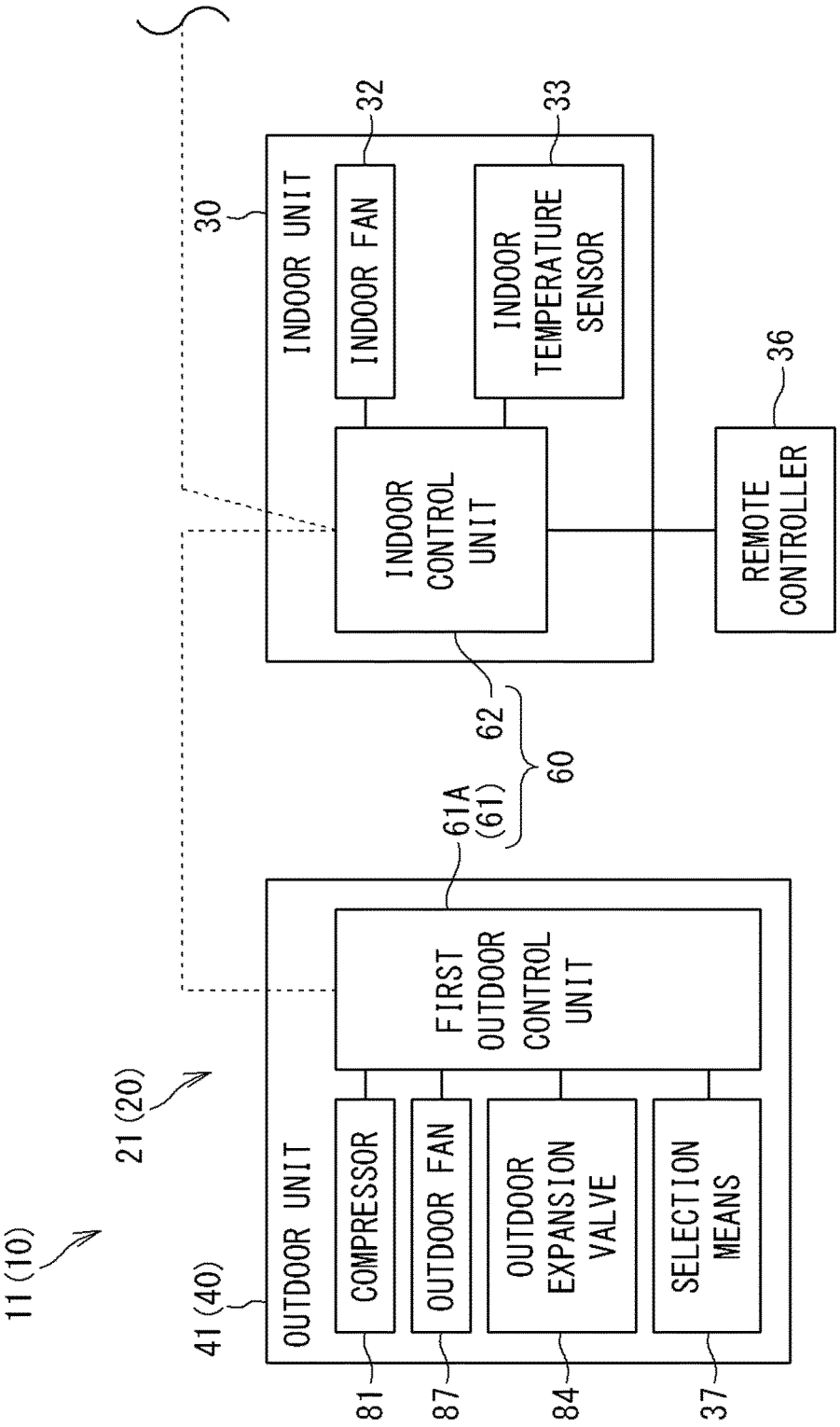

11 (10)
21 (20)
41 (40)
OUTDOOR UNIT
COMPRESSOR
OUTDOOR FAN
OUTDOOR EXPANSION VALVE
SELECTION MEANS
FIRST OUTDOOR CONTROL UNIT
61A (61)
60
62
INDOOR UNIT
30
INDOOR FAN
32
INDOOR TEMPERATURE SENSOR
33
INDOOR CONTROL UNIT
REMOTE CONTROLLER
36
81
87
84
37

