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(54) HEAT RECOVERY-TYPE REFRIGERATION DEVICE

(57) A heat recovery refrigeration device (1) includes a compressor (21), a plurality of heat source side heat exchangers (24, 25), and a plurality of usage side heat exchangers (52a, 52b, 52c, 52d), and is able to perform heat recovery between the usage side heat exchangers by sending refrigerant from the usage side heat exchanger which functions as a radiator for refrigerant to the usage side heat exchanger which functions as an evaporator for refrigerant. Then, the plurality of heat source side heat exchangers (24, 25) have a first heat source side heat exchanger (24) and a second heat source side heat exchanger (25) which has a heat exchange capacity which is 1.8 times to 4.0 times of the first heat source side heat exchanger (24).

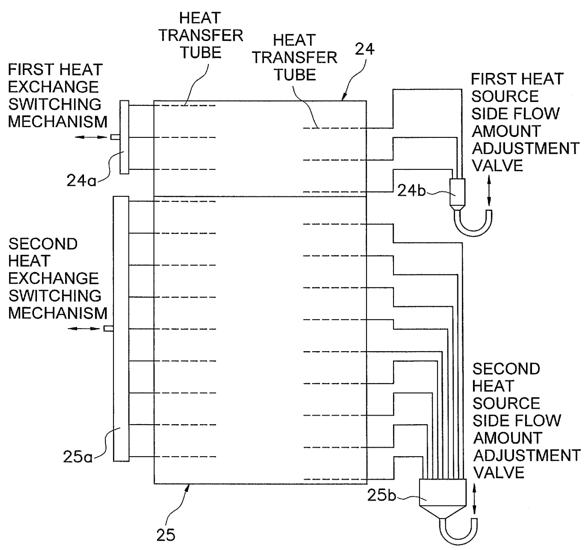

FIG. 3

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Description

TECHNICAL FIELD

[0001] The present invention relates to a heat recovery refrigeration device and particularly relates to a heat recovery refrigeration device which includes a compressor, a plurality of heat source side heat exchangers, and a plurality of usage side heat exchangers and which is able to perform heat recovery between the usage side heat exchangers by sending refrigerant from the usage side heat exchanger which functions as a radiator for refrigerant to the usage side heat exchanger which functions as an evaporator for refrigerant.

BACKGROUND ART

[0002] There is a simultaneous air cooling and air heating operation air conditioner device in the background art which is one type of heat recovery refrigeration device with a configuration which includes a compressor, two outdoor heat exchangers which are heat source side heat exchangers, and a plurality of indoor heat exchangers which are usage side heat exchangers as shown in Patent Literature 1 (Japanese Laid-open Patent Application Publication No. H5-332637). In this heat recovery refrigeration device, switching is possible so that each of the usage side heat exchangers individually functions as an evaporator or a radiator for refrigerant and it is possible to perform heat recovery (here, perform a simultaneous air cooling and air heating operation where an air cooling operation and an air heating operation are performed simultaneously) between the usage side heat exchangers by sending refrigerant from the usage side heat exchanger which functions as a radiator for refrigerant to the usage side heat exchanger which functions as an evaporator for refrigerant. Moreover, in this heat recovery refrigeration device, switching is possible so that the two heat source side heat exchangers individually function as an evaporator or a radiator for refrigerant and it is possible to perform switching with the two heat source side heat exchangers functioning as an evaporator or a radiator for refrigerant according to the heat load (evaporator load and radiator load) over all of the plurality of the usage side heat exchangers where heat recovery described above is also taken in consideration.

SUMMARY OF THE INVENTION

[0003] Here, in the heat recovery refrigeration device in the background art described above, since the heat load over all of the plurality of the usage side heat exchangers is reduced in a case where heat recovery is performed between the usage side heat exchangers, it is necessary for it to be possible to reduce the heat load over all of the two heat source side heat exchangers provide a countermeasure to this.

[0004] With regard to this, two heat source side heat exchangers where the heat exchange capacities are different (here 3.5 horsepower and 5.0 horsepower) are adopted in the heat recovery refrigeration device in the background art described above. Then, both of the two heat source side heat exchangers function as evaporators or radiators for refrigerant in a case where the heat load over all of the plurality of the usage side heat exchangers is large, and only the heat source side heat exchanger where the heat exchange capacity is small functions as an evaporator or a radiator for refrigerant in a case where the heat load over all of the plurality of the usage side heat exchangers is small.

[0005] However, in the two heat source side heat exchangers in the background art described above, there is a limit to the extent to which it is possible to reduce the heat load even if only the heat source side heat exchanger where the heat exchange capacity is small functions as an evaporator or a radiator for refrigerant since the ratio of heat exchange capacities of the two heat source side heat exchangers is small (the heat source side heat exchanger where the heat exchange capacity is large is approximately 1.4 times of the heat source side heat exchanger where the heat exchange capacity is small). For this reason, it is difficult to provide a countermeasure in the heat recovery refrigeration device in the background art described above for a case where the heat load over all of the plurality of usage side heat exchangers is small even when only the heat source side heat exchanger where the heat exchange capacity is small functions as an evaporator or a radiator for refrigerant.

[0006] With regard to this, it is thought that a countermeasure could be provided in the heat recovery refrigeration device in the background art described above for a case where the heat load over all of the plurality of usage side heat exchangers is small by reducing the heat load over all of the two heat source side heat exchangers due to one out of the two heat source side heat exchangers functioning as an evaporator for refrigerant and the other out of the two heat source side heat exchangers functioning as a radiator for refrigerant, and the evaporator load and the radiator load of the heat exchangers cancelling each other out.

[0007] However, since the flow amount of refrigerant which flows through the two heat source side heat exchangers is increased in the countermeasure described above where the evaporator load and the radiator load of the two heat source side heat exchangers cancel each other out, it is necessary for the operation capacity of the compressor to be increased in accompaniment with this and consequently there is a concern that the operation performance will be reduced in a case where the heat load over all of the plurality of usage side heat exchangers is small.

[0008] The object of the present invention is a heat recovery refrigeration device which includes a compressor, a plurality of heat source side heat exchangers, and a plurality of usage side heat exchangers and which is able to perform heat recovery between the usage side heat exchangers wherein it is possible to provide a countermeasure for a case where the heat load over all of the plurality of usage side heat exchangers is small while suppressing reductions in operation performance.

[0009] A heat recovery refrigeration device according to a first aspect includes a compressor, a plurality of heat source side heat exchangers which are able to switch between individually functioning as an evaporator or a radiator for refrigerant, and a plurality of usage side heat exchangers which are able to switch between individually functioning as an evaporator or a radiator for refrigerant, and which is able to perform heat recovery between the usage side heat exchangers by sending refrigerant from the usage side heat exchanger which functions as a radiator for refrigerant to the usage side heat exchanger which functions as an evaporator for refrigerant. Then, the plurality of heat source side heat exchangers have a first heat source side heat exchanger and a second heat source side heat exchanger which has a heat exchange capacity which is 1.8 times to 4.0 times of the first heat source side heat exchanger.

[0010] Here, firstly, the heat exchange capacity of the second heat source side heat exchanger is equal to or more than 1.8 times of the first heat source side heat exchanger as described above. For this reason, it is possible to widen the range over which it is possible to reduce the heat load in a case where only the first heat source side heat exchanger where the heat exchange capacity is small functions as an evaporator or a radiator for refrigerant. Due to this, it is possible to provide a countermeasure for a case where the heat load over all of the plurality of usage side heat exchangers is small. Moreover, here, the heat exchange capacity of the second heat source side heat exchanger is equal to or less than 4.0 times of the first heat source side heat exchanger as described above. For this reason, it is possible for the flow amount of refrigerant which flows through the two heat source side heat exchangers as well as the operation capacity of the compressor to not become large in a case of performing the countermeasure where one out of the two heat source side heat exchangers functions as an evaporator for refrigerant and the other out of the two heat source side heat exchangers functions as a radiator for refrigerant, and the evaporator load and the radiator load of the two heat source side heat exchangers cancel each other out. Due to this, it is possible to provide a countermeasure for a case where the heat load over all of the plurality of usage side heat exchangers is small while suppressing reductions in operation performance.

[0011] Here, in this manner, it is possible to provide a countermeasure for a case where the heat load over all of the plurality of usage side heat exchangers is small while suppressing reductions in operation performance.

[0012] A heat recovery refrigeration device according to a second aspect is the heat recovery refrigeration device according to the first aspect wherein the first heat source side heat exchanger is arranged more to the upper side than the second heat source side heat exchanger.

[0013] Here, firstly, the two heat source side heat exchangers are arranged to be above and below each other as described above. At this time, there is a tendency for it to be easy for liquid refrigerant to stagnate due to the head difference between the two heat source side heat exchangers in the heat source side heat exchanger which is arranged on the lower side compared to the heat source side heat exchanger which is arranged on the upper side. For this reason, when assuming that the first heat source side heat exchanger is arranged at the lower side, there is a concern that the desired heat exchange performance will not be obtained due to a state being generated where all of the first heat source side heat exchanger is filled with liquid refrigerant (set below as "liquid sink") since the heat exchange capacity is small.

[0014] Therefore, here, the first heat source side heat exchanger where the heat exchange capacity is small is arranged more to the upper side than the second heat source side heat exchanger where the heat exchange capacity is large as described above. For this reason, the second heat source side heat exchanger where the heat exchange capacity is large is arranged on the lower side and it is possible for it to be difficult for liquid sink to be generated. Due to this, it is possible for a desired heat exchange performance to be exhibited in both of the heat exchange side heat exchangers in a case where the two heat source side heat exchangers are arranged to be above and below each other.

[0015] A heat recovery refrigeration device according to a third aspect is the heat recovery refrigeration device according to the first or second aspect wherein a first heat source side flow amount adjustment valve, where adjustment to its opening is possible, is connected with the liquid side of the first heat source side heat exchanger, and a second heat source side flow amount adjustment valve, where adjustment to its opening is possible, is connected with the liquid side of the second heat source side heat exchanger. Then, the rated Cv value of the second heat source side flow amount adjustment valve is larger than the Cv value of the first heat source side flow amount adjustment valve.

[0016] Here, in regard to connecting the heat source side flow amount adjustment valves with the liquid side of each of heat source side heat exchangers, the second heat source side flow amount adjustment valve is used so that the rated Cv value is larger than the first heat source side flow amount adjustment valve. Due to this, it is possible to appropriately adjust the flow amount of refrigerant which flows through each of the heat source side heat exchangers according to the heat exchange capacities of each of the heat source side heat exchangers.

[0017] A heat recovery refrigeration device according to a fourth aspect is the heat recovery refrigeration device according to any of the first to third aspects wherein a first header, which is for performing merging and branching of refrigerant between a plurality of heat transfer tubes which configure the first heat source side heat exchanger, is provided on the gas side of the first heat source side heat exchanger, and a second header, which is for performing merging and branching of refrigerant between a plurality of heat transfer tubes which configure the second heat source side heat exchanger, is provided on the gas side of the second heat source side heat exchanger. Then, the flow path cross sectional area of the second header is larger than the flow path cross sectional area of the first header.

[0018] Here, in regard to providing the heads on the gas side of each of the heat source side heat exchangers, the second header is used so that the flow path cross sectional area is larger than the first header as described above. Due to this, it is possible to appropriately perform merging and branching of refrigerant between the plurality of heat transfer tubes which configure each of the heat source side heat exchangers and the headers according to the heat exchange capacities of each of the heat source side heat exchangers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

Fig. 1 is an outline configuration diagram of a simultaneous air cooling and air heating operation air conditioner device as an embodiment of a heat recovery refrigeration device according to the present invention.
Fig. 2 is a diagram illustrating an internal configuration of an outline of a heat source unit which configures the simultaneous air cooling and air heating operation air conditioner device.
Fig. 3 is a diagram schematically illustrating the configuration of heat source side heat exchangers.
Fig. 4 is a diagram illustrating actions (flow of refrigerant) in an air cooling operation mode (where the evaporator load is large) in the simultaneous air cooling and air heating operation air conditioner device.
Fig. 5 is a diagram illustrating actions (flow of refrigerant) in an air cooling operation mode (where the evaporator load is small) in the simultaneous air cooling and air heating operation air conditioner device.
Fig. 6 is a diagram illustrating actions (flow of refrigerant) in an air heating operation mode (where the radiator load is large) in the simultaneous air cooling and air heating operation air conditioner device.
Fig. 7 is a diagram illustrating actions (flow of refrigerant) in an air heating operation mode (where the radiator load is small) in the simultaneous air cooling and air heating operation air conditioner device.
Fig. 8 is a diagram illustrating actions (flow of refrigerant) in a simultaneous air cooling and air heating operation mode (where the evaporator load is dominant) in the simultaneous air cooling and air heating operation air conditioner device.
Fig. 9 is a diagram illustrating actions (flow of refrigerant) in a simultaneous air cooling and air heating operation mode (where the radiator load is dominant) in the simultaneous air cooling and air heating operation air conditioner device.
Fig. 10 is a diagram illustrating actions (flow of refrigerant) in a simultaneous air cooling and air heating operation mode (with a balance between the evaporator and radiator loads) in the simultaneous air cooling and air heating operation air conditioner device.

DESCRIPTION OF EMBODIMENTS

[0020] An embodiment of a heat recovery refrigerant device according to the present invention will be described below based on the drawings. Here, the specific configuration of the heat recovery refrigeration device according to the present invention is not limited to the embodiment or the modified examples described below and modifications are possible within a scope which does not depart from the gist of the invention.

(1) Configuration of Heat Recovery Refrigerant Device (Simultaneous Air Cooling and Air Heating Operation Air Conditioner Device)

[0021] Fig. 1 is an outline configuration diagram of a simultaneous air cooling and air heating operation air conditioner device 1 as an embodiment of the heat recovery refrigeration device according to the present invention. Fig. 2 is a diagram illustrating an internal configuration of an outline of a heat source unit 2 which configures the simultaneous air cooling and air heating operation air conditioner device 1. Fig. 3 is a diagram schematically illustrating the configuration of heat source side heat exchangers 24 and 25. The simultaneous air cooling and air heating operation air conditioner device 1 is a device which is used indoors in air cooling and air heating such as in buildings by performing a vapor compression type of refrigeration cycle operation.

[0022] The simultaneous air cooling and air heating operation air conditioner device 1 mainly has one heat source unit 2, a plurality (here, four) usage units 3a, 3b, 3c, and 3d, connecting units 4a, 4b, 4c, and 4d which are connected with each of the usage units 3a, 3b, 3c, and 3d, and refrigerant communication pipes 7, 8, and 9 which connect the heat source unit 2 and the usage units 3a, 3b, 3c, and 3d via the connecting units 4a, 4b, 4c, and 4d. That is, a vapor compression type of refrigerant circuit 10 in the simultaneous air cooling and air heating operation air conditioner device 1 is configured by connecting the heat source unit 2, the usage units 3a, 3b, 3c, and 3d, the connecting units 4a, 4b, 4c, and 4d, and the refrigerant communication pipes 7, 8, and 9. Then, the simultaneous air cooling and air heating operation air conditioner device 1 is configured so that it is possible for each of the usage units 3a, 3b, 3c, and 3d to individually perform an air cooling operation or an air heating operation and so that it is possible to perform heat recovery (here, perform a simultaneous air cooling and air heating operation where an air cooling operation and an air heating operation are performed simultaneously) between the usage units by sending refrigerant from the usage unit which performs an air heating operation to the usage unit which performs an air cooling operation. Moreover, the simultaneous air cooling and air heating operation air conditioner device 1 is configured so that the heat load of the heat source unit 2 is balanced according to the heat load over all of the plurality of usage units 3a, 3b, 3c, and 3d where heat recovery described above (a simultaneous air cooling and air heating operation) is also taken in consideration.

<Usage Units>

[0023] The usage units 3a, 3b, 3c, and 3d are arranged indoors such as in a building by being built into or hang down from the ceiling or the like or hang from an internal wall surface or the like. The usage units 3a, 3b, 3c, and 3d are connected with the heat source unit 2 via the refrigerant communication pipes 7, 8, and 9 and the connecting units 4a, 4b, 4c, and 4d and configure a portion of the refrigerant circuit 10.

