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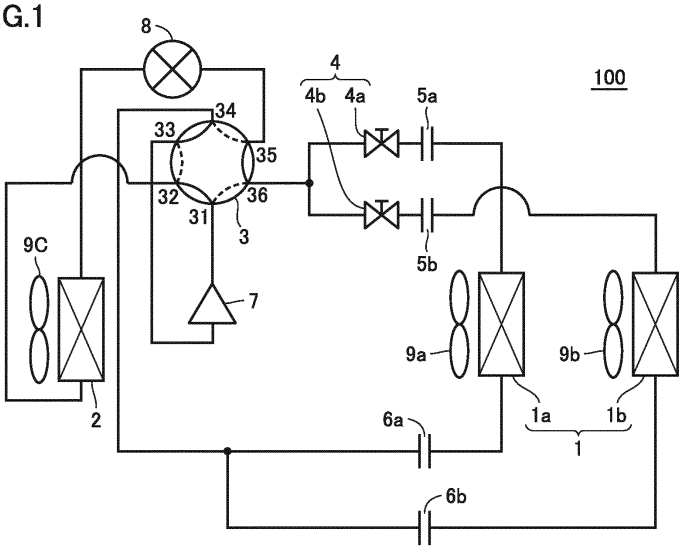
(54) REFRIGERATION CYCLE DEVICE

(57) Provided is a refrigeration cycle apparatus in which, even when it is placed in a state where some indoor units are operated and other indoor units are stopped, refrigerant is suppressed from stagnating in the stopped indoor units. The refrigeration cycle apparatus includes a plurality of indoor heat exchangers (1a, 1b) exchanging heat between refrigerant and air, an outdoor heat exchanger (2) exchanging heat between the refrigerant and air, a six-way valve (3) switching a flow path of the refrigerant, a compressor (7) for compressing the refrigerant, and a shut-off valve (4a, 4b) configured to be capable of shutting off a flow of the refrigerant. The plurality of indoor heat exchangers are connected with the outdoor heat exchanger via the six-way valve. The plurality of indoor heat exchangers are arranged in parallel and connected with the six-way valve. At least one of the plurality of indoor heat exchangers is connected with the six-way valve via the shut-off valve.

FIG.1



EP 3 379 176 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a refrigeration cycle apparatus, and in particular to a refrigeration cycle apparatus including a plurality of indoor heat exchangers,

BACKGROUND ART

[0002] Conventionally, there is a heat pump air conditioner which includes a six-way valve and an expansion valve, and can achieve thermal counterflow heat exchange for an outdoor unit or an indoor/outdoor unit both at the time of cooling and at the time of heating (see Japanese Patent Laying-Open No. 8-170864, and Japanese Patent Laying-Open No. 8-170865).

CITATION LIST

PATENT DOCUMENT

[0003]

PTD 1: Japanese Patent Laying-Open No. 8-170864
PTD 2: Japanese Patent Laying-Open No. 8-170865

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004] However, a conventional heat pump air conditioner has a problem that, when it is applied to a refrigeration cycle apparatus including a plurality of indoor units provided to be individually switchable between an operation action and a stop action, and the refrigeration cycle apparatus is placed in a state where some of the indoor units are operated and the other indoor units are stopped, refrigerant stagnates in the stopped indoor units.

[0005] The present invention has been made to solve the aforementioned problem. A main object of the present invention is to provide a refrigeration cycle apparatus which includes a plurality of indoor units provided to be individually switchable between an operation action and a stop action, and in which, even when it is placed in a state where some of the indoor units are operated and the other indoor units are stopped, refrigerant is suppressed from stagnating in the stopped indoor units.

SOLUTION TO PROBLEM

[0006] A refrigeration cycle apparatus in accordance with the present invention includes a plurality of indoor heat exchangers exchanging heat between refrigerant and indoor air, an outdoor heat exchanger exchanging heat between the refrigerant and outdoor air, a six-way valve switching a flow path of the refrigerant, a compressor for compressing the refrigerant, and a shut-off valve configured to be capable of shutting off a flow of the refrigerant. The plurality of indoor heat exchangers are connected with the outdoor heat exchanger via the six-way valve. The plurality of indoor heat exchangers are arranged in parallel and connected with the six-way valve. At least one of the plurality of indoor heat exchangers is connected with the six-way valve via the shut-off valve.