FIG. 4

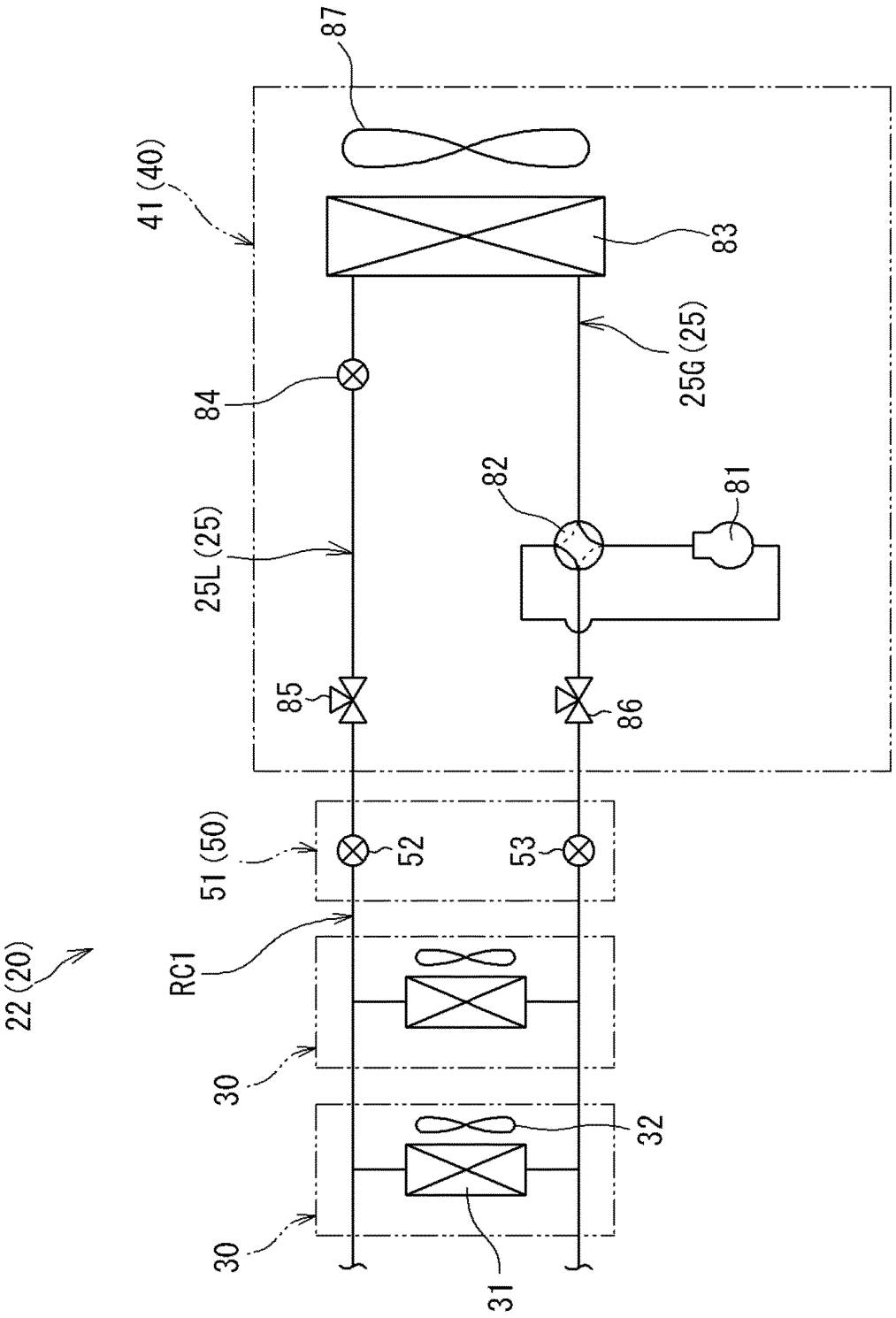

87
41 (40)
83
25G (25)
84
82
81
25L (25)
85
86
51 (50)
52
53
RC1
22 (20)
30
32
30
31

FIG. 5

FIG. 6

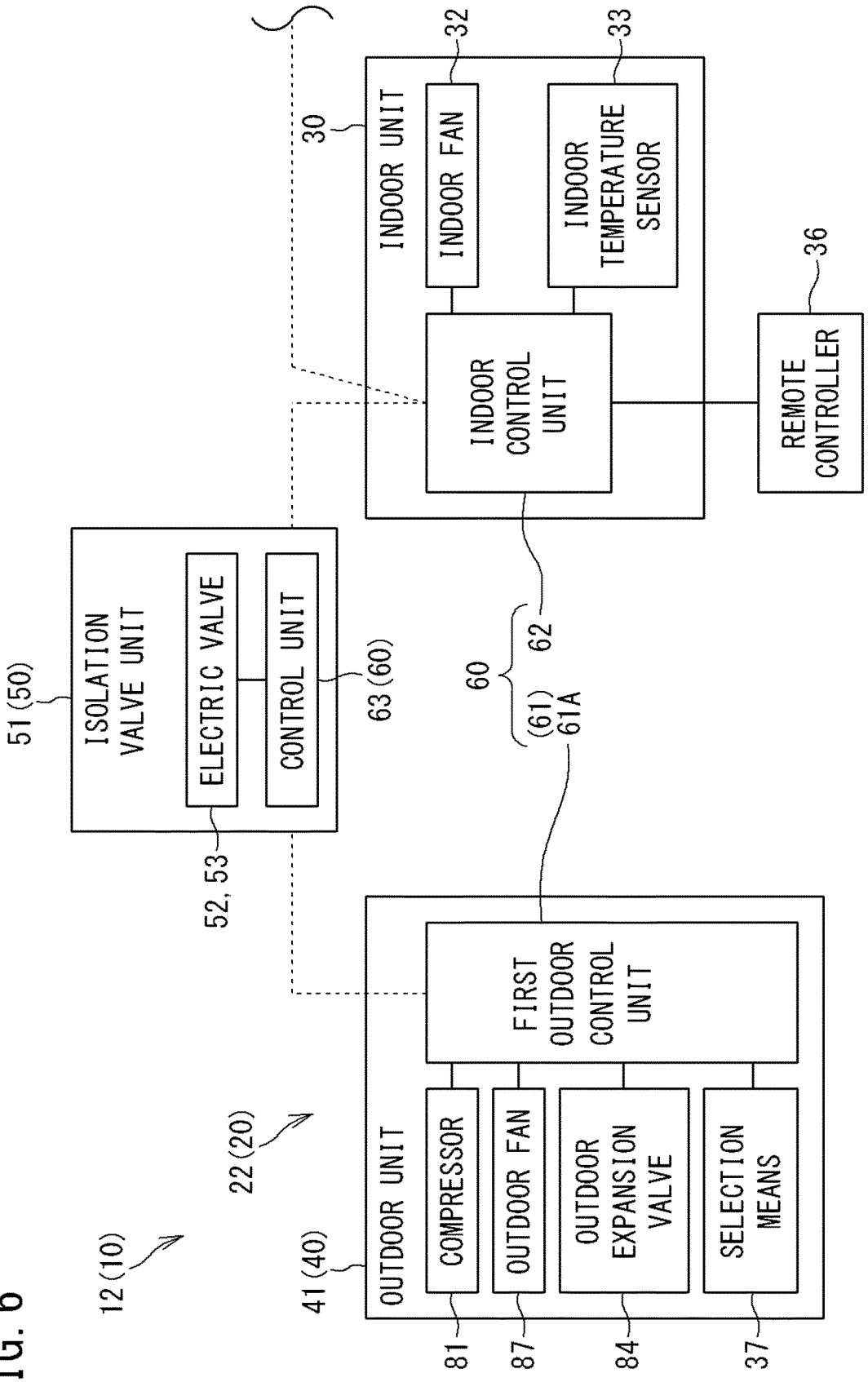

12 (10)
22 (20)
41 (40)
OUTDOOR UNIT
COMPRESSOR
OUTDOOR FAN
OUTDOOR EXPANSION VALVE
SELECTION MEANS
FIRST OUTDOOR CONTROL UNIT
81
87
84
37
52, 53
ELECTRIC VALVE
CONTROL UNIT
ISOLATION VALVE UNIT
51 (50)
63 (60)
60
(61) 61A
62
30
INDOOR UNIT
INDOOR FAN
INDOOR TEMPERATURE SENSOR
INDOOR CONTROL UNIT
32
33
36
REMOTE CONTROLLER