[0024] Next, the configuration of the usage units 3a, 3b, 3c, and 3d will be described. Here, since the usage unit 3a and the usage units 3b, 3c, and 3d have the same configuration, only the configuration of the usage unit 3a will be described here and the subscripts "b", "c", and "d" are respectively added instead of the subscript "a" in the reference numerals, which indicate each section of the usage unit 3a, to the configurations of the usage units 3b, 3c, and 3d and the description of each section is omitted.

[0025] The usage unit 3 a mainly configures a portion of the refrigerant circuit 10 and has a usage side refrigerant circuit 13a (there are usage side refrigerant circuits 13b, 13c, and 13d respectively in each of the usage units 3b, 3c, and 3d). The usage side refrigerant circuit 13a mainly has a usage side flow amount adjustment valve 51a and a usage side heat exchanger 52a.

[0026] The usage side flow amount adjustment valve 51a is an electric expansion valve where adjustment to its opening is possible and which is connected with the liquid side of the usage side heat exchanger 52a in order to perform adjustment of the flow amount of refrigerant which flows through the usage side heat exchanger 52a and the like.

[0027] The usage side heat exchanger 52a is a device for performing heat exchange between refrigerant and indoor air and consists of, for example, a fin and tube type of heat exchanger which is configured using a plurality of heat transfer tubes and fins. Here, the usage unit 3a has an indoor fan 53a for suctioning indoor air into the inside of the unit and supplying the indoor air indoors as supply air after heat exchange is carried out, and heat exchange between indoor air and refrigerant which flows through the usage side heat exchanger 52a is possible. The indoor fan 53a is driven using an indoor fan motor 54a.

[0028] In addition, the usage unit 3a has a usage side control section 50a which controls the actions of each of the sections 51a and 54a which configure the usage unit 53a. Then, the usage side control section 50a has a microcomputer and a memory which are provided in order to perform control of the usage unit 3a, and it is possible to perform transfer of control signals and the like with a remote controller (which is not shown in the diagrams) and to perform transfer of control signals and the like with the heat source unit 2.

<Heat Source Unit>

[0029] The heat source unit 2 is arranged on the roof of a building or the like, is connected with the usage units 3a, 3b, 3c, and 3d via the refrigerant communication pipes 7, 8, and 9, and configures the refrigerant circuit 10 along with the usage units 3a, 3b, 3c, and 3d.

[0030] Next, the configuration of the heat source unit 2 will be described. The heat source unit 2 mainly configures a portion of the refrigerant circuit 10 and has a heat source side refrigerant circuit 12. The heat source side refrigerant circuit 12 mainly has a compressor 21, a plurality (here, two) of heat exchange switching mechanisms 22 and 23, a plurality (here, two) of heat source side heat exchangers 24 and 25, a plurality (here, two) of heat source side flow amount adjustment valves 26 and 27, a receiver 28, a bridge circuit 29, a high and low pressure switching mechanism 30, a liquid side shutoff valve 31, a high and low pressure gas side shutoff valve 32, and a low pressure gas side shutoff valve 33.

[0031] Here, the compressor 21 is a device for compressing refrigerant and consists of, for example, a positive displacement type of compressor such as a scroll type where it is possible to vary the operation capacity by controlling an inverter in a compressor motor 21a.

[0032] The first heat exchange switching mechanism 22 is a device where it is possible to switch the flow path of refrigerant inside the heat source side refrigerant circuit 12 so that the discharge side of the compressor 21 and the gas side of the first heat source side heat exchanger 24 are connected (refer to the solid line in the first heat exchange switching mechanism 22 in Fig. 1) in a case where the first heat source side heat exchanger 24 functions as a radiator for refrigerant (set below as a "radiator operation state") and so that the suction side of the compressor 21 and the gas side of the first heat source side heat exchanger 24 are connected (refer to the dashed line in the first heat exchange switching mechanism 22 in Fig. 1) in a case where the first heat source side heat exchanger 24 functions as an evaporator for refrigerant (set below as an "evaporator operation state") and consists of, for example, a four-path switching valve. In addition, the second heat exchange switching mechanism 23 is a device where it is possible to switch the flow path of refrigerant inside the heat source side refrigerant circuit 12 so that the discharge side of the compressor 21 and the gas side of the second heat source side heat exchanger 25 are connected (refer to the solid line in the second heat exchange switching mechanism 23 in Fig. 1) in a case where the second heat source side heat exchanger 25 functions as a radiator for refrigerant (set below as a "radiator operation state") and so that the suction side of the compressor 21 and the gas side of the second heat source side heat exchanger 25 are connected (refer to the dashed line in the second heat exchange switching mechanism 23 in Fig. 1) in a case where the second heat source side heat exchanger 25 functions as an evaporator for refrigerant (set below as an "evaporator operation state") and consists of, for example, a four-path switching valve. Then, switching is possible so that the first heat source side heat exchanger 24 and the second heat source side heat exchanger 25 individually function as an evaporator or a radiator for refrigerant by modifying the switching states of the first heat exchange switching mechanism 22 and the second heat exchange switching mechanism 23.

[0033] The first heat source side heat exchanger 24 is a device for performing heat exchange between refrigerant and outdoor air and consists of, for example, a fin and tube type of heat exchanger which is configured using a plurality of heat transfer tubes and fins. The gas side of the first heat source side heat exchanger 24 is connected with the first heat exchange switching mechanism 22 and the liquid side of the first heat source side heat exchanger 24 is connected with the first heat source side flow amount adjustment valve 26. In detail, the gas side of the first heat source side heat exchanger 24 is provided with a first header 24a for performing merging and branching of refrigerant between a plurality of heat transfer tubes which configure the first heat source side heat exchanger 24, and the first header 24a is connected with the first heat exchange switching mechanism 22. The liquid side of the first heat source side heat exchanger 24 is provided with a first flow divider 24b for performing merging and branching of refrigerant between a plurality of heat transfer tubes which configure the first heat source side heat exchanger 24, and the first flow divider 24b is connected with the first heat source side flow amount adjustment valve 26. In addition, the second heat source side heat exchanger 25 is a device for performing heat exchange between refrigerant and outdoor air and consists of, for example, a fin and tube type of heat exchanger which is configured using a plurality of heat transfer tubes and fins. The gas side of the second heat source side heat exchanger 25 is connected with the second heat exchange switching mechanism 23 and the liquid side of the second heat source side heat exchanger 25 is connected with the second heat source side flow amount adjustment valve 27. In detail, the gas side of the second heat source side heat exchanger 25 is provided with a second header 25a for performing merging and branching of refrigerant between a plurality of heat transfer tubes which configure the second heat source side heat exchanger 25, and the second header 25a is connected with the second heat exchange switching mechanism 23. The liquid side of the second heat source side heat exchanger 25 is provided with a second flow divider 25b for performing merging and branching of refrigerant between a plurality of heat transfer tubes which configure the second heat source side heat exchanger 25, and the second flow divider 25b is connected with the second heat source side flow amount adjustment valve 27.

[0034] Here, the heat exchange capacities of the first heat source side heat exchanger 24 and the second heat source side heat exchanger 25 are different, and the heat exchange capacity of the second heat source side heat exchanger 25 is larger than the first heat source side heat exchanger 24. In detail, the second heat source side heat exchanger 25 has a heat exchange capacity which is 1.8 times to 4.0 times of the first heat source side heat exchanger 24. In addition, the first heat source side heat exchanger 24 where the heat exchange capacity is small is arranged on the upper side of the second heat source side heat exchanger 25 where the heat exchange capacity is large. In detail, the first heat source side heat exchanger 24 and the second heat source side heat exchanger 25 are configured as an integral heat source side heat exchanger, and the upper portion functions as the first heat source side heat exchanger 24 by the heat transfer tubes which configure the upper portion being connected with the first header 24a and the first flow divider 24b and the lower portion functions as the second heat source side heat exchanger 25 by the heat transfer tubes which configure the lower portion being connected with the second header 25a and the second flow divider 25b. In addition, the flow path cross sectional area of the second header 25a is larger than the first header 24a. In detail, the inner diameter size of the second header 25a is larger than the inner diameter size of the first header 24a. Then, the heat source unit 2 has an outdoor fan 34 for suctioning outdoor air into the inside of the unit and exhausting the outdoor air to the outside of the unit after heat exchange is carried out, and heat exchange between outdoor air and refrigerant which flows through the heat source side heat exchangers 24 and 25 is possible. The outdoor fan 34 is driven using an outdoor fan motor 34a. Here, a suction opening 2a for suctioning outdoor air is formed in the side surface of the heat source unit 2, an exhaust opening 2b for exhausting outdoor air is formed in the top surface of the heat source unit 2, and the outdoor fan 34 is arranged at an upper portion of the heat source unit 2.

[0035] The first heat source side flow amount adjustment valve 26 is an electric expansion valve where adjustment to its opening is possible and which is connected with the liquid side of the first heat source side heat exchanger 24 in order to perform adjustment of the flow amount of refrigerant which flows through the first heat source side heat exchanger 24 and the like. In addition, the second heat source side flow amount adjustment valve 27 is an electric expansion valve where adjustment to its opening is possible and which is connected with the liquid side of the second heat source side heat exchanger 25 in order to perform adjustment of the flow amount of refrigerant which flows through the second heat source side heat exchanger 25 and the like. Here, the rated Cv values of the first heat source side flow amount adjustment valve 26 and the second heat source side flow amount adjustment valve 27 are different, and the rated Cv value of the second heat source side flow amount adjustment valve 27 is larger than the rated Cv value of the first heat source side flow amount adjustment valve 26.

[0036] The receiver 28 is a container for temporarily retaining refrigerant which flows between the heat source side heat exchangers 24 and 25 and the usage side refrigerant circuits 13a, 13b, 13c, and 13d. A receiver input pipe 28a is provided at an upper portion of the receiver 28 and a receiver output pipe 28b is provided at a lower portion of the receiver 28. In addition, a receiver input opening and closing valve 28c where opening and closing control is possible is provided in the receiver input pipe 28a. Then, the input pipe 28a and the output pipe 28b in the receiver 28 connect between the heat source side heat exchangers 24 and 25 and the liquid side shutoff valve 31 via the bridge circuit 29.

[0037] The bridge circuit 29 is a circuit which has a function of causing refrigerant to flow into the inside of the receiver 28 via the receiver input pipe 28a and of causing refrigerant to flow out from the inside of the receiver 28 via the receiver output pipe 28b in either a case where refrigerant flows from the heat source side heat exchangers 24 and 25 side toward the liquid side shutoff valve 31 side or a case where refrigerant flows from the liquid side shutoff valve 31 side toward the heat source side heat exchangers 24 and 25 side. The bridge circuit 29 has four check valves 29a, 29b, 29c, and 29d. Then, the input check valve 29a is a check valve which only permits passage of refrigerant from the heat source side heat exchangers 24 and 25 side to the receiver input pipe 28a. The input check valve 29b is a check valve which only permits passage of refrigerant from the liquid side shutoff valve 31 side to the receiver input pipe 28a. That is, the input check valves 29a and 29b have a function of causing the passage of refrigerant from the heat source side heat exchangers 24 and 25 side or the liquid side shutoff valve 31 side to the receiver input pipe 28a. The output check valve 29c is a check valve which only permits passage of refrigerant from the receiver output pipe 28b to the liquid side shutoff valve 31 side. The output check valve 29d is a check valve which only permits passage of refrigerant from the receiver output pipe 28b to the heat source side heat exchangers 24 and 25 side. That is, the output check valves 29c and 29d have a function of causing the passage of refrigerant from the receiver output pipe 28b to the heat source side heat exchangers 24 and 25 side or the liquid side shutoff valve 31 side.

[0038] The high and low pressure switching mechanism 30 is a device where it is possible to switch the flow path of refrigerant inside the heat source side refrigerant circuit 12 so that the discharge side of the compressor 21 and the high and low pressure gas side shutoff valve 32 are connected (refer to the dashed line in the high and low pressure switching mechanism 30 in Fig. 1) in a case where high pressure gas refrigerant which is discharged from the compressor 21 is sent to the usage side refrigerant circuits 13a, 13b, 13c, and 13d (set below as a "radiator load dominant operation state") and so that the high and low pressure gas side shutoff valve 32 and the suction side of the compressor 21 are connected (refer to the solid line in the high and low pressure switching mechanism 30 in Fig. 1) in a case where high pressure gas refrigerant which is discharged from the compressor 21 is not sent to the usage side refrigerant circuits 13a, 13b, 13c, and 13d (set below as an "evaporator load dominant operation state"), and consists of, for example, a four-path switching valve.

[0039] The liquid side shutoff valve 31, the high and low pressure gas side shutoff valve 32, and the low pressure gas side shutoff valve 33 are valves which are provided at connection openings with external devices and pipes (in detail, with the refrigerant communication pipes 7, 8, and 9). The liquid side shutoff valve 31 is connected with the receiver input pipe 28a or the receiver output pipe 28b via the bridge circuit 29. The high and low pressure gas side shutoff valve 32 is connected with the high and low pressure switching mechanism 30. The low pressure gas side shutoff valve 33 is connected with the suction side of the compressor 21.

[0040] In addition, the heat source unit 2 has a heat source side control section 20 which controls actions of each of the sections 21a, 22, 23, 26, 27, 28c, 30, and 34a which configure the heat source unit 2. Then, the heat source side control section 20 has a microcomputer and a memory which are provided in order to perform control of the heat source unit 2, and it is possible to perform transfer of control signals and the like with the usage side control sections 50a, 50b, 50c, and 50d in the usage units 3a, 3b, 3c, 3d.

<Connecting Units>

[0041] The connecting units 4a, 4b, 4c, and 4d are arranged indoors along with the usage units 3a, 3b, 3c, and 3d such as in a building. The connecting units 4a, 4b, 4c, and 4d are in between the usage units 3a, 3b, 3c, and 3d and the heat source unit 2 along with the refrigerant communication pipes 7, 8, and 9 and configures a portion of the refrigerant circuit 10.

[0042] Next, the configuration of the connecting units 4a, 4b, 4c, and 4d will be described. Here, since the connecting unit 4a and the connecting units 4b, 4c, and 4d have the same configuration, only the configuration of the connecting unit 4a will be described here and the subscripts "b", "c", and "d" are respectively added instead of the subscript "a" in the reference numerals, which indicate each section of the connecting unit 4a, to the configurations of the connecting units 4b, 4c, and 4d and the description of each section is omitted.

[0043] The connecting unit 4a mainly configures a portion of the refrigerant circuit 10 and has a connecting side refrigerant circuit 14a (there are connecting side refrigerant circuits 14b, 14c, and 14d respectively in each of the connecting units 4b, 4c, and 4d). The connecting side refrigerant circuit 14a mainly has a liquid connecting pipe 61a and a gas connecting pipe 62a.

[0044] The liquid connecting pipe 61a connects the liquid refrigerant communication pipe 7 and the usage side flow amount adjustment valve 51a in the usage side refrigerant circuit 13a.

[0045] The gas connecting pipe 62a has a high pressure gas connecting pipe 63a which is connected with the high and low pressure gas refrigerant communication pipe 8, a low pressure gas connecting pipe 64a which is connected with the low pressure gas refrigerant communication pipe 9, and a merging gas connecting pipe 65a where the high pressure gas connecting pipe 63a and the low pressure gas connecting pipe 64a merge. The merging gas connecting pipe 65a is connected with the gas side of the usage side heat exchanger 52a in the usage side refrigerant circuit 13a. A high pressure gas opening and closing valve 66a where opening and closing control is possible is provided in the high pressure gas connecting pipe 63a, and a low pressure gas opening and closing valve 67a where opening and closing control is possible is provided in the low pressure gas connecting pipe 64a.