ADVANTAGEOUS EFFECTS OF INVENTION

[0007] According to the present invention, there can be provided a refrigeration cycle apparatus in which, even when it includes a plurality of indoor units provided to be individually switchable between an operation action and a stop action, and it is placed in a state where some of the indoor units are operated and the other indoor units are stopped, refrigerant is suppressed from stagnating in the stopped indoor units.

BRIEF DESCRIPTION OF DRAWINGS

[0008]

Fig. 1 is a view showing a refrigeration cycle apparatus in accordance with a first embodiment.
Fig. 2 is a cross sectional view showing a six-way valve in the refrigeration cycle apparatus in accordance with the first embodiment, at the time of cooling operation.
Fig. 3 is a cross sectional view showing the six-way valve in the refrigeration cycle apparatus in accordance with the first embodiment, at the time of heating operation.
Fig. 4 is a view showing a variation of the six-way valve in the refrigeration cycle apparatus in accordance with the first embodiment.
Fig. 5 is a view showing states of the six-way valve shown in Fig. 4 at the time of cooling operation and at the time of heating operation.
Fig. 6 is a view showing a refrigeration cycle apparatus in accordance with a second embodiment.

DESCRIPTION OF EMBODIMENTS

[0009] Hereinafter, embodiments of the present invention will be described with reference to the drawings. It should be noted that, in the drawings below, identical or corresponding parts will be designated by the same reference numerals, and the description thereof will not be repeated.

(First Embodiment)

<Configuration of Refrigeration Cycle Apparatus>

[0010] Next, a refrigeration cycle apparatus 100 in accordance with a first embodiment will be described with

reference to Fig. 1. Refrigeration cycle apparatus 100 includes a plurality of indoor heat exchangers 1 (1a, 1b), an outdoor heat exchanger 2, a six-way valve 3, shut-off valves 4 (4a, 4b), extension pipes 5 (5a, 5b) and 6 (6a, 6b), a compressor 7, an expansion valve (a second expansion valve) 8, and fans 9a, 9b, and 9c. In refrigeration cycle apparatus 100, the plurality of indoor heat exchangers 1, outdoor heat exchanger 2, six-way valve 3, shut-off valves 4, extension pipes 5 and 6, compressor 7, and expansion valve (the second expansion valve) 8 are connected with one another, and constitute a refrigerant circuit in which refrigerant circulates. Refrigeration cycle apparatus 100 includes a plurality of shut-off valves 4a and 4b. All indoor heat exchangers 1a and 1b are connected with six-way valve 3 via shut-off valves 4a and 4b, respectively.

[0011] The plurality of indoor heat exchangers 1a and 1b are provided to be individually switchable between an operated state and a stopped state. The plurality of indoor heat exchangers 1a and 1b each exchange heat between the refrigerant and indoor air, in the operated state. The plurality of indoor heat exchangers 1a and 1b are arranged in parallel and connected with six-way valve 3. Entry sides of the plurality of indoor heat exchangers 1a and 1b are each connected with a port 36 of six-way valve 3, and exit sides of the plurality of indoor heat exchangers 1a and 1b are each connected with a port 34 of six-way valve 3.

[0012] Outdoor heat exchanger 2 exchanges heat between the refrigerant and outdoor air. Six-way valve 3 is provided to be capable of switching between a cooling cycle state at the time of cooling operation (see solid lines in Fig. 1) and a heating cycle state at the time of heating operation (see broken lines in Fig. 1), in response to a control signal from a control device (not shown). The plurality of indoor heat exchangers 1a and 1b are connected with outdoor heat exchanger 2 via six-way valve 3.