FIG. 7

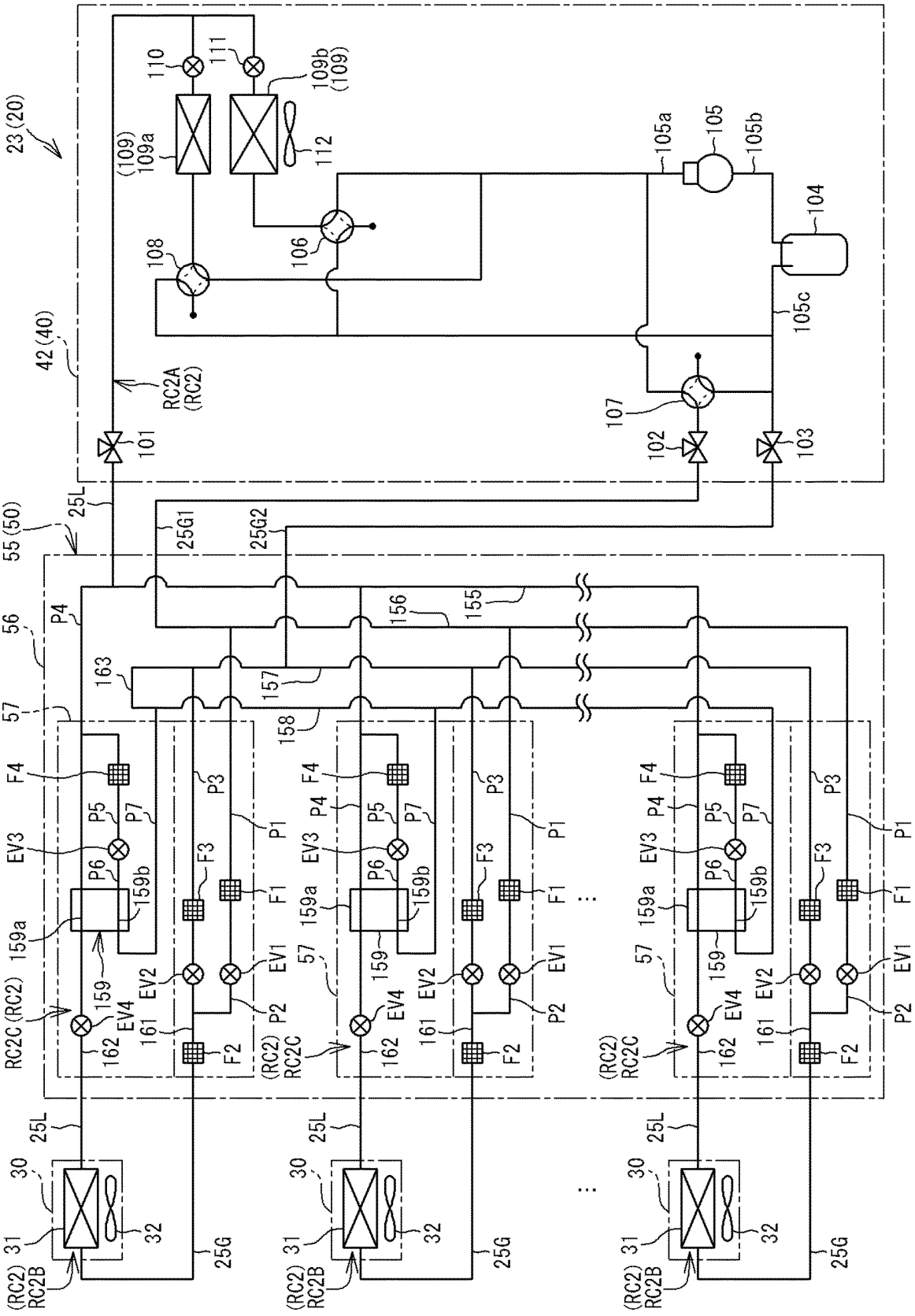

23 (20)
110
111
109b (109)
(109) 109a
112
105a
105
105b
104
108
106
105c
42 (40)
RC2A (RC2)
107
101
102
103
25L
55 (50)
25G1
25G2
56
P4
155
156
163
157
57
158
F4
P3
P5
P7
EV3
P6
159b
F3
P1
159a
F1
159
EV2
EV1
RC2C (RC2)
EV4
161
P2
162
F2
(RC2) RC2C
30
31
32
25G
(RC2) RC2B