[0046] Then, by setting a state where the low pressure gas opening and closing valve 67a is open when the usage unit 3a is performing an air cooling operation, it is possible for the connecting unit 4a to function so as to send refrigerant, which flows into the liquid connecting pipe 61 a via the liquid refrigerant communication pipe 7, to the usage side heat exchanger 52a via the usage side flow amount adjustment valve 51 a in the usage side refrigerant circuit 13a and to return refrigerant, which evaporates due to heat exchange with indoor air in the usage side heat exchanger 52a, to the low pressure gas refrigerant communication pipe 9 via the merging gas connecting pipe 65a and the low pressure gas connecting pipe 64a. In addition, by setting a state where the low pressure gas opening and closing valve 67a is closed and the high pressure gas opening and closing valve 66a is open when the usage unit 3a is performing an air heating operation, it is possible for the connecting unit 4a to function so as to send refrigerant, which flows into the high pressure gas connecting pipe 63a and the merging gas connecting pipe 65a via the high and low pressure gas refrigerant communication pipe 8, to the usage side heat exchanger 52a in the usage side refrigerant circuit 13a and to return refrigerant, which releases heat due to heat exchange with indoor air in the usage side heat exchanger 52a, to the liquid refrigerant communication pipe 7 via the usage side flow amount adjustment valve 51 a and the liquid connecting pipe 61 a. Since not only the connecting unit 4a but the connecting units 4b, 4c, and 4d also have the same functions, switching is possible so that the usage side heat exchangers 52a, 52b, 52c, and 52d individually function as an evaporator or a radiator for refrigerant due to the connecting units 4a, 4b, 4c, and 4d.

[0047] In addition, the connecting unit 4a has a connecting side control section 60a which controls the actions of each of the sections 66a and 67a which configure the connecting unit 4a. Then, the connecting side control section 60a has a microcomputer and a memory which are provided in order to perform control of the connecting unit 4a, and it is possible to perform transfer of control signals and the like with the usage side control section 50a in the usage unit 3a.

[0048] As above, the refrigerant circuit 10 in the simultaneous air cooling and air heating operation air conditioner device 1 is configured by connecting the usage side refrigerant circuits 13a, 13b, 13c, and 13d, the heat source side refrigerant circuit 12, the refrigerant communication pipes 7, 8, and 9, and the connecting side refrigerant circuits 14a, 14b, 14c, and 14d. Then, in the simultaneous air cooling and air heating operation air conditioner device 1, it is possible to perform a simultaneous air cooling and air heating operation where, for example, the usage units 3a and 3b perform an air cooling operation and the usage units 3c and 3d perform an air heating operation. At this time, heat recovery is performed between the usage units 3a, 3b, 3c, and 3d by sending refrigerant from the usage side heat exchangers 52a and 52b which function as radiators for refrigerant to the usage side heat exchangers 52c and 52d which function as evaporators for refrigerant. That is, the simultaneous air cooling and air heating operation air conditioner device 1 is configured as a heat recovery refrigeration device which includes the compressor 21, the plurality (here, two) of heat source side heat exchangers 24 and 25 which are able to switch between individually functioning as an evaporator or a radiator for refrigerant, and the plurality (here, four) of usage side heat exchangers 52a, 52b, 52c, and 52d which are able to switch between individually functioning as an evaporator or a radiator for refrigerant and which is able to perform heat recovery between the usage side heat exchangers by sending refrigerant from the usage side heat exchanger which functions as a radiator for refrigerant to the usage side heat exchanger which functions as an evaporator for refrigerant. Then, here, the heat exchange capacity of the second heat source side heat exchanger 25 is equal to or more than 1.8 times of the first heat source side heat exchanger 24 as described above.

(2) Actions of Heat Recovery Refrigeration Device (Simultaneous Air Cooling and Air Heating Operation Air Conditioner Device)

[0049] Next, the actions of the simultaneous air cooling and air heating operation air conditioner device 1 will be described.

[0050] It is possible to divide the operation modes of the simultaneous air cooling and air heating operation air conditioner device 1 into an air cooling operation mode (where the evaporator load is large), an air cooling operation mode (where the evaporator load is small), an air heating operation mode (where the radiator load is large), an air heating operation mode (where the radiator load is small), a simultaneous air cooling and air heating operation mode (where the evaporator load is dominant), a simultaneous air cooling and air heating operation mode (where the radiator load is dominant), and a simultaneous air cooling and air heating operation mode (with a balance between the evaporator and radiator loads). Here, the air cooling operation mode (where the evaporator load is large) is an operation mode which is only for the usage units which perform an air cooling operation (that is, an operation where the usage side heat exchanger functions as an evaporator for refrigerant) and which is where both of the heat source side heat exchangers 24 and 25 function as radiators for refrigerant with regard to the evaporator load over all of the usage units. The air cooling operation mode (where the evaporator load is small) is an operation mode which is only for the usage units which perform an air cooling operation (that is, an operation where the usage side heat exchanger functions as an evaporator for refrigerant) and which is where only the first heat source side heat exchanger 24 functions as a radiator for refrigerant with regard to the evaporator load over all of the usage units. The heat cooling operation mode (where the radiator load is large) is an operation mode which is only for the usage units which perform an air heating operation (that is, an operation where the usage side heat exchanger functions as a radiator for refrigerant) and which is where both of the heat source side heat exchangers 24 and 25 function as evaporators for refrigerant with regard to the radiator load over all of the usage units. The air heating operation mode (where the radiator load is small) is an operation mode which is only for the usage units which perform an air heating operation (that is, an operation where the usage side heat exchanger functions as a radiator for refrigerant) and which is where only the first heat source side heat exchanger 24 functions as an evaporator for refrigerant with regard to the radiator load over all of the usage units. The simultaneous air cooling and air heating operation mode (where the evaporator load is dominant) is an operation mode where there is a mixture of the usage units which perform an air cooling operation (that is, an operation where the usage side heat exchanger functions as an evaporator for refrigerant) and the usage units which perform an air heating operation (that is, an operation where the usage side heat exchanger functions as a radiator for refrigerant) and where only the first heat source side heat exchanger 24 functions as a radiator for refrigerant with regard to the evaporator load over all of the usage units in a case where the heat load over all of the usage units is dominated by the evaporator load. The simultaneous air cooling and air heating operation mode (where the radiator load is dominant) is an operation mode where there is a mixture of the usage units which perform an air cooling operation (that is, an operation where the usage side heat exchanger functions as an evaporator for refrigerant) and the usage units which perform an air heating operation (that is, an operation where the usage side heat exchanger functions as a radiator for refrigerant) and where only the first heat source side heat exchanger 24 functions as an evaporator for refrigerant with regard to the radiator load over all of the usage units in a case where the heat load over all of the usage units is dominated by the radiator load. The simultaneous air cooling and air heating operation mode (with a balance between the evaporator and radiator loads) is an operation mode where there is a mixture of the usage units which perform an air cooling operation (that is, an operation where the usage side heat exchanger functions as an evaporator for refrigerant) and the usage units which perform an air heating operation (that is, an operation where the usage side heat exchanger functions as a radiator for refrigerant) and where the first heat source side heat exchanger 24 functions as a radiator for refrigerant and the second heat source side heat exchanger 25 functions as an evaporator for refrigerant in a case where the evaporator load and the radiator load is balanced over all of the usage units.

[0051] Here, actions of the simultaneous air cooling and air heating operation air conditioner device 1 which include these operation modes are performed using the control sections 20, 50a, 50b, 50c, 50d, 60a, 60b, 60c, and 60d described above.

<Air Cooling Operation Mode (where the evaporator load is large)>

[0052] The refrigerant circuit 10 in the air conditioner device 1 is configured as shown in Fig. 4 (for the flow of refrigerant, refer to the arrows which are added to the refrigerant circuit 10 in Fig. 4) during the air cooling operation mode (where the evaporator load is large) when, for example, all of the usage units 3a, 3b, 3c, and 3d perform an air cooling operation (that is, an operation where all of the usage side heat exchangers 52a, 52b, 52c, and 52d function as evaporators for refrigerant) and both of the heat source side heat exchangers 24 and 25 function as radiators for refrigerant.

[0053] In detail, in the heat source unit 2, both of the heat source side heat exchangers 24 and 25 function as radiators for refrigerant by the first heat exchange switching mechanism 22 switching to a radiator operation state (a state which is indicated by the solid line in the first heat exchange switching mechanism 22 in Fig. 4) and the second heat exchange switching mechanism 23 switching to a radiator operation state (a state which is indicated by the solid line in the second heat exchange switching mechanism 23 in Fig. 4). In addition, the high and low pressure switching mechanism 30 switches to an evaporator load dominant operation state (a state which is indicated by the solid line in the high and low pressure switching mechanism 30 in Fig. 4). In addition, the heat source side flow amount adjustment valves 26 and 27 adjust their openings and the receiver input opening and closing valve 28c is in an open state. All of the usage side heat exchangers 52a, 52b, 52c, and 52d in the usage units 3a, 3b, 3c, and 3d function as evaporators for refrigerant due to the high pressure gas opening and closing valves 66a, 66b, 66c, and 66d and the low pressure gas opening and closing valves 67a, 67b, 67c, and 67d being in an open state in the connecting units 4a, 4b, 4c, and 4d, and there is a state where all of the usage side heat exchangers 52a, 52b, 52c, and 52d in the usage units 3a, 3b, 3c, and 3d and the suction side of the compressor 21 in the heat source unit 2 are connected via the high and low pressure gas refrigerant communication pipe 8 and the low pressure gas refrigerant communication pipe 9. In the usage units 3a, 3b, 3c, and 3d, the usage side flow amount adjustment valves 51a, 51b, 51c, and 51d adjust their openings.

[0054] In this manner, in the refrigerant circuit 10, high pressure gas refrigerant which is compressed by and discharged from the compressor 21 is sent to both of the heat source side heat exchangers 24 and 25 via the heat exchange switching mechanisms 22 and 23. Then, the high pressure gas refrigerant which is sent to the heat source side heat exchangers 24 and 25 releases heat by heat exchange being performed with outdoor air which is the heat source which is supplied using the outdoor fan 34 in the heat source side heat exchangers 24 and 25. Then, the refrigerant which releases heat in the heat source side heat exchangers 24 and 25 is sent to the receiver 28 via the input check valve 29a and the receiver input opening and closing valve 28c by merging after the flow amount is adjusted in the heat source side flow amount adjustment valves 26 and 27. Then, the refrigerant which is sent to the receiver 28 is sent to the liquid refrigerant communication pipe 7 via the output check valve 29c and the liquid side shutoff valve 31 after being temporarily retained inside the receiver 28.

[0055] Then, the refrigerant which is sent to the liquid refrigerant communication pipe 7 is branched off four ways and is sent to the liquid connecting pipes 61 a, 61b, 61c, and 61 d in each of the connecting units 4a, 4b, 4c, and 4d. Then, the refrigerant which is sent to the liquid connecting pipes 61 a, 61b, 61c, and 61 d is sent to the usage side flow amount adjustment valves 51a, 51b, 51c, and 51d in the usage units 3a, 3b, 3c, and 3d.

[0056] Then, the refrigerant which is sent to the usage side flow amount adjustment valves 51a, 51b, 51c, and 51 d becomes low pressure gas refrigerant by evaporating due to heat exchange being performed with indoor air which is supplied using the indoor fans 53a, 53b, 53c, and 53d in the usage side heat exchangers 52a, 52b, 52c, and 52d after the flow amount is adjusted in the usage side flow amount adjustment valves 51a, 51b, 51c, and 51d. At the same time, an air cooling operation is performed using the usage units 3a, 3b, 3c, and 3d by the indoor air being cooled and supplied indoors. Then, the low pressure gas refrigerant is sent to the merging gas connecting pipes 65a, 65b, 65c, and 65d in the connecting units 4a, 4b, 4c, and 4d.

[0057] Then, the low pressure gas refrigerant which is sent to the merging gas connecting pipes 65a, 65b, 65c, and 65d merges due to being sent to the high and low pressure gas refrigerant communication pipe 8 via the high pressure gas opening and closing valves 66a, 66b, 66c, and 66d and the high pressure gas connecting pipes 63a, 63b, 63c, and 63d and merges due to being sent to the low pressure gas refrigerant communication pipe 9 via the low pressure gas opening and closing valves 67a, 67b, 67c, and 67d and the low pressure gas connecting pipes 64a, 64b, 64c, and 64d.

[0058] Then, the low pressure gas refrigerant which is sent to the gas refrigerant communication pipes 8 and 9 is returned to the suction side of the compressor 21 via the gas side shutoff valves 32 and 33 and the high and low pressure switching mechanism 30.

[0059] In this manner, an operation in the air cooling operation mode (where the evaporator load is large) is performed.

<Air Cooling Operation Mode (where the evaporator load is small)>

[0060] The refrigerant circuit 10 in the air conditioner device 1 is configured as shown in Fig. 5 (for the flow of refrigerant, refer to the arrows which are added to the refrigerant circuit 10 in Fig. 5) during the air cooling operation mode (where the evaporator load is small) when, for example, only the usage unit 3a performs an air cooling operation (that is, an operation where only the usage side heat exchanger 52a functions as an evaporator for refrigerant) and only the first heat source side heat exchanger 24 functions as a radiator for refrigerant.

[0061] In detail, in the heat source unit 2, only the first heat source side heat exchanger 24 functions as a radiator for refrigerant by the first heat exchange switching mechanism 22 switching to a radiator operation state (a state which is indicated by the solid line in the first heat exchange switching mechanism 22 in Fig. 5). In addition, the high and low pressure switching mechanism 30 switches to an evaporator load dominant operation state (a state which is indicated by the solid line in the high and low pressure switching mechanism 30 in Fig. 5). In addition, the first heat source side flow amount adjustment valve 26 adjusts its opening, the second heat source side flow amount adjustment valve 27 is in a closed state, and the receiver input opening and closing valve 28c is in an open state. Only the usage side heat exchanger 52a in the usage unit 3a functions as an evaporator for refrigerant due to the high pressure gas opening and closing valve 66a and the low pressure gas opening and closing valve 67a being in an open state and the high pressure gas opening and closing valves 66b, 66c, and 66d and the low pressure gas opening and closing valves 67b, 67c, and 67d being in a closed state in the connecting units 4a, 4b, 4c, and 4d, and there is a state where the usage side heat exchanger 52a in the usage unit 3a and the suction side of the compressor 21 in the heat source unit 2 are connected via the high and low pressure gas refrigerant communication pipe 8 and the low pressure gas refrigerant communication pipe 9. The usage side flow amount adjustment valve 51a adjusts its opening in the usage unit 3a and the usage side flow amount adjustment valves 51 b, 51 c, and 51 d are in a closed state in the usage units 3b, 3c, and 3d.

[0062] In this manner, in the refrigerant circuit 10, high pressure gas refrigerant which is compressed by and discharged from the compressor 21 is sent to only the first heat source side heat exchanger 24 via the first heat exchange switching mechanism 22. Then, the high pressure gas refrigerant which is sent to the first heat source side heat exchanger 24 releases heat by heat exchange being performed with outdoor air which is the heat source which is supplied using the outdoor fan 34 in the first heat source side heat exchanger 24. Then, the refrigerant which releases heat in the first heat source side heat exchanger 24 is sent to the receiver 28 via the input check valve 29a and the receiver input opening and closing valve 28c after the flow amount is adjusted in the first heat source side flow amount adjustment valve 26. Then, the refrigerant which is sent to the receiver 28 is sent to the liquid refrigerant communication pipe 7 via the output check valve 29c and the liquid side shutoff valve 31 after being temporarily retained inside the receiver 28.

[0063] Then, the refrigerant which is sent to the liquid refrigerant communication pipe 7 is sent to only the liquid connecting pipe 61a in the connecting unit 4a. Then, the refrigerant which is sent to the liquid connecting pipe 61 a in the connecting unit 4a is sent to the usage side flow amount adjustment valve 51a in the usage unit 3a.

[0064] Then, the refrigerant which is sent to the usage side flow amount adjustment valve 51 a becomes low pressure gas refrigerant by evaporating due to heat exchange being performed with indoor air which is supplied using the indoor fan 53a in the usage side heat exchanger 52a after the flow amount is adjusted in the usage side flow amount adjustment valve 51 a. At the same time, an air cooling operation is performed using only the usage unit 3a by the indoor air being cooled and supplied indoors. Then, the low pressure gas refrigerant is sent to the merging gas connecting pipe 65a in the connecting unit 4a.