[0013] Referring to Figs. 2 and 3, six-way valve 3 is configured as a sliding-type switching valve, for example. Six-way valve 3 has a valve main body 30 which is a hollow frame body, and six ports 31, 32, 33, 34, 35, and 36 connected to valve main body 30. Five ports 32, 33, 34, 35, and 36 are arranged in an extending direction of valve main body 30, on a side opposite to port 31 with respect to valve main body 30. Port 31 is connected with a discharge side of compressor 7. Port 32 is connected with outdoor heat exchanger 2. Port 32 is connected with an entry side of outdoor heat exchanger 2 at the time of cooling operation, and an exit side of outdoor heat exchanger 2 at the time of heating operation. Port 33 is connected with a suction side of compressor 7. Port 34 is connected with the exit sides of the plurality of indoor heat exchangers 1a and 1b. Port 35 is connected with outdoor heat exchanger 2 via expansion valve 8. Port 35 is connected with an exit side of outdoor heat exchanger 2 at the time of cooling operation, and an entry side of outdoor heat exchanger 2 at the time of heating operation. Port 36 is connected with the entry sides of the plurality of indoor heat exchangers 1a and 1b.

[0014] In valve main body 30, a slide valve body 39 which is slidable in the extending direction described above is provided. Two pipelines are provided in slide valve body 39. The two pipelines in slide valve body 39 are each provided to be capable of connecting two ports of five ports 32, 33, 34, 35, and 36. In valve main body 30, two flow paths in slide valve body 39, and one flow path between port 31 and one port which is not connected with the two pipelines on the outside of slide valve body 39 are formed.

[0015] As shown in Fig. 2, in six-way valve 3, at the time of cooling operation, connection is established between port 31 and port 32, between port 33 and port 34, and between port 35 and port 36. As shown in Fig. 3, in six-way valve 3, at the time of heating operation, connection is established between port 31 and port 36, between port 32 and port 33, and between port 34 and port 35. Port 36 of six-way valve 3 functions as an outflow port which flows out the refrigerant to indoor heat exchangers 1a and 1b, whether at the time of cooling operation or at the time of heating operation. Port 34 of six-way valve 3 is provided such that the refrigerant can flow thereinto from indoor heat exchangers 1a and 1b, whether at the time of cooling operation or at the time of heating operation.

[0016] A pipe which connects port 36 of six-way valve 3 and indoor heat exchangers 1a and 1b has a portion connected to port 32, and portions which are branched from the portion connected to port 36, are configured to be parallel to each other, and are connected to indoor heat exchangers 1a and 1b, respectively. Shut-off valve 4a and extension pipe 5a are provided in the portion connected to indoor heat exchanger 1a, of the pipe which connects port 36 of six-way valve 3 and indoor heat exchangers 1a and 1b. Shut-off valve 4b and extension pipe 5b are provided in the portion connected to indoor heat exchanger 1b, of the pipe which connects port 36 of six-way valve 3 and indoor heat exchangers 1a and 1b.

[0017] Shut-off valves 4a and 4b are each provided to be capable of independently shutting off a flow of the refrigerant. Shut-off valve 4a is provided on the pipe which connects port 36 of six-way valve 3 and indoor heat exchanger 1a, as described above, and is provided to be capable of closing the pipe. Shut-off valve 4b is provided on the pipe which connects port 36 of six-way valve 3 and indoor heat exchanger 1b, as described above, and is provided to be capable of closing the pipe. Shut-off valves 4a and 4b may each have any configuration as long as they are provided to be capable of controlling closing or opening of the pipe, and are each configured as a solenoid valve, for example. Shut-off valves 4a and 4b are provided, for example, at positions closer to six-way valve 3 than extension pipes 5a and 5b.

[0018] Extension pipe 5a is provided between port 36 of six-way valve 3 and indoor heat exchanger 1a, as described above, and more particularly, is provided between shut-off valve 4a, and indoor heat exchanger 1a.

Extension pipe 5b is provided between port 36 of six-way valve 3 and indoor heat exchanger 1b, as described above, and more particularly, is provided between shut-off valve 4b and indoor heat exchanger 1b.