FIG. 8

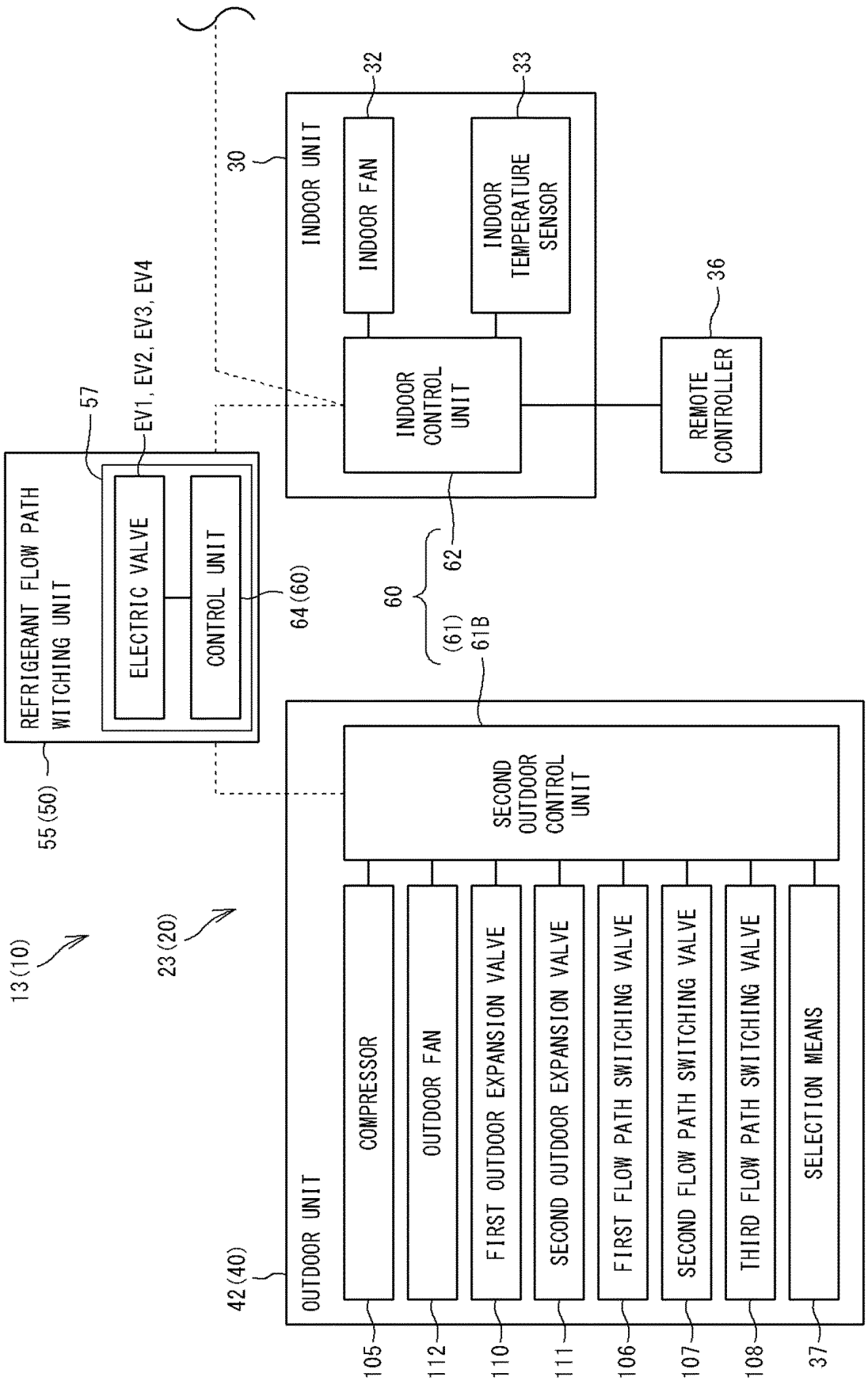

13 (10)
23 (20)
55 (50)
REFRIGERANT FLOW PATH WITCHING UNIT
57
EV1, EV2, EV3, EV4
ELECTRIC VALVE
CONTROL UNIT
64 (60)
30
INDOOR UNIT
32
INDOOR FAN
33
INDOOR TEMPERATURE SENSOR
INDOOR CONTROL UNIT
36
REMOTE CONTROLLER
60
62
(61)
61B
SECOND OUTDOOR CONTROL UNIT
42 (40)
OUTDOOR UNIT
COMPRESSOR
OUTDOOR FAN
FIRST OUTDOOR EXPANSION VALVE
SECOND OUTDOOR EXPANSION VALVE
FIRST FLOW PATH SWITCHING VALVE
SECOND FLOW PATH SWITCHING VALVE
THIRD FLOW PATH SWITCHING VALVE
SELECTION MEANS
105
112
110
111
106
107
108
37