[0065] Then, the low pressure gas refrigerant which is sent to the merging gas connecting pipe 65a is sent to the high and low pressure gas refrigerant communication pipe 8 via the high pressure gas opening and closing valve 66a and the high pressure gas connecting pipe 63a and is sent to the low pressure gas refrigerant communication pipe 9 via the low pressure gas opening and closing valve 67a and the low pressure gas connecting pipe 64a.

[0066] Then, the low pressure gas refrigerant which is sent to the gas refrigerant communication pipes 8 and 9 is returned to the suction side of the compressor 21 via the gas side shutoff valves 32 and 33 and the high and low pressure switching mechanism 30.

[0067] In this manner, an operation in the air cooling operation mode (where the evaporator load is small) is performed.

<Air Heating Operation Mode (where the radiator load is large)>

[0068] The refrigerant circuit 10 in the air conditioner device 1 is configured as shown in Fig. 6 (for the flow of refrigerant, refer to the arrows which are added to the refrigerant circuit 10 in Fig. 6) during the air heating operation mode (where the radiator load is large) when, for example, all of the usage units 3a, 3b, 3c, and 3d perform an air heating operation (that is, an operation where all of the usage side heat exchangers 52a, 52b, 52c, and 52d function as radiators for refrigerant) and both of the heat source side heat exchangers 24 and 25 function as evaporators for refrigerant.

[0069] In detail, in the heat source unit 2, both of the heat source side heat exchangers 24 and 25 function as evaporators for refrigerant by the first heat exchange switching mechanism 22 switching to an evaporator operation state (a state which is indicated by the dashed line in the first heat exchange switching mechanism 22 in Fig. 6) and the second heat exchange switching mechanism 23 switching to an evaporator operation state (a state which is indicated by the dashed line in the second heat exchange switching mechanism 23 in Fig. 6). In addition, the high and low pressure switching mechanism 30 switches to a radiator load dominant operation state (a state which is indicated by the dashed line in the high and low pressure switching mechanism 30 in Fig. 6). In addition, the heat source side flow amount adjustment valves 26 and 27 adjust their openings and the receiver input opening and closing valve 28c is in an open state. All of the usage side heat exchangers 52a, 52b, 52c, and 52d in the usage units 3a, 3b, 3c, and 3d function as radiators for refrigerant due to the high pressure gas opening and closing valves 66a, 66b, 66c, and 66d being in an open state and the low pressure gas opening and closing valves 67a, 67b, 67c, and 67d being in a closed state in the connecting units

4a, 4b, 4c, and 4d, and there is a state where all of the usage side heat exchangers 52a, 52b, 52c, and 52d in the usage units 3a, 3b, 3c, and 3d and the discharge side of the compressor 21 in the heat source unit 2 are connected via the high and low pressure gas refrigerant communication pipe 8. In the usage units 3a, 3b, 3c, and 3d, the usage side flow amount adjustment valves 51a, 51b, 51c, and 51d adjust their openings.

[0070] In this manner, in the refrigerant circuit 10, high pressure gas refrigerant which is compressed by and discharged from the compressor 21 is sent to the high and low pressure gas refrigerant communication pipe 8 via the high and low pressure switching mechanism 30 and the high and low pressure gas side shutoff valve 32.

[0071] Then, the high pressure gas refrigerant which is sent to the high and low pressure gas refrigerant communication pipe 8 is branched off four ways and is sent to the high pressure gas connecting pipes 63a, 63b, 63c, and 63d in each of the connecting units 4a, 4b, 4c, and 4d. The high pressure gas refrigerant which is sent to the high pressure gas connecting pipes 63a, 63b, 63c, and 63d is sent to the usage side heat exchangers 52a, 52b, 52c, and 52d in the usage units 3a, 3b, 3c, and 3d via the high pressure gas opening and closing valves 66a, 66b, 66c, and 66d and the merging gas connecting pipes 65a, 65b, 65c, and 65d.

[0072] Then, the high pressure gas refrigerant which is sent to the usage side heat exchangers 52a, 52b, 52c, and 52d releases heat by heat exchange being performed with indoor air which is supplied using the indoor fans 53a, 53b, 53c, and 54d in the usage side heat exchangers 52a, 52b, 52c, and 52d. At the same time, an air heating operation is performed using the usage units 3a, 3b, 3c, and 3d by the indoor air being heated and supplied indoors. The refrigerant which releases heat in the usage side heat exchangers 52a, 52b, 52c, and 52d is sent to the liquid connecting pipes 61 a, 61b, 61c, and 61 d in the connecting units 4a, 4b, 4c, and 4d after the flow amount is adjusted in the usage side flow amount adjustment valves 51 a, 51 b, 51 c, and 51 d.

[0073] Then, the refrigerant which is sent to the liquid connecting pipes 61 a, 61 b, 61 c, and 61d merges by being sent to the liquid refrigerant communication pipe 7.

[0074] Then, the refrigerant which is sent to the liquid refrigerant communication pipe 7 is sent to the receiver 28 via the liquid side shutoff valve 31, the input check valve 29b, and the receiver input opening and closing valve 28c. Then, the refrigerant which is sent to the receiver 28 is sent to both of the heat source side flow amount adjustment valves 26 and 27 via the output check valve 29d after being temporarily retained inside the receiver 28. Then, the refrigerant which is sent to the heat source side flow amount adjustment valves 26 and 27 becomes low pressure gas refrigerant by evaporating due to heat exchange being performed with outdoor air which is supplied using the outdoor fan 34 in the heat source side heat exchangers 24 and 25 after the flow amount is adjusted in the heat source side flow amount adjustment valves 26 and 27 and the low pressure gas refrigerant is sent to the heat exchange switching mechanisms 22 and 23. Then, the low pressure gas refrigerant which is sent to the heat exchange switching mechanisms 22 and 23 merges and is returned to the suction side of the compressor 21.

[0075] In this manner, an operation in the air heating operation mode (where the radiator load is large) is performed.

<Air Heating Operation Mode (where the radiator load is small)>

[0076] The refrigerant circuit 10 in the air conditioner device 1 is configured as shown in Fig. 7 (for the flow of refrigerant, refer to the arrows which are added to the refrigerant circuit 10 in Fig. 7) during the air heating operation mode (where the radiator load is small) when, for example, only the usage unit 3a performs an air heating operation (that is, an operation where only the usage side heat exchanger 52a functions as a radiator for refrigerant) and only the first heat source side heat exchanger 24 functions as an evaporator for refrigerant.

[0077] In detail, in the heat source unit 2, only the first heat source side heat exchanger 24 functions as an evaporator for refrigerant by the first heat exchange switching mechanism 22 switching to an evaporator operation state (a state which is indicated by the dashed line in the first heat exchange switching mechanism 22 in Fig. 7). In addition, the high and low pressure switching mechanism 30 switches to a radiator load dominant operation state (a state which is indicated by the dashed line in the high and low pressure switching mechanism 30 in Fig. 7). In addition, the first heat source side flow amount adjustment valve 26 adjusts its opening, the second heat source side flow amount adjustment valve 27 is in a closed state, and the receiver input opening and closing valve 28c is in an open state. Only the usage side heat exchanger 52a in the usage unit 3a functions as a radiator for refrigerant due to the high pressure gas opening and closing valve 66a being in an open state and the high pressure gas opening and closing valves 66b, 66c, and 66d and the low pressure gas opening and closing valves 67a, 67b, 67c, and 67d being in a closed state in the connecting units 4a, 4b, 4c, and 4d, and there is a state where the usage side heat exchanger 52a in the usage unit 3a and the discharge side of the compressor 21 in the heat source unit 2 are connected via the high and low pressure gas refrigerant communication pipe 8. The usage side flow amount adjustment valve 51a adjusts its opening in the usage unit 3a and the usage side flow amount adjustment valves 51b, 51c, and 51d are in a closed state in the usage units 3b, 3c, and 3d.

[0078] In this manner, in the refrigerant circuit 10, high pressure gas refrigerant which is compressed by and discharged from the compressor 21 is sent to the high and low pressure gas refrigerant communication pipe 8 via the high and low pressure switching mechanism 30 and the high and low pressure gas side shutoff valve 32.

[0079] Then, the high pressure gas refrigerant which is sent to the high and low pressure gas refrigerant communication pipe 8 is sent to only the high pressure gas connecting pipe 63a in the connecting unit 4a. The high pressure gas refrigerant which is sent to the high pressure gas connecting pipe 63a is sent to the usage side heat exchanger 52a in the usage unit 3a via the high pressure gas opening and closing valve 66a and the merging gas connecting pipe 65a.

[0080] Then, the high pressure gas refrigerant which is sent to the usage side heat exchanger 52a releases heat by heat exchange being performed with indoor air which is supplied using the indoor fan 53a in the usage side heat exchanger 52a. At the same time, an air heating operation is performed using only the usage unit 3a by the indoor air being heated and supplied indoors. The refrigerant which releases heat in the usage side heat exchanger 52a is sent to the liquid connecting pipe 61a in the connecting units 4a after the flow amount is adjusted in the usage side flow amount adjustment valve 51a.

[0081] Then, the refrigerant which is sent to the liquid connecting pipe 61 a is sent to the liquid refrigerant communication pipe 7.

[0082] Then, the refrigerant which is sent to the liquid refrigerant communication pipe 7 is sent to the receiver 28 via the liquid side shutoff valve 31, the input check valve 29b, and the receiver input opening and closing valve 28c. The refrigerant which is sent to the receiver 28 is sent to only the first heat source side flow amount adjustment valve 26 via the output check valve 29d after being temporarily retained inside the receiver 28. Then, the refrigerant which is sent to the first heat source side flow amount adjustment valve 26 becomes low pressure gas refrigerant by evaporating due to heat exchange being performed with outdoor air which is supplied using the outdoor fan 34 in the first heat source side heat exchanger 24 after the flow amount is adjusted in the first heat source side flow amount adjustment valve 26 and the low pressure gas refrigerant is sent to the first heat exchange switching mechanism 22. Then, the low pressure gas refrigerant which is sent to the first heat exchange switching mechanism 22 is returned to the suction side of the compressor 21.

[0083] In this manner, an operation in the air heating operation mode (where the radiator load is small) is performed.

<Simultaneous Air Cooling and Air Heating Operation Mode (where the evaporator load is dominant)>

[0084] The refrigerant circuit 10 in the air conditioner device 1 is configured as shown in Fig. 8 (for the flow of refrigerant, refer to the arrows which are added to the refrigerant circuit 10 in Fig. 8) during the simultaneous air cooling and air heating operation mode (where the evaporator load is dominant) when, for example, the usage units 3a, 3b, and 3c perform an air cooling operation and the usage unit 3d performs an air heating operation (that is, an operation where the usage side heat exchangers 52a, 52b, and 52c function as evaporators for refrigerant and the usage side heat exchanger 52d functions as a radiator for refrigerant) and only the first heat source side heat exchanger 24 functions as a radiator for refrigerant.

[0085] In detail, in the heat source unit 2, only the first heat source side heat exchanger 24 functions as a radiator for refrigerant by the first heat exchange switching mechanism 22 switching to a radiator operation state (a state which is indicated by the solid line in the first heat exchange switching mechanism 22 in Fig. 8). In addition, the high and low pressure switching mechanism 30 switches to a radiator load dominant operation state (a state which is indicated by the dashed line in the high and low pressure switching mechanism 30 in Fig. 8). In addition, the first heat source side flow amount adjustment valve 26 adjusts its opening, the second heat source side flow amount adjustment valve 27 is in a closed state, and the receiver input opening and closing valve 28c is in an open state. The usage side heat exchangers 52a, 52b, and 52c in the usage units 3a, 3b, and 3c function as evaporators for refrigerant and the usage side heat exchanger 52d in the usage unit 3d functions as a radiator for refrigerant due to the high pressure gas opening and closing valve 66d and the low pressure gas opening and closing valves 67a, 67b, and 67c being in an open state and the high pressure gas opening and closing valves 66a, 66b, and 66c and the low pressure gas opening and closing valve 67d being in an closed state in the connecting units 4a, 4b, 4c, and 4d, and there is a state where the usage side heat exchangers 52a, 52b, and 52c in the usage units 3a, 3b, and 3c and the suction side of the compressor 21 in the heat source unit 2 are connected via the low pressure gas refrigerant communication pipe 9 and there is a state where the usage side heat exchanger 52d in the usage unit 3d and the discharge side of the compressor 21 in the heat source unit 2 are connected via the high and low pressure gas refrigerant communication pipe 8. In the usage units 3a, 3b, 3c, and 3d, the usage side flow amount adjustment valves 51a, 51b, 51c, and 51 d adjust their openings.

[0086] In this manner, in the refrigerant circuit 10, a portion of the high pressure gas refrigerant which is compressed by and discharged from the compressor 21 is sent to the high and low pressure gas refrigerant communication pipe 8 via the high and low pressure switching mechanism 30 and the high and low pressure gas side shutoff valve 32 and the remaining portion of the high pressure gas refrigerant which is compressed by and discharged from the compressor 21 is sent to the first heat source side heat exchanger 24 via the first heat exchange switching mechanism 22.

[0087] Then, the high pressure gas refrigerant which is sent to the high and low pressure gas refrigerant communication pipe 8 is sent to the high pressure gas connecting pipe 63d in the connecting unit 4d. The high pressure gas refrigerant which is sent to the high pressure gas connecting pipe 63d is sent to the usage side heat exchanger 52d in the usage unit 3d via the high pressure gas opening and closing valve 66d and the merging gas connecting pipe 65d.

[0088] Then, the high pressure gas refrigerant which is sent to the usage side heat exchanger 52d releases heat by heat exchange being performed with indoor air which is supplied using the indoor fan 53d in the usage side heat exchanger 52d. At the same time, an air heating operation is performed using the usage unit 3d by the indoor air being heated and supplied indoors. The refrigerant which releases heat in the usage side heat exchanger 52d is sent to the liquid connecting pipe 61d in the connecting unit 4d after the flow amount is adjusted in the usage side flow amount adjustment valve 51d.

[0089] In addition, the high pressure gas refrigerant which is sent to the first heat source side heat exchanger 24 releases heat by heat exchange being performed with outdoor air which is the heat source which is supplied using the outdoor fan 34 in the first heat source side heat exchanger 24. Then, the refrigerant which releases heat in the first heat source side heat exchanger 24 is sent to the receiver 28 via the input check valve 29a and the receiver input opening and closing valve 28c after the flow amount is adjusted in the first heat source side flow amount adjustment valve 26. Then, the refrigerant which is sent to the receiver 28 is sent to the liquid refrigerant communication pipe 7 via the output check valve 29c and the liquid side shutoff valve 31 after being temporarily retained inside the receiver 28.

[0090] The refrigerant which is sent to the liquid connecting pipe 61 d with heat being released in the usage side heat exchanger 52d is sent to the liquid refrigerant communication pipe 7 and merges with refrigerant which is sent to the liquid refrigerant communication pipe 7 with heat being released in the first heat source side heat exchanger 24.

[0091] Then, the refrigerant which merges in the liquid refrigerant communication pipe 7 is branched off three ways and is sent to the liquid connecting pipes 61 a, 61 b, and 61c in each of the connecting units 4a, 4b, and 4c. Then, the refrigerant which is sent to the liquid connecting pipes 61a, 61b, and 61c is sent to the usage side flow amount adjustment valves 51a, 51b, and 51c in the usage units 3a, 3b, and 3c.

[0092] Then, the refrigerant which is sent to the usage side flow amount adjustment valves 51 a, 51 b, and 51 c becomes low pressure gas refrigerant by evaporating due to heat exchange being performed with indoor air which is supplied using the indoor fans 53a, 53b, and 53c in the usage side heat exchangers 52a, 52b, and 52c after the flow amount is adjusted in the usage side flow amount adjustment valves 51a, 51b, and 51c. At the same time, an air cooling operation is performed using the usage units 3a, 3b, and 3c by the indoor air being cooled and supplied indoors. Then, the low pressure gas refrigerant is sent to the merging gas connecting pipes 65a, 65b, and 65c in the connecting units 4a, 4b, and 4c.