[0019] Extension pipe 6a is provided between indoor heat exchanger 1a and port 34 of six-way valve 3, as described above. Extension pipe 6b is provided between indoor heat exchanger 1b and port 34 of six-way valve 3, as described above.

[0020] Compressor 7 compresses the refrigerant sucked from port 33 of six-way valve 3, and discharges the refrigerant to port 31 of six-way valve 3. At the time of cooling operation, expansion valve 8 expands the refrigerant which flows from outdoor heat exchanger 2 to port 35 of six-way valve 3. At the time of heating operation, expansion valve 8 expands the refrigerant which flows from port 35 of six-way valve 3 to outdoor heat exchanger 2. Fans 9a, 9b, and 9c are provided to be capable of blowing air to indoor heat exchangers 1a and 1b and outdoor heat exchanger 2, respectively.

[0021] Fluids circulated in refrigeration cycle apparatus 100 are water or an antifreezing solution (brine), and the refrigerant. The refrigerant is, for example, a mixed refrigerant prepared by mixing at least two or more types of refrigerants. The refrigerant may be an azeotropic mixed refrigerant, or may be an non-azeotropic mixed refrigerant.

<Action of Refrigeration Cycle Apparatus>

[0022] Next, action of refrigeration cycle apparatus 100 will be described with reference to Figs. 1 to 3. First, a case where all of the plurality of indoor heat exchangers 1a and 1b are in an active state will be described. At the time of cooling operation, six-way valve 3 is controlled to adopt the configuration shown in Fig. 2. Thereby, refrigeration cycle apparatus 100 is placed in the cooling cycle state indicated by the solid lines in Fig. 1. The refrigerant discharged from compressor 7 flows through port 31 and port 32 of six-way valve 3, reaches outdoor heat exchanger 2, exchanges heat with outdoor air in outdoor heat exchanger 2, and is condensed. The condensed refrigerant flows through expansion valve 8 and is expanded. The expanded refrigerant flows through port 35 and port 36 of six-way valve 3 and opened shut-off valves 4a and 4b, reaches indoor heat exchangers 1a and 1b, exchanges heat with indoor air in indoor heat exchangers 1a and 1b, and is evaporated.

[0023] Next, a case where, of the plurality of indoor heat exchangers 1a and 1b, one indoor heat exchanger 1a is in an active state and the other indoor heat exchanger 1b is in a stopped state will be described. In this case, shut-off valve 4b is closed. Since shut-off valve 4b is closed, the refrigerant expanded by expansion valve 8 does not flow to indoor heat exchanger 1b, and flows through opened shut-off valve 4a, reaches indoor heat exchanger 1a, exchanges heat with indoor air in indoor heat exchanger 1a, and is evaporated.

<Function and Effect>

[0024] Next, the function and effect of refrigeration cycle apparatus 100 will be described. Refrigeration cycle apparatus 100 includes: the plurality of indoor heat exchangers 1a and 1b exchanging heat between the refrigerant and indoor air in the operated state, and provided to be individually switchable between the operated state and the stopped state; outdoor heat exchanger 2 exchanging heat between the refrigerant and outdoor air; six-way valve 3 switching a flow path of the refrigerant; compressor 7 for compressing the refrigerant; and shut-off valves 4a and 4b configured to be capable of shutting off a flow of the refrigerant. The plurality of indoor heat exchangers 1a and 1b are connected with outdoor heat exchanger 2 via six-way valve 3. The plurality of indoor heat exchangers 1a and 1b are arranged in parallel and connected with six-way valve 3. At least one of the plurality of indoor heat exchangers 1a and 1b is connected with six-way valve 3 via shut-off valves 4a and 4b.

[0025] With such a configuration, when one indoor heat exchanger 1 a is in the operated state and the other indoor heat exchanger 1b is in the stopped state, of the plurality of indoor heat exchangers 1a and 1b, the flow of the refrigerant between six-way valve 3 and indoor heat exchanger 1b in the stopped state can be shut off by shut-off valve 4b. As a result, refrigeration cycle apparatus 100 suppresses the refrigerant from flowing into indoor heat exchanger 1b in the stopped state and stagnating therein.