FIG. 9

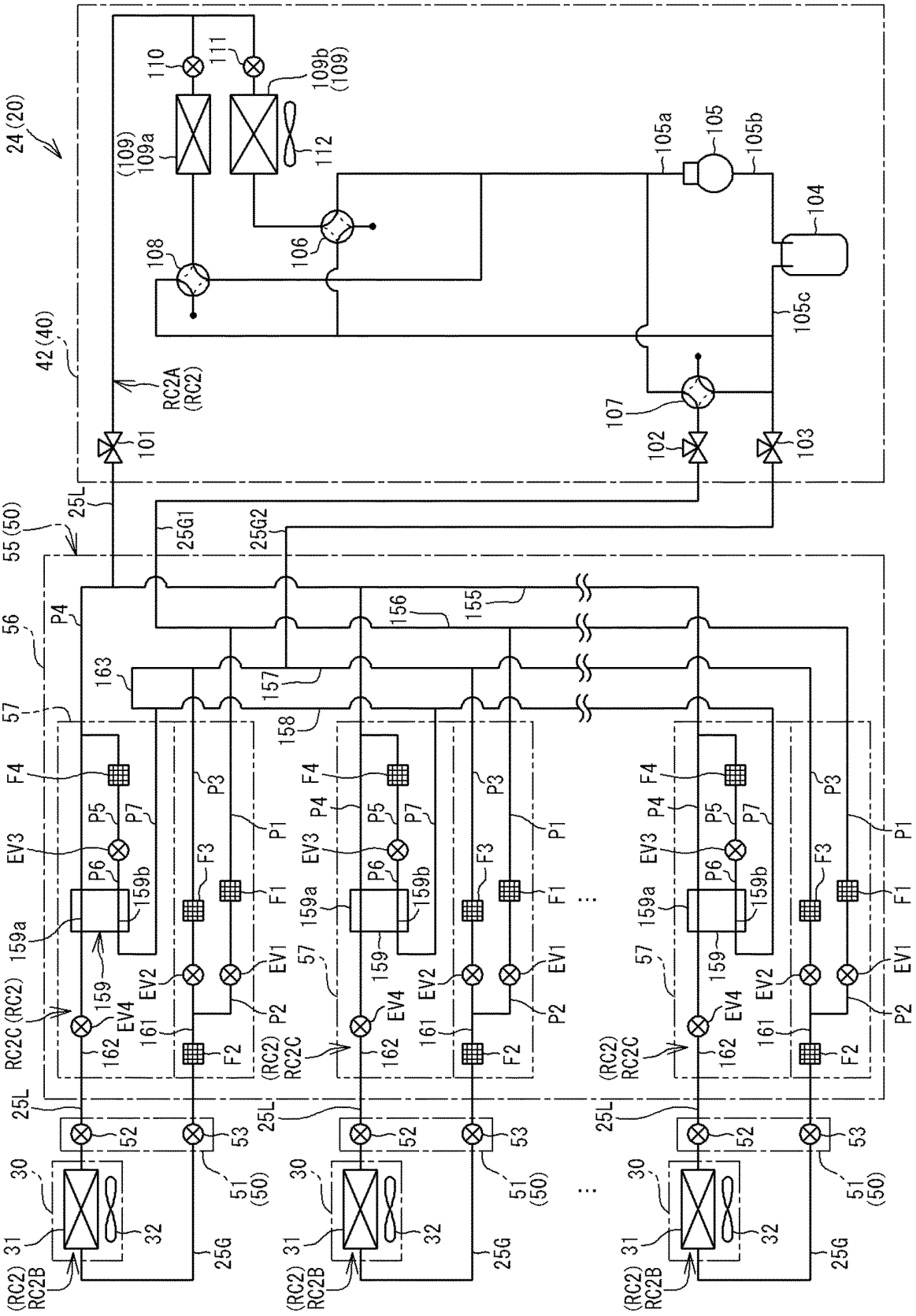

24 (20)
110
111
109b (109)
(109) 109a
112
105a
105
105b
104
108
106
105c
42 (40)
RC2A (RC2)
107
101
102
103
55 (50)
25L
25G1
25G2
56
P4
155
156
163
157
57
158
F4
P5
P7
P3
EV3
P6
159b
F3
P1
159a
F1
159
EV2
EV1
RC2C (RC2)
EV4
161
P2
162
F2
(RC2) RC2C
52
53
30
51 (50)
31
32
25G
(RC2) RC2B