[0093] Then, the low pressure gas refrigerant which is sent to the merging gas connecting pipes 65a, 65b, and 65c merges due to being sent to the low pressure gas refrigerant communication pipe 9 via the low pressure gas opening and closing valves 67a, 67b, and 67c and the low pressure gas connecting pipes 64a, 64b, and 64c.

[0094] Then, the low pressure gas refrigerant which is sent to the low pressure gas refrigerant communication pipe 9 is returned to the suction side of the compressor 21 via the gas side shutoff valve 33.

[0095] In this manner, an operation in the simultaneous air cooling and air heating operation mode (where the evaporator load is dominant) is performed. Then, in the simultaneous air cooling and air heating operation mode (where the evaporator load is dominant), heat recovery is performed between the usage side heat exchangers 52a, 52b, 52c, and 52d by sending refrigerant from the usage side heat exchanger 52d which functions as a radiator for refrigerant to the usage side heat exchangers 52a, 52b, and 52c which function as evaporators for refrigerant as described above.

<Simultaneous Air Cooling and Air Heating Operation Mode (where the radiator load is dominant)>

[0096] The refrigerant circuit 10 in the air conditioner device 1 is configured as shown in Fig. 9 (for the flow of refrigerant, refer to the arrows which are added to the refrigerant circuit 10 in Fig. 9) during the simultaneous air cooling and air heating operation mode (where the radiator load is dominant) when, for example, the usage units 3a, 3b, and 3c perform an air heating operation and the usage unit 3d performs an air cooling operation (that is, an operation where the usage side heat exchangers 52a, 52b, and 52c function as radiators for refrigerant and the usage side heat exchanger 52d functions as an evaporator for refrigerant) and only the first heat source side heat exchanger 24 functions as an evaporator for refrigerant.

[0097] In detail, in the heat source unit 2, only the first heat source side heat exchanger 24 functions as an evaporator for refrigerant by the first heat exchange switching mechanism 22 switching to an evaporator operation state (a state which is indicated by the dashed line in the first heat exchange switching mechanism 22 in Fig. 9). In addition, the high and low pressure switching mechanism 30 switches to a radiator load dominant operation state (a state which is indicated by the dashed line in the high and low pressure switching mechanism 30 in Fig. 9). In addition, the first heat source side flow amount adjustment valve 26 adjusts its openings, the second heat source side flow amount adjustment valve 27 is in a closed state, and the receiver input opening and closing valve 28c is in an open state. The usage side heat exchangers 52a, 52b, and 52c in the usage units 3a, 3b, and 3c function as radiators for refrigerant and the usage side heat exchanger 52d in the usage unit 3d functions as an evaporator for refrigerant due to the high pressure gas opening and closing valves 66a, 66b, and 66c and the low pressure gas opening and closing valve 67d being in an open state and the high pressure gas opening and closing valve 66d and the low pressure gas opening and closing valves 67a, 67b, and 67c being in a closed state in the connecting units 4a, 4b, 4c, and 4d, and there is a state where the usage side heat exchanger 52d in the usage unit 3d and the suction side of the compressor 21 in the heat source unit 2 are connected via the low pressure gas refrigerant communication pipe 9 and there is a state where the usage side heat exchangers 52a, 52b, and 52c in the usage units 3a, 3b, and 3c and the discharge side of the compressor 21 in the heat source unit 2 are connected via the high and low pressure gas refrigerant communication pipe 8. In the usage units 3a, 3b, 3c, and 3d, the usage side flow amount adjustment valves 51a, 51b, 51c, and 51d adjust their openings.

[0098] In this manner, in the refrigerant circuit 10, high pressure gas refrigerant which is compressed by and discharged from the compressor 21 is sent to the high and low pressure gas refrigerant communication pipe 8 via the high and low pressure switching mechanism 30 and the high and low pressure gas side shutoff valve 32.

[0099] Then, the high pressure gas refrigerant which is sent to the high and low pressure gas refrigerant communication pipe 8 is branched off three ways and is sent to the high pressure gas connecting pipes 63a, 63b, and 63c in each of the connecting units 4a, 4b, and 4c. The high pressure gas refrigerant which is sent to the high pressure gas connecting pipes 63a, 63b, and 63c is sent to the usage side heat exchangers 52a, 52b, and 52c in the usage units 3a, 3b, and 3c via the high pressure gas opening and closing valves 66a, 66b, and 66c and the merging gas connecting pipes 65a, 65b, and 65c.

[0100] Then, the high pressure gas refrigerant which is sent to the usage side heat exchangers 52a, 52b, and 52c releases heat by heat exchange being performed with indoor air which is supplied using the indoor fans 53a, 53b, and 53c in the usage side heat exchangers 52a, 52b, and 52c. At the same time, an air heating operation is performed using the usage units 3a, 3b, and 3c by the indoor air being heated and supplied indoors. The refrigerant which releases heat in the usage side heat exchangers 52a, 52b, and 52c is sent to the liquid connecting pipes 61 a, 61b, and 61c in the connecting units 4a, 4b, and 4c after the flow amount is adjusted in the usage side flow amount adjustment valves 51a, 51b, and 51c.

[0101] Then, the refrigerant which is sent to the liquid connecting pipes 61 a, 61b, and 61c merges by being sent to the liquid refrigerant communication pipe 7.

[0102] A portion of the refrigerant which merges in the liquid refrigerant communication pipe 7 is sent to the liquid connecting pipe 61 d in the connecting unit 4d and the remaining portion of the refrigerant which merges in the liquid refrigerant communication pipe 7 is sent to the receiver 28 via the liquid side shutoff valve 31, the input check valve 29b, and the receiver input opening and closing valve 28c.

[0103] Then, the refrigerant which is sent to the liquid connecting pipe 61d in the connecting unit 4d is sent to the usage side flow amount adjustment valve 51d in the usage unit 3d.

[0104] Then, the refrigerant which is sent to the usage side flow amount adjustment valve 51 d becomes low pressure gas refrigerant by evaporating due to heat exchange being performed with indoor air which is supplied using the indoor fan 53d in the usage side heat exchanger 52d after the flow amount is adjusted in the usage side flow amount adjustment valve 51d. At the same time, an air cooling operation is performed using the usage unit 3d by the indoor air being cooled and supplied indoors. Then, the low pressure gas refrigerant is sent to the merging gas connecting pipe 65d in the connecting unit 4d.

[0105] Then, the low pressure gas refrigerant which is sent to the merging gas connecting pipe 65d is sent to the low pressure gas refrigerant communication pipe 9 via the low pressure gas opening and closing valve 67d and the low pressure gas connecting pipe 64d.

[0106] Then, the low pressure gas refrigerant which is sent to the low pressure gas refrigerant communication pipe 9 is returned to the suction side of the compressor 21 via the gas side shutoff valve 33.

[0107] In addition, the refrigerant which is sent to the receiver 28 is sent to the first heat source side flow amount adjustment valve 26 via the output check valve 29d after being temporarily retained inside the receiver 28. Then, the refrigerant which is sent to the first heat source side flow amount adjustment valve 26 becomes low pressure gas refrigerant by evaporating due to heat exchange being performed with outdoor air which is supplied using the outdoor fan 34 in the first heat source side heat exchanger 24 after the flow amount is adjusted in the first heat source side flow amount adjustment valve 26 and the low pressure gas refrigerant is sent to the first heat exchange switching mechanism 22. Then, the low pressure gas refrigerant which is sent to the first heat exchange switching mechanism 22 is returned to the suction side of the compressor 21 by merging with the low pressure gas refrigerant which is returned to the suction side of the compressor 21 via the low pressure gas refrigerant communication pipe 9 and the gas side shutoff valve 33.

[0108] In this manner, an operation in the simultaneous air cooling and air heating operation mode (where the radiator load is dominant) is performed. Then, in the simultaneous air cooling and air heating operation mode (where the radiator load is dominant), heat recovery is performed between the usage side heat exchangers 52a, 52b, 52c, and 52d by sending refrigerant from the usage side heat exchangers 52a, 52b, and 52c which function as radiators for refrigerant to the usage side heat exchanger 52d which functions as an evaporator for refrigerant as described above.

<Simultaneous Air Cooling and Air Heating Operation Mode (with a balance between the evaporator and the radiator loads)>

[0109] The refrigerant circuit 10 in the air conditioner device 1 is configured as shown in Fig. 10 (for the flow of refrigerant, refer to the arrows which are added to the refrigerant circuit 10 in Fig. 10) during the simultaneous air cooling and air heating operation mode (with a balance between the evaporator and radiator loads) when, for example, the usage units 3a and 3b perform an air cooling operation and the usage units 3c and 3d perform an air heating operation (that is, an operation where the usage side heat exchangers 52a and 52b function as evaporators for refrigerant and the usage side heat exchangers 52c and 52d functions as radiators for refrigerant), the first heat source side heat exchanger 24 functions as a radiator for refrigerant, and the second heat source side heat exchanger 25 functions as an evaporator for refrigerant.

[0110] In detail, in the heat source unit 2, the first heat source side heat exchanger 24 functions as a radiator for refrigerant and the second heat source side heat exchanger 25 functions as an evaporator for refrigerant by the first heat exchange switching mechanism 22 switching to a radiator operation state (a state which is indicated by the solid line in the first heat exchange switching mechanism 22 in Fig. 10) and the second heat exchange switching mechanism 23 switching to an evaporator operation state (a state which is indicated by the dashed line in the second heat exchange switching mechanism 23 in Fig. 10). In addition, the high and low pressure switching mechanism 30 switches to a radiator load dominant operation state (a state which is indicated by the dashed line in the high and low pressure switching mechanism 30 in Fig. 10). In addition, the heat source side flow amount adjustment valves 26 and 27 adjust their openings. The usage side heat exchangers 52a and 52b in the usage units 3a and 3b function as evaporators for refrigerant and the usage side heat exchangers 52c and 52d in the usage units 3c and 3d function as radiators for refrigerant due to the high pressure gas opening and closing valves 66c and 66d and the low pressure gas opening and closing valves 67a and 67b being in an open state and the high pressure gas opening and closing valves 66a and 66b and the low pressure gas opening and closing valves 67c and 67d being in a closed state in the connecting units 4a, 4b, 4c, and 4d, and there is a state where the usage side heat exchangers 52a and 52b in the usage units 3a and 3b and the suction side of the compressor 21 in the heat source unit 2 are connected via the low pressure gas refrigerant communication pipe 9 and there is a state where the usage side heat exchangers 52c and 52d in the usage units 3c and 3d and the discharge side of the compressor 21 in the heat source unit 2 are connected via the high and low pressure gas refrigerant communication pipe 8. In the usage units 3a, 3b, 3c, and 3d, the usage side flow amount adjustment valves 51a, 51 b, 51 c, and 51 d adjust their openings.

[0111] In this manner, in the refrigerant circuit 10, a portion of the high pressure gas refrigerant which is compressed by and discharged from the compressor 21 is sent to the high and low pressure gas refrigerant communication pipe 8 via the high and low pressure switching mechanism 30 and the high and low pressure gas side shutoff valve 32 and the remaining portion of the high pressure gas refrigerant which is compressed by and discharged from the compressor 21 is sent to the first heat source side heat exchanger 24 via the first heat exchange switching mechanism 22.

[0112] Then, the high pressure gas refrigerant which is sent to the high and low pressure gas refrigerant communication pipe 8 is sent to the high pressure gas connecting pipe s 63c and 63d in the connecting units 4c and 4d. The high pressure gas refrigerant which is sent to the high pressure gas connecting pipes 63c and 63d is sent to the usage side heat exchangers 52c and 52d in the usage units 3c and 3d via the high pressure gas opening and closing valves 66c and 66d and the merging gas connecting pipes 65c and 65d.

[0113] Then, the high pressure gas refrigerant which is sent to the usage side heat exchangers 52c and 52d releases heat by heat exchange being performed with indoor air which is supplied using the indoor fans 53c and 53d in the usage side heat exchangers 52c and 52d. At the same time, an air heating operation is performed using the usage units 3c and 3d by the indoor air being heated and supplied indoors. The refrigerant which releases heat in the usage side heat exchangers 52c and 52d is sent to the liquid connecting pipes 61c and 61 d in the connecting units 4c and 4d after the flow amount is adjusted in the usage side flow amount adjustment valves 51 c and 51 d.

[0114] The refrigerant which is sent to the liquid connecting pipes 61c and 61 d with heat being released in the usage side heat exchangers 52c and 52d merges by being sent to the liquid refrigerant communication pipe 7.

[0115] Then, the refrigerant which merges in the liquid refrigerant communication pipe 7 is branched off two ways and is sent to the liquid connecting pipes 61a and 61 b in each of the connecting units 4a and 4b. Then, the refrigerant which is sent to the liquid connecting pipes 61 a and 61 b is sent to the usage side flow amount adjustment valves 51 a and 51 b in the usage units 3a and 3b.

[0116] Then, the refrigerant which is sent to the usage side flow amount adjustment valves 51 a and 51 b becomes low pressure gas refrigerant by evaporating due to heat exchange being performed with indoor air which is supplied using the indoor fans 53a and 53b in the usage side heat exchangers 52a and 52b after the flow amount is adjusted in the usage side flow amount adjustment valves 51a and 51b. At the same time, an air cooling operation is performed using the usage units 3a and 3b by the indoor air being cooled and supplied indoors. Then, the low pressure gas refrigerant is sent to the merging gas connecting pipes 65a and 65b in the connecting units 4a and 4b.

[0117] Then, the low pressure gas refrigerant which is sent to the merging gas connecting pipes 65a and 65b merges due to being sent to the low pressure gas refrigerant communication pipe 9 via the low pressure gas opening and closing valves 67a and 67b and the low pressure gas connecting pipes 64a and 64b.
[0118] Then, the low pressure gas refrigerant which is sent to the low pressure gas refrigerant communication pipe 9 is returned to the suction side of the compressor 21 via the gas side shutoff valve 33.
[0119] In addition, the high pressure gas refrigerant which is sent to the first heat source side heat exchanger 24 releases heat by heat exchange being performed with outdoor air which is the heat source which is supplied using the outdoor fan 34 in the first heat source side heat exchanger 24. Then, most of the refrigerant which releases heat in the first heat source side heat exchanger 24 is sent to the second heat source side flow amount adjustment valve 27 after passing through the first heat source side flow amount adjustment valve 26. For this reason, there is a state where the refrigerant which releases heat in the first heat source side heat exchanger 24 is not sent to the liquid refrigerant communication pipe 7 via the receiver 28, the bridge circuit 29, and the liquid side shutoff valve 31. Then, the refrigerant which is sent to the second heat source side flow amount adjustment valve 27 becomes low pressure gas refrigerant by evaporating due to heat exchange being performed with outdoor air which is supplied using the outdoor fan 34 in the second heat source side heat exchanger 25 after the flow amount is adjusted in the second heat source side flow amount adjustment valve 27 and the low pressure gas refrigerant is sent to the second heat exchange switching mechanism 23. Then, the low pressure gas refrigerant which is sent to the second heat exchange switching mechanism 23 is returned to the suction side of the compressor 21 by merging with the low pressure gas refrigerant which is returned to the suction side of the compressor 21 via the low pressure gas refrigerant communication pipe 9 and the gas side shutoff valve 33.
[0120] In this manner, an operation in the simultaneous air cooling and air heating operation mode (with a balance between the evaporator and radiator loads) is performed. Then, in the simultaneous air cooling and air heating operation mode (with a balance between the evaporator and radiator loads), heat recovery is performed between the usage side heat exchangers 52a, 52b, 52c, and 52d by sending refrigerant from the usage side heat exchangers 52c and 52d which function as radiators for refrigerant to the usage side heat exchangers 52a and 52b which function as evaporators for refrigerant as described above. In addition, in the simultaneous air cooling and air heating operation mode (with a balance between the evaporator and radiator loads), a countermeasure is performed so that the evaporator load and the radiator load of the two heat source side heat exchangers 24 and 25 cancelling each other out by the first heat source side heat exchanger 24 functioning as a radiator for refrigerant and the second heat source side heat exchanger 25 functioning as an evaporator for refrigerant as described above.

(3) Characteristics of Heat Recovery Refrigeration Device (Simultaneous Air Cooling and Air Heating Operation Air Conditioner Device)

[0121] The simultaneous air cooling and air heating operation air conditioner device 1 has the following characteristics.