[0026] Further, in the plurality of indoor heat exchangers 1a and 1b, by means of six-way valve 3, the direction in which the refrigerant flows is constant and is not reversed both at the time of cooling operation and at the time of heating operation. Specifically, port 36 of six-way valve 3, to which the plurality of indoor heat exchangers 1a and 1b are connected in parallel, is connected with port 35 connected with outdoor heat exchanger 2 via expansion valve 8 at the time of cooling operation, and is connected with port 31 connected with the discharge side of compressor 7 at the time of heating operation. Accordingly, both at the time of cooling operation and at the time of heating operation, the refrigerant which flows to the plurality of indoor heat exchangers 1a and 1b flows in from port 36 of six-way valve 3, and flows out to port 34. With refrigeration cycle apparatus 100, thermal counter-flow heat exchange can be achieved in indoor heat exchangers 1a and 1b both at the time of cooling operation and at the time of heating operation. Accordingly, refrigeration cycle apparatus 100 has a high heat transfer performance. Further, with refrigeration cycle apparatus 100, the logarithmic mean temperature difference between the refrigerant and air in indoor heat exchangers 1a and 1b can be increased, when compared with a conventional refrigeration cycle apparatus in which parallel flow heat exchange is achieved between refrigerant and air in indoor heat exchangers either at the time of cooling operation or at the time of heating operation. Accordingly,

in refrigeration cycle apparatus 100, even when an non-azeotropic refrigerant mixture is enclosed and a temperature gradient is formed in indoor heat exchangers 1a and 1b, a reduction in heat exchange performance is suppressed. Furthermore, in refrigeration cycle apparatus 100, since the above logarithmic mean temperature is high in indoor heat exchangers 1a and 1b, refrigerant pressure on the suction side of compressor 7 obtained when the amount of heat exchange in indoor heat exchangers 1a and 1b is set to a predetermined value can be increased, when compared with the conventional refrigeration cycle apparatus described above. Accordingly, with refrigeration cycle apparatus 100, the ratio of compressing the refrigerant in compressor 7 can be reduced and the efficiency of a refrigeration cycle can be improved, when compared with the conventional refrigeration cycle apparatus described above.

[0027] Further, since refrigeration cycle apparatus 100 is provided such that the counterflow heat exchange can be achieved in the plurality of indoor heat exchangers 1a and 1b by means of six-way valve 3, refrigeration cycle apparatus 100 can be downsized, when compared with a conventional refrigeration cycle apparatus provided such that counterflow heat exchange can be achieved by combining a plurality of elements such as a four-way valve, a bridge circuit, and the like. Further, in refrigeration cycle apparatus 100, the number of parts can be reduced when compared with a case where counterflow heat exchange in the plurality of indoor heat exchangers as described above and prevention of refrigerant stagnation in the indoor heat exchangers are achieved in a conventional refrigeration cycle apparatus, and thus reliability is improved.

[0028] It should be noted that, when only one indoor heat exchanger 1b, of the plurality of indoor heat exchangers 1a and 1b, can be switched between the active state and the stopped state, it is only necessary to provide shut-off valve 4b between one indoor heat exchanger 1b and six-way valve 3. When all of the plurality of indoor heat exchangers 1a and 1b can be switched between the active state and the stopped state, shut-off valves 4a and 4b are provided between all indoor heat exchangers 1a and 1b and six-way valve 3, respectively.

[0029] Shut-off valves 4a and 4b may each be configured as a solenoid valve, for example. With such a configuration, shut-off valves 4a and 4b can each be controlled easily and independently.