FIG. 10

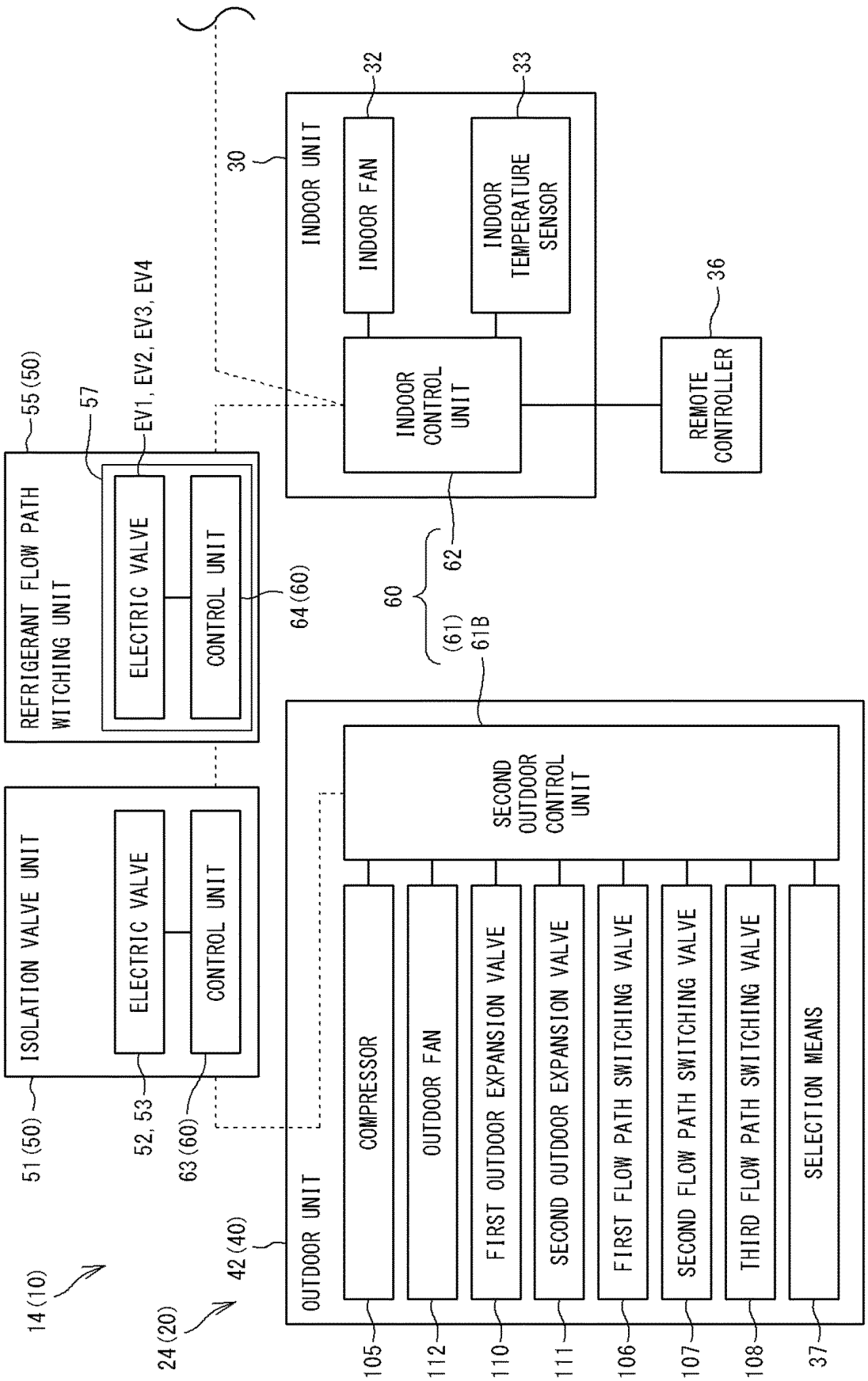
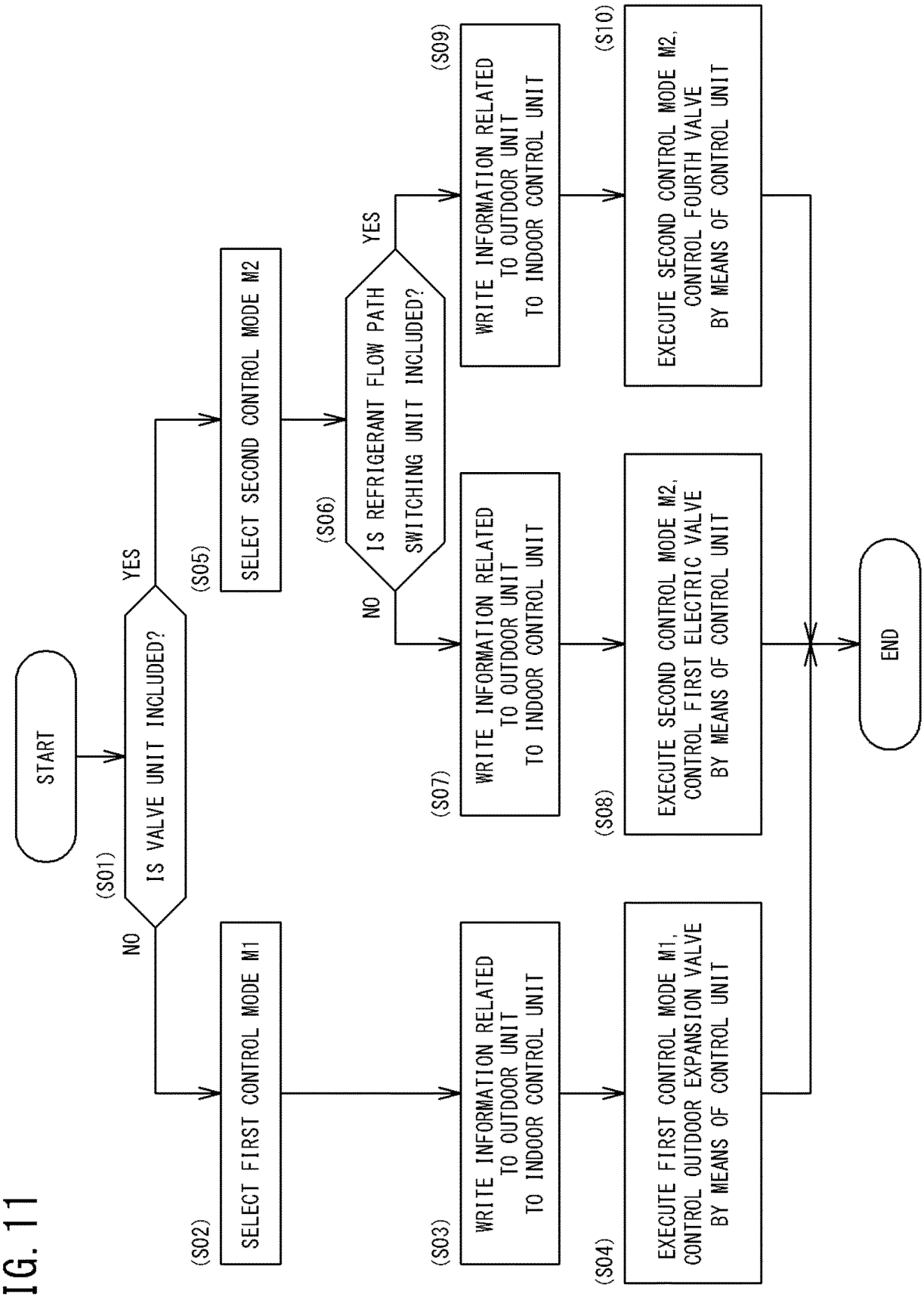