<A> Here, firstly, the heat exchange capacity of the second heat source side heat exchanger 25 is equal to or more than 1.8 times of the first heat source side heat exchanger 24 as described above. For this reason, it is possible to widen the range over which it is possible to reduce the heat load in a case where only the first heat source side heat exchanger 24 where the heat exchange capacity is small functions as an evaporator or a radiator for refrigerant in, for example, the air cooling operation mode (where the evaporator load is small), the simultaneous air cooling and air heating operation mode (where the evaporator load is dominant), the air heating operation mode (where the radiator load is small), and the simultaneous air cooling and air heating operation mode (where the radiator load is dominant) described above, compared to a case where the ratio of heat exchange capacities of the heat source side heat exchangers is small as in the background art. Due to this, it is possible to provide a countermeasure for a case where the heat load over all of the plurality of usage side heat exchangers 52a, 52b, 52c, and 52d is small. Moreover, here, the heat exchange capacity of the second heat source side heat exchanger 25 is equal to or less than 4.0 times of the first heat source side heat exchanger 24 as described above. For this reason, it is possible for the flow amount of refrigerant which flows through the two heat source side heat exchangers 24 and 25 as well as the operation capacity of the compressor 21 to not become large in a case of performing the countermeasure where one out of the two heat source side heat exchangers 24 and 25 functions as an evaporator for refrigerant and the other out of the two heat source side heat exchangers 24 and 25 functions as a radiator for refrigerant, and the evaporator load and the radiator load of the two heat source side heat exchangers 24 and 25 cancel each other out in, for example, the simultaneous air cooling and air heating operation mode (with a balance between the evaporator and radiator loads) described above. Due to this, it is possible to provide a countermeasure for a case where the heat load over all of the plurality of usage side heat exchangers 52a, 52b, 52c, and 52d is small while suppressing reductions in operation performance.
Here, in this manner, it is possible to provide a countermeasure for a case where the heat load over all of the plurality of usage side heat exchangers 52a, 52b, 52c, and 52d is small while suppressing reductions in operation perform-

ance.

<B> Here, firstly, the two heat source side heat exchangers 24 and 25 are arranged to be above and below each other as described above. At this time, there is a tendency for it to be easy for liquid refrigerant to stagnate due to the head difference between the two heat source side heat exchangers in the heat source side heat exchanger which is arranged on the lower side compared to the heat source side heat exchanger which is arranged on the upper side. For this reason, when assuming that the first heat source side heat exchanger 24 is arranged at the lower side, there is a concern that the desired heat exchange performance will not be obtained due to a state being generated where all of the first heat source side heat exchanger 24 is filled with liquid refrigerant (set below as "liquid sink") since the heat exchange capacity is small.

Therefore, here, the first heat source side heat exchanger 24 where the heat exchange capacity is small is arranged more to the upper side than the second heat source side heat exchanger 25 where the heat exchange capacity is large as described above. For this reason, the second heat source side heat exchanger 25 where the heat exchange capacity is large is arranged on the lower side and it is possible for it to be difficult for liquid sink to be generated. Due to this, it is possible for a desired heat exchange performance to be exhibited in both of the heat exchange side heat exchangers 24 and 25 in a case where the two heat source side heat exchangers 24 and 25 are arranged to be above and below each other.

<C> Here, in regard to connecting the heat source side flow amount adjustment valves 26 and 27 with the liquid side of each of heat source side heat exchangers 24 and 25, the second heat source side flow amount adjustment valve 27 is used so that the rated Cv value is larger than the first heat source side flow amount adjustment valve 26. Due to this, it is possible to appropriately adjust the flow amount of refrigerant which flows through each of the heat source side heat exchangers 24 and 25 according to the heat exchange capacities of each of the heat source side heat exchangers 24 and 25.

<D> Here, in regard to providing the headers on the gas side of each of the heat source side heat exchangers 24 and 25, the second header 25a is used so that the flow path cross sectional area is larger than the first header 24a as described above. Due to this, it is possible to appropriately perform merging and branching of refrigerant between the plurality of heat transfer tubes which configure each of the heat source side heat exchangers 24 and 25 and the headers 24a and 25a according to the heat exchange capacities of each of the heat source side heat exchangers 24 and 25.

(4) Modified Examples

[0122] The example of the configuration of the simultaneous air cooling and air heating operation air conditioner device 1 is exemplified and described in the embodiment described above as the heat recovery refrigeration device where the present invention is applied but the present invention is not limited to this. That is, it is possible for the present invention to be applied as long as it is a configuration where a compressor, a plurality of heat source side heat exchangers, and a plurality of usage side heat exchangers are included and it is possible to perform heat recovery between the usage side heat exchangers by sending refrigerant from the usage side heat exchanger which functions as a radiator for refrigerant to the usage side heat exchanger which functions as an evaporator for refrigerant.

INDUSTRIAL APPLICABILITY

[0123] It is possible for the present invention to be widely applied with regard to heat recovery refrigeration devices which include a compressor, a plurality of heat source side heat exchangers, and a plurality of usage side heat exchangers, and which is able to perform heat recovery between the usage side heat exchangers by sending refrigerant from the usage side heat exchanger which functions as a radiator for refrigerant to the usage side heat exchanger which functions as an evaporator for refrigerant.

REFERENCE SIGNS LIST

[0124]

1	SIMULTANEOUS AIR COOLING AND AIR HEATINGOPERATION AIR CONDITIONER DEVICE (HEAT RECOVERY REFRIGERATION DEVICE)
21	COMPRESSOR
24	FIRST HEAT SOURCE SIDE HEAT EXCHANGER
24a	FIRST HEADER
25	SECOND HEAT SOURCE SIDE HEAT EXCHANGER
25a	SECOND HEADER

26	FIRST HEAT SOURCE SIDE FLOW AMOUNT ADJUSTMENT VALVE
27	SECOND HEAT SOURCE SIDE FLOW AMOUNT ADJUSTMENT VALVE
52a, 52b, 52c, 52d	USAGE SIDE HEAT EXCHANGER

CITATION LIST

PATENT LITERATURE

<Patent Literature 1> Japanese Laid-open Patent Application Publication No. H5-332637

Claims

1. A heat recovery refrigeration device (1) which includes a compressor (21), a plurality of heat source side heat exchangers (24, 25) which are able to switch between individually functioning as an evaporator or a radiator for refrigerant, and a plurality of usage side heat exchangers (52a, 52b, 52c, 52d) which are able to switch between individually functioning as an evaporator or a radiator for the refrigerant, and which is able to perform heat recovery between the usage side heat exchangers by sending the refrigerant from the usage side heat exchanger which functions as a radiator for the refrigerant to the usage side heat exchanger which functions as an evaporator for the refrigerant, wherein
the plurality of heat source side heat exchangers have a first heat source side heat exchanger and a second heat source side heat exchanger which has a heat exchange capacity which is 1.8 times to 4.0 times of the first heat source side heat exchanger.

2. The heat recovery refrigeration device (1) according to claim 1, wherein

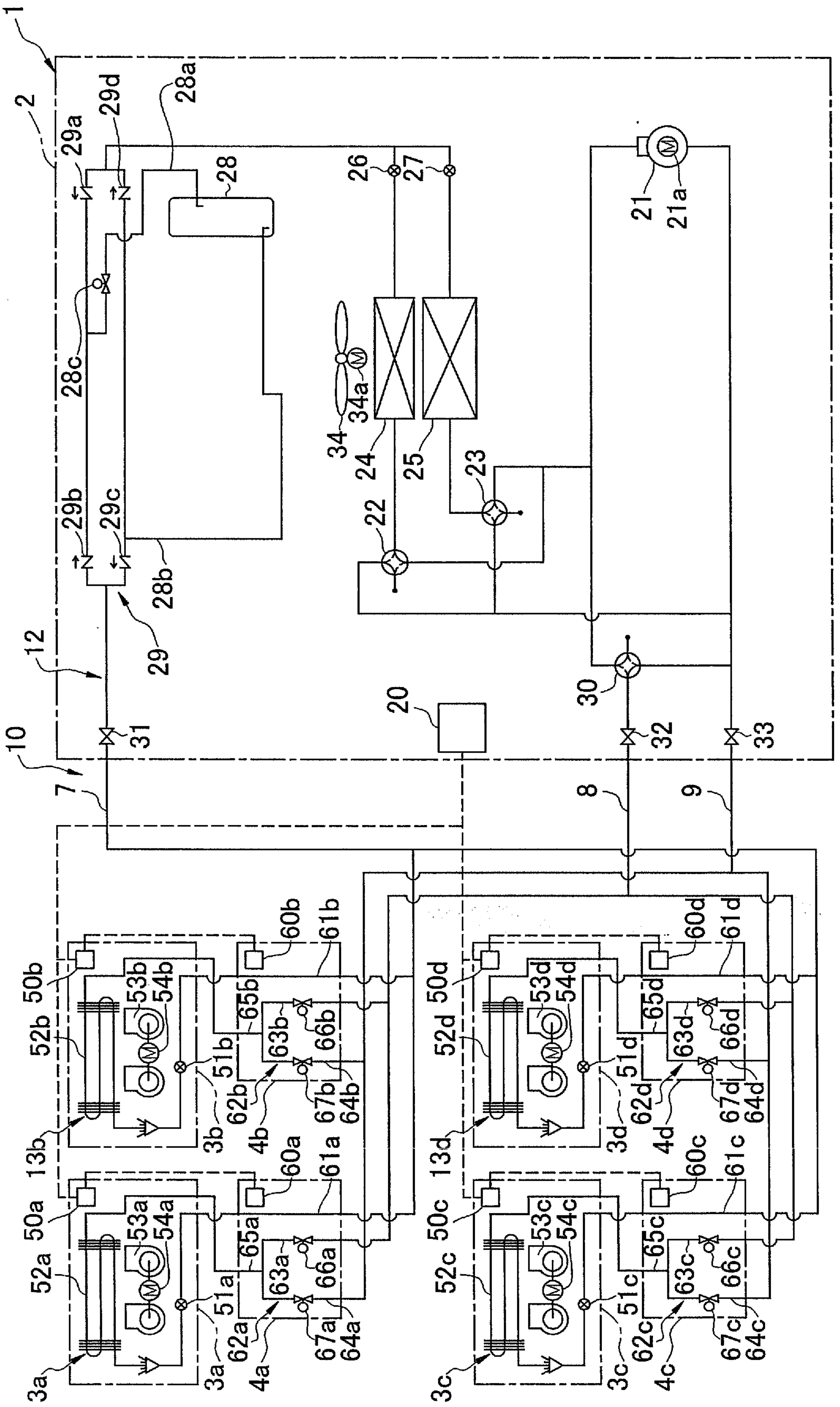
   the first heat source side heat exchanger (24) is arranged more to the upper side than the second heat source side heat exchanger (25).

3. The heat recovery refrigeration device (1) according to claim 1 or 2, wherein

   a first heat source side flow amount adjustment valve (26), where adjustment to its opening is possible, is connected with a liquid side of the first heat source side heat exchanger (24),
   a second heat source side flow amount adjustment valve (27), where adjustment to its opening is possible, is connected with a liquid side of the second heat source side heat exchanger (25), and
   a rated Cv value of the second heat source side flow amount adjustment valve is larger than a rated Cv of the first heat source side flow amount adjustment valve.

4. The heat recovery refrigeration device (1) according to any one of claims 1 to 3, wherein

   a first header (24a), which is for performing merging and branching of the refrigerant between a plurality of heat transfer tubes which configure the first heat source side heat exchanger (24), is provided on a gas side of the first heat source side heat exchanger,
   a second header (25a), which is for performing merging and branching of the refrigerant between a plurality of heat transfer tubes which configure the second heat source side heat exchanger (25), is provided on a gas side of the second heat source side heat exchanger, and
   a flow path cross sectional area of the second header is larger than a flow path cross sectional area of the first header.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62d
67d
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13d
3d
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FIG. 1

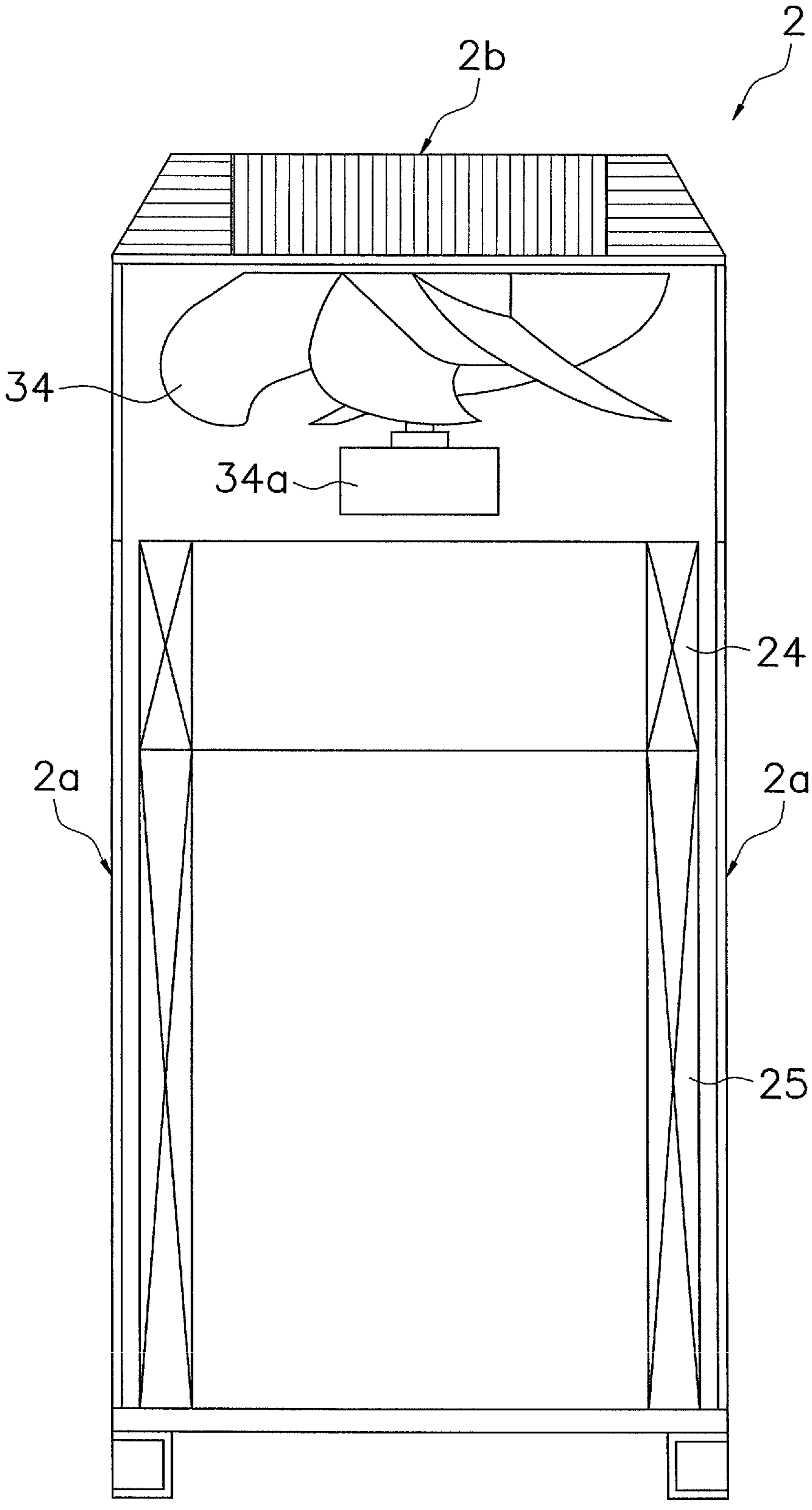
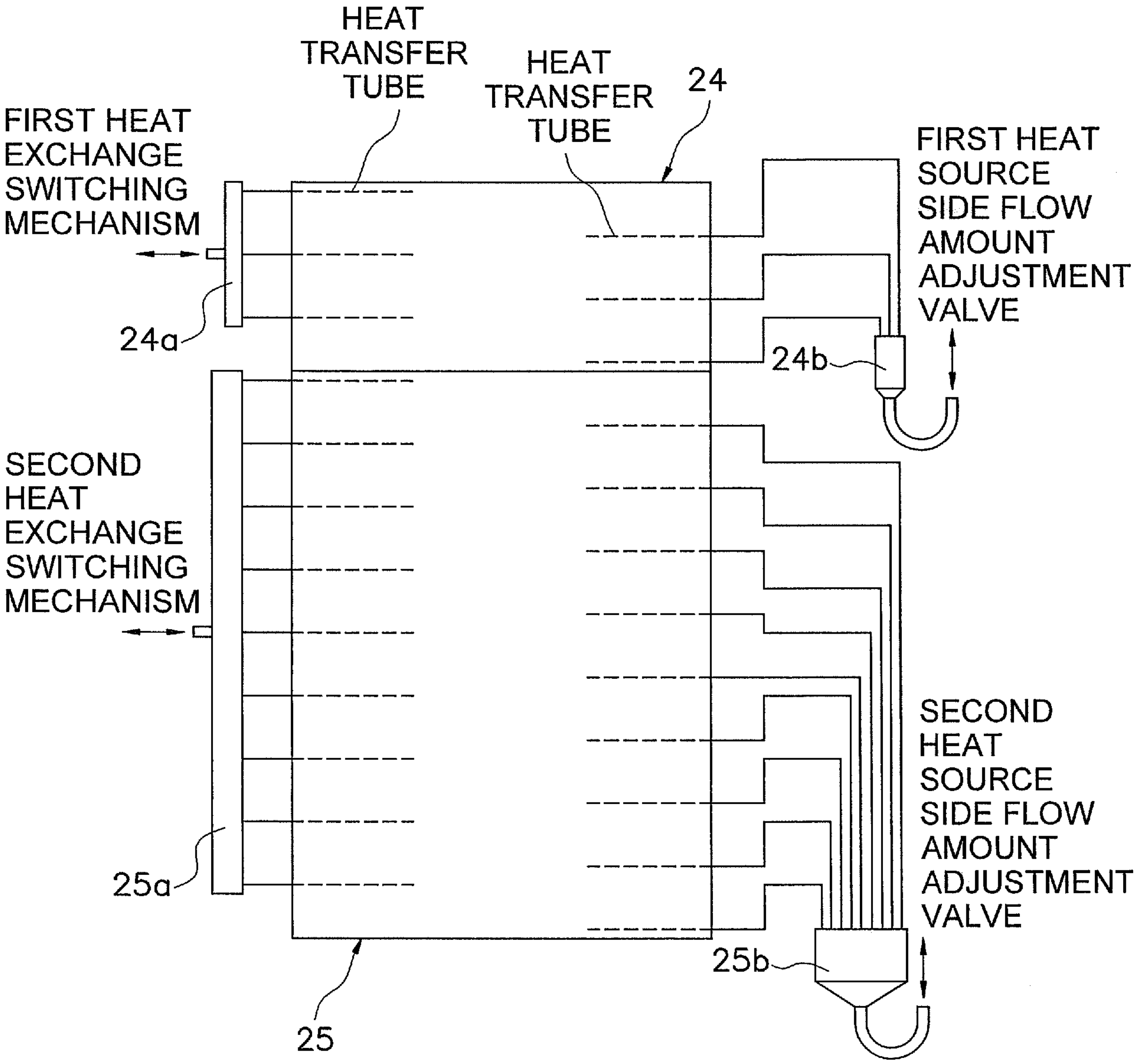