14 (10)
24 (20)
42 (40)
OUTDOOR UNIT
105
COMPRESSOR
112
OUTDOOR FAN
110
FIRST OUTDOOR EXPANSION VALVE
111
SECOND OUTDOOR EXPANSION VALVE
106
FIRST FLOW PATH SWITCHING VALVE
107
SECOND FLOW PATH SWITCHING VALVE
108
THIRD FLOW PATH SWITCHING VALVE
37
SELECTION MEANS
SECOND OUTDOOR CONTROL UNIT
61B
60
(61)
62
INDOOR UNIT
30
INDOOR FAN
32
INDOOR TEMPERATURE SENSOR
33
INDOOR CONTROL UNIT
REMOTE CONTROLLER
36
REFRIGERANT FLOW PATH WITCHING UNIT
55 (50)
57
EV1, EV2, EV3, EV4
ELECTRIC VALVE
CONTROL UNIT
64 (60)
ISOLATION VALVE UNIT
ELECTRIC VALVE
CONTROL UNIT
51 (50)
52, 53
63 (60)

FIG. 11


START
(S01)
IS VALVE UNIT INCLUDED?
YES
NO
(S02)
SELECT FIRST CONTROL MODE M1
(S03)
WRITE INFORMATION RELATED TO OUTDOOR UNIT TO INDOOR CONTROL UNIT
(S04)
EXECUTE FIRST CONTROL MODE M1, CONTROL OUTDOOR EXPANSION VALVE BY MEANS OF CONTROL UNIT
(S05)
SELECT SECOND CONTROL MODE M2
(S06)
IS REFRIGERANT FLOW PATH SWITCHING UNIT INCLUDED?
YES
NO
(S07)
WRITE INFORMATION RELATED TO OUTDOOR UNIT TO INDOOR CONTROL UNIT
(S08)
EXECUTE SECOND CONTROL MODE M2, CONTROL FIRST ELECTRIC VALVE BY MEANS OF CONTROL UNIT
(S09)
WRITE INFORMATION RELATED TO OUTDOOR UNIT TO INDOOR CONTROL UNIT
(S10)
EXECUTE SECOND CONTROL MODE M2, CONTROL FOURTH VALVE BY MEANS OF CONTROL UNIT
END

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2022/023628

A. CLASSIFICATION OF SUBJECT MATTER

F24F 11/65(2018.01)i; ***F24F 11/36***(2018.01)i
FI: F24F11/65; F24F11/36

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F11/65; F24F11/36

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2022
Registered utility model specifications of Japan 1996-2022
Published registered utility model applications of Japan 1994-2022

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 6-123512 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.) 06 May 1994 (1994-05-06) paragraphs [0014]-[0028], fig. 1-3	1-6
Y		7-8
Y	JP 2018-115780 A (DAIKIN INDUSTRIES, LTD.) 26 July 2018 (2018-07-26) paragraphs [0071]-[0077], fig. 4	7-8
Y	JP 2001-174033 A (MATSUSHITA REFRIGERATION CO.) 29 June 2001 (2001-06-29) paragraphs [0005]-[0008], fig. 21	8
A	JP 2008-116085 A (MITSUBISHI HEAVY INDUSTRIES, LTD.) 22 May 2008 (2008-05-22) entire text, all drawings	1-8

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 August 2022	**30 August 2022**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2022/023628

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 6-123512 A	06 May 1994	(Family: none)	
JP 2018-115780 A	26 July 2018	(Family: none)	
JP 2001-174033 A	29 June 2001	(Family: none)	
JP 2008-116085 A	22 May 2008	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2019064566 A **[0003]**