FIG. 2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AMOUNT
ADJUSTMENT
VALVE
24b
SECOND
HEAT
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SWITCHING
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AMOUNT
ADJUSTMENT
VALVE
25b
25

FIG. 3

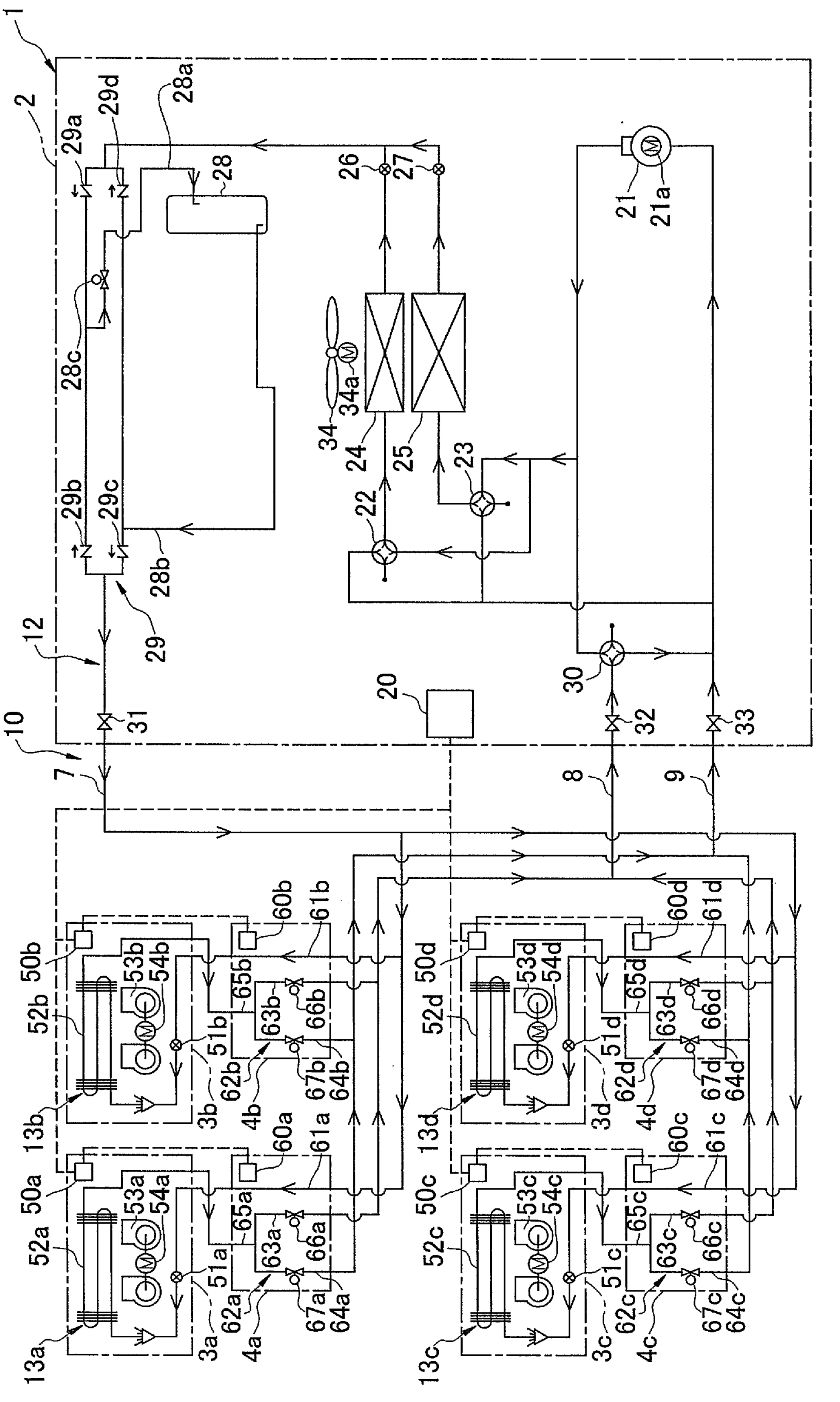
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FIG. 4

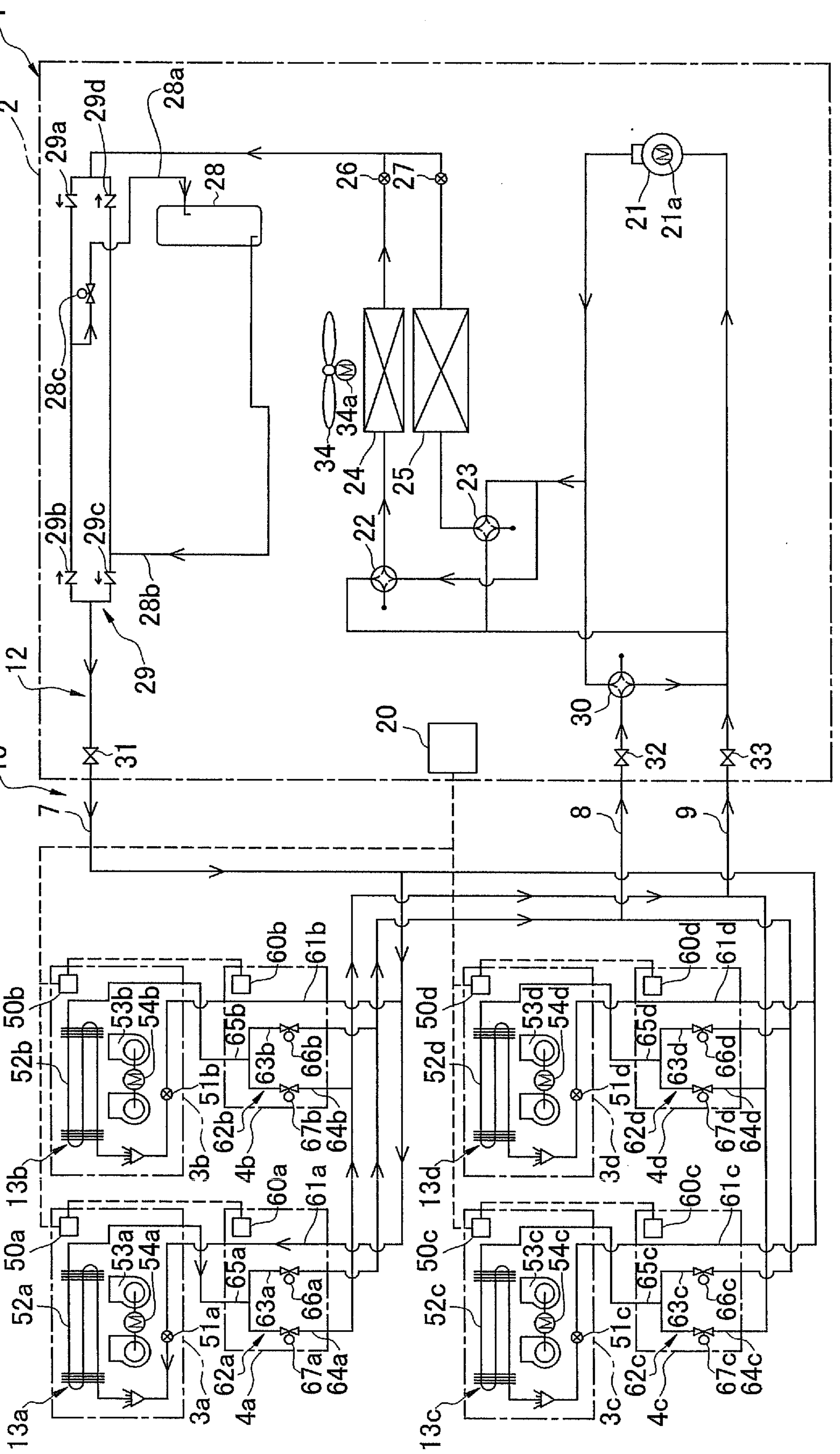
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FIG. 5

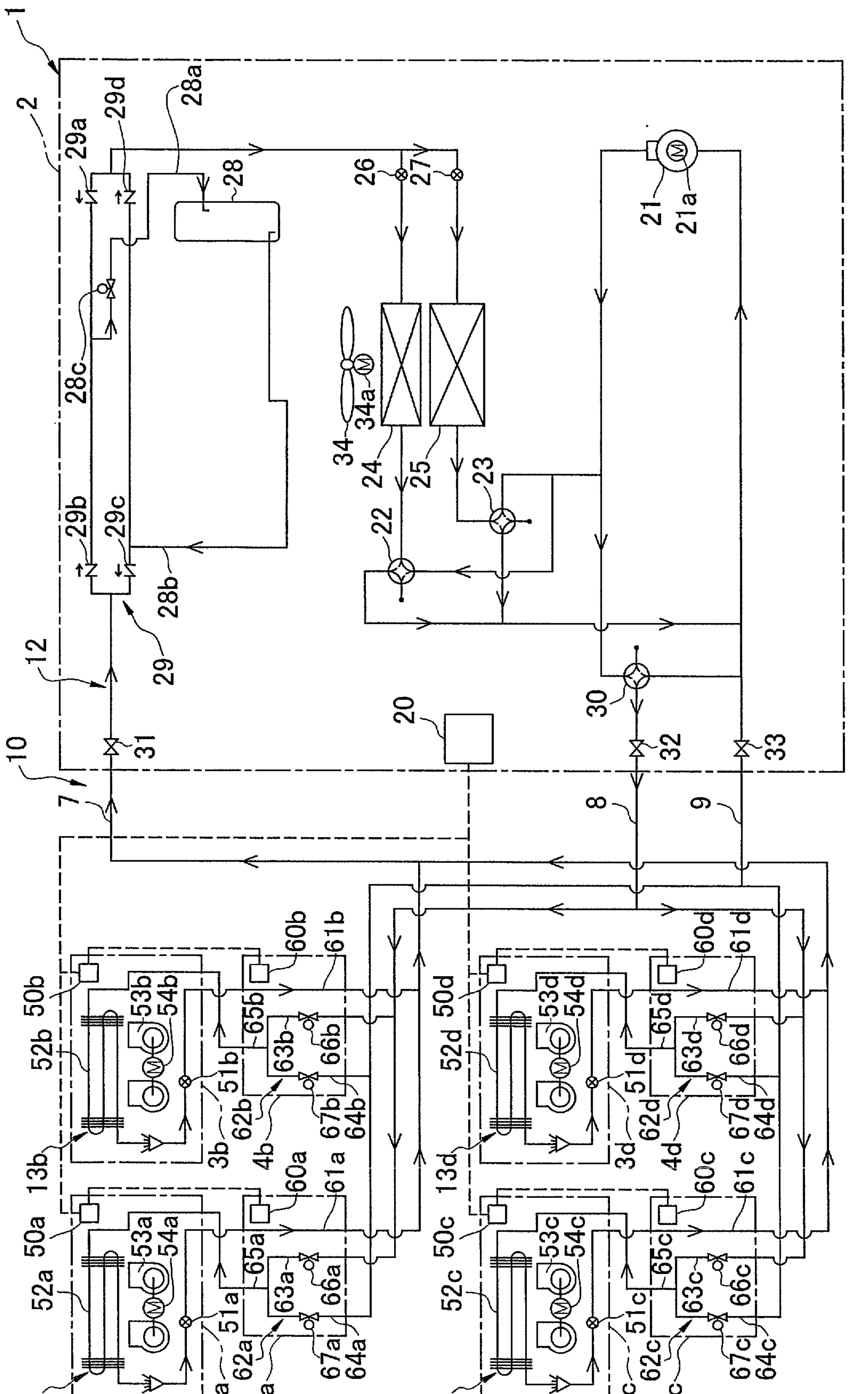
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FIG. 6

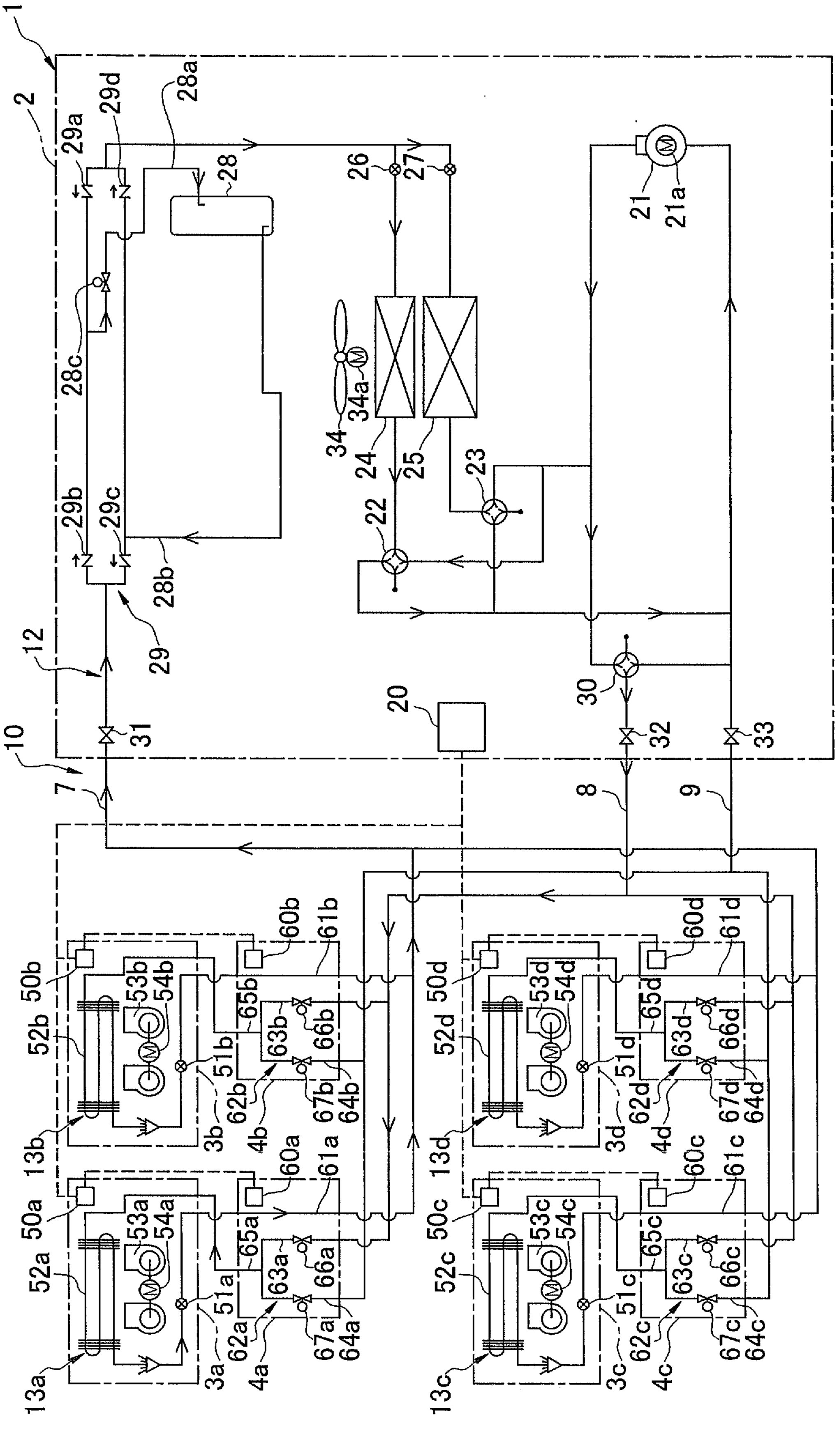
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FIG. 7

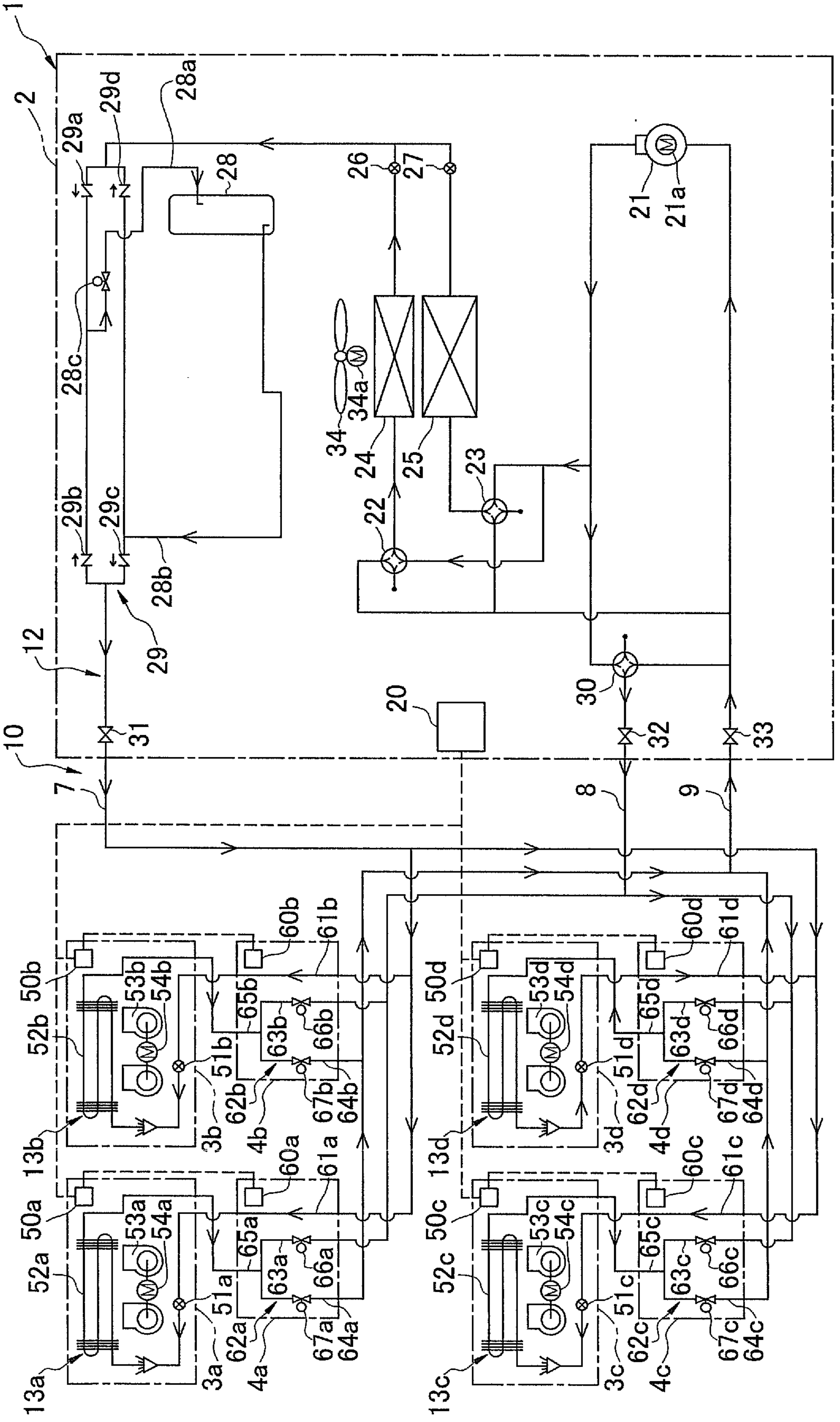
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FIG. 8

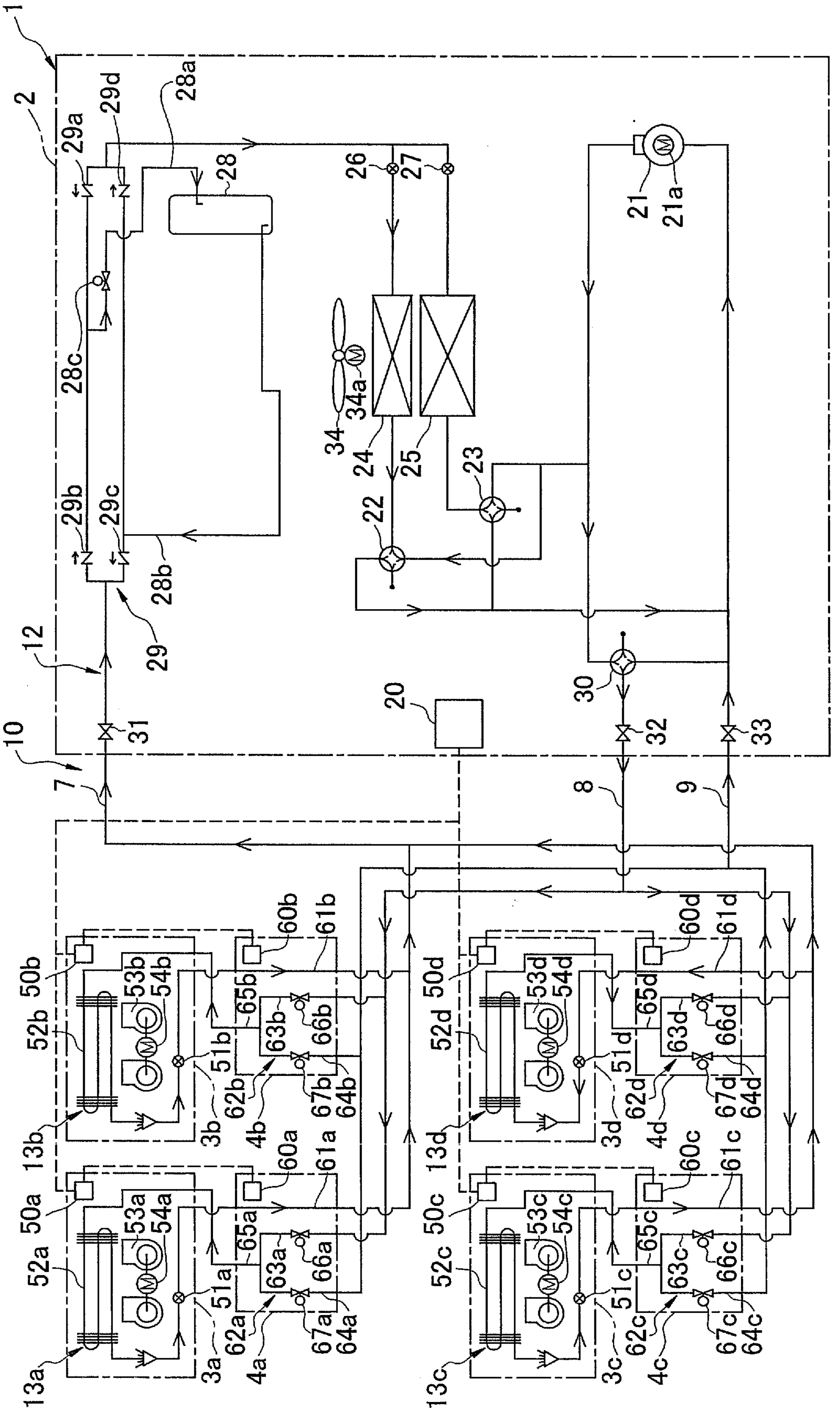
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FIG. 9

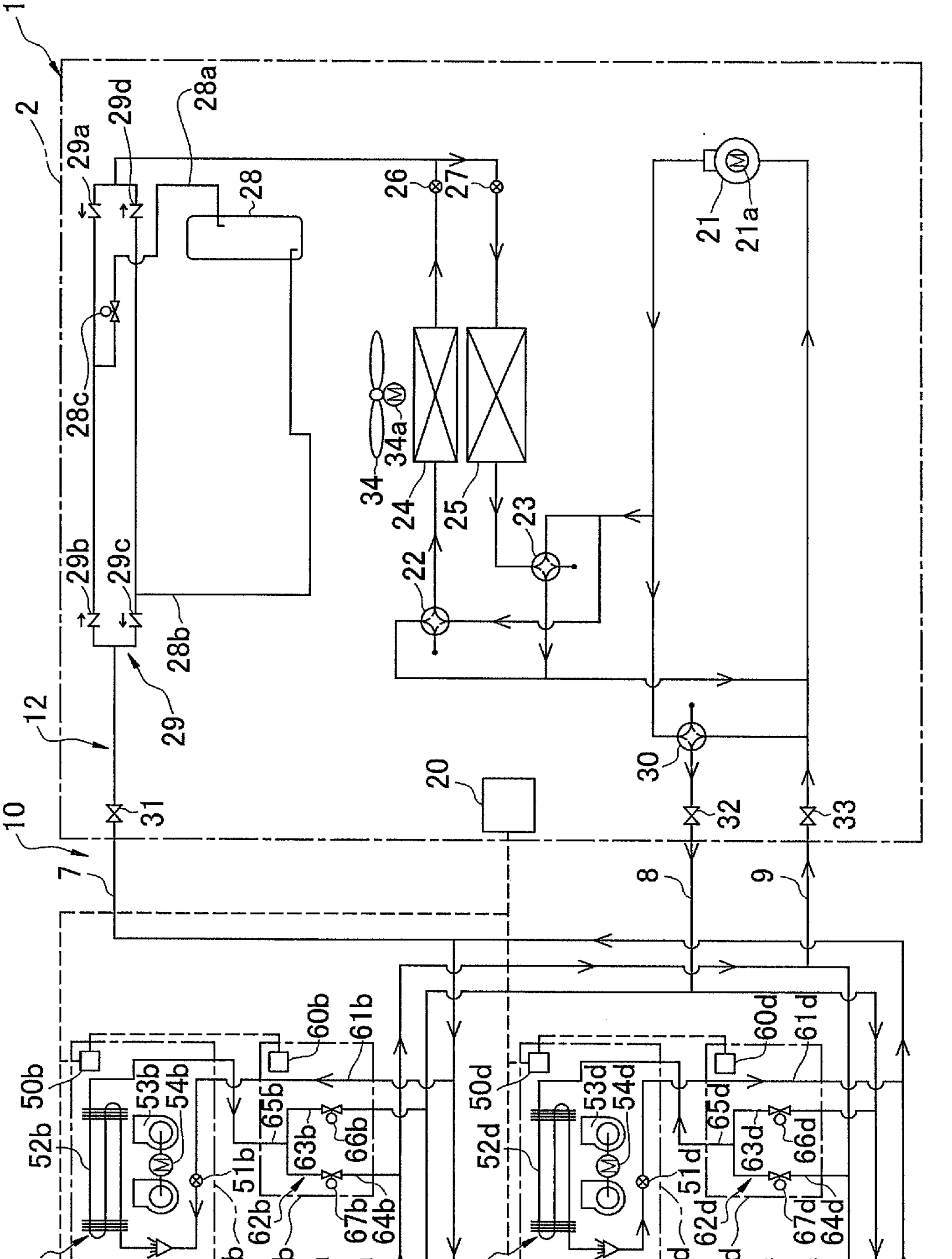
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FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/072737

A. CLASSIFICATION OF SUBJECT MATTER
F24F1/16(2011.01)i, *F24F1/14*(2011.01)i, *F25B5/02*(2006.01)i, *F25B6/02* (2006.01)i, *F25B13/00*(2006.01)i, *F25B39/00*(2006.01)i

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)
F24F1/16, F24F1/14, F25B5/02, F25B6/02, F25B13/00, F25B39/00

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2014
Kokai Jitsuyo Shinan Koho	1971-2014	Toroku Jitsuyo Shinan Koho	1994-2014

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.
Y	JP 5-332637 A (Sanyo Electric Co., Ltd.), 14 December 1993 (14.12.1993), paragraphs [0010] to [0024]; fig. 1 to 2 (Family: none)	1-4
Y	JP 2004-286253 A (Sanyo Electric Co., Ltd.), 14 October 2004 (14.10.2004), paragraphs [0007], [0011] (Family: none)	1-4
Y	JP 2008-249236 A (Mitsubishi Electric Corp.), 16 October 2008 (16.10.2008), paragraph [0060] (Family: none)	3

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

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"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
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"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
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 November, 2014 (11.11.14)	18 November, 2014 (18.11.14)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/072737

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2001-141379 A (Showa Aluminum Corp.), 25 May 2001 (25.05.2001), paragraphs [0014] to [0015]; fig. 1 (Family: none)	4
A	JP 2001-304719 A (Korea Institute of Machinery & Materials), 31 October 2001 (31.10.2001), paragraph [0024] & KR 10-2001-0096132 A	4
A	JP 4-64879 A (Hitachi, Ltd.), 28 February 1992 (28.02.1992), page 5, lower right column, line 13 to page 6, upper left column, line 16 (Family: none)	4
A	WO 2004/025207 A1 (GAC Corp.), 25 March 2004 (25.03.2004), page 19, line 16 to page 20, line 3; fig. 13 & US 2006/0048928 A1 & EP 1548387 A1 & AU 2003262034 A & CN 1682089 A	4

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REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- JP H5332637 B **[0002]**