[0030] Referring to Figs. 4 and 5, six-way valve 3 may be configured as a rotary-type switching valve. Six-way valve 3 has valve main body 30, and six ports 31, 32, 33, 34, 35, and 36 connected to valve main body 30. Valve main body 30 includes, for example, a first valve body 30A and a second valve body 30B provided to be relatively rotatable. Port 31 is connected to first valve body 30A, and ports 32, 33, 34, 35, and 36 are connected to second valve body 30B. Ports 32, 33, 34, 35, and 36 are arranged in a circumferential direction of second valve body 30B. Three pipelines 41, 42, and 43 are formed in first valve body 30A. Five pipelines connected with ports 32, 33, 34, 35, and 36, respectively, are formed in second valve body 30B. With such a configuration, at the time of switching between cooling operation and heating operation performed by six-way valve 3, the switching can be performed without once stopping compressor 7 to suppress a switching sound. Further, since the above switching can be performed without once stopping compressor 7, refrigeration cycle apparatus 100 requires less time taken until the operated state after the switching is stabilized.

[0031] Pipeline 41 is provided such that it can always be connected with port 31, irrespective of the relative rotary action of first valve body 30A and second valve body 30B. Pipeline 41 is provided such that it can be connected with port 32 or port 36, by means of the relative rotary action of first valve body 30A and second valve body 30B. Pipeline 41 is provided such that it can form a flow path between port 31 and port 32, or between port 31 and port 36, by means of the rotary action described above. Pipelines 42 and 43 are each provided to be capable of connecting two ports of ports 32, 33, 34, 35, and 36. Pipeline 42 is provided such that it can form a flow path between port 33 and port 34, or between port 32 and port 33, by means of the rotary action described above. Pipeline 43 is provided such that it can form a flow path between port 35 and port 36, or between port 34 and port 35, by means of the rotary action described above. Also with such a configuration, six-way valve 3 can switch between the cooling cycle state indicated by the solid lines in Fig. 1 and the heating cycle state indicated by the broken lines in Fig. 1.

(Second Embodiment)

[0032] Next, a refrigeration cycle apparatus 101 in accordance with a second embodiment will be described with reference to Fig. 6. Refrigeration cycle apparatus 101 has basically the same configuration as that of refrigeration cycle apparatus 1 00, and differs therefrom in that the shut-off valves are configured as expansion valves (first expansion valves) 10a and 10b.

[0033] Expansion valves 10a and 10b are each provided to be capable of independently shutting off a flow of the refrigerant. Expansion valve 10a is provided on the pipe which connects port 36 of six-way valve 3 and indoor heat exchanger 1a. Expansion valve 10b is provided on the pipe which connects port 36 of six-way valve 3 and indoor heat exchanger 1b, as described above, Expansion valves 10a and 10b can close the pipes or expand the refrigerant which flows in the pipes, according to opening degrees thereof. Expansion valves 10a and 10b are controlled to close the pipes when indoor heat exchangers 1a and 1b are in the stopped state, and to expand the refrigerant which flows in the pipes when indoor heat exchangers 1a and 1b are in the operated state. Expansion valves 10a and 10b are provided, for example, at positions closer to six-way valve 3 than extension pipes

5a and 5b.

[0034] Also with such a configuration, when one indoor heat exchanger 1a is in the operated state and the other indoor heat exchanger 1b is in the stopped state, of the plurality of indoor heat exchangers 1a and 1b, the flow of the refrigerant between six-way valve 3 and indoor heat exchanger 1b in the stopped state can be shut off by expansion valve 10b. As a result, refrigeration cycle apparatus 100 suppresses the refrigerant from flowing into indoor heat exchanger 1b in the stopped state and stagnating therein. Since refrigeration cycle apparatus 101 includes six-way valve 3 having the same configuration as that in refrigeration cycle apparatus 100, thermal counterflow heat exchange can be achieved in indoor heat exchangers 1a and 1b both at the time of cooling operation and at the time of heating operation.

[0035] It should be noted that, in refrigeration cycle apparatus 101, expansion valve 8 is preferably completely opened at the time of cooling operation. Generally, at the time of cooling operation, refrigerant in a liquid state (liquid refrigerant) condensed in an outdoor heat exchanger is decompressed and expanded by an expansion valve, and is delivered to an indoor heat exchanger in a two-phase state of a liquid phase and a gaseous phase. In refrigeration cycle apparatus 101, expansion valve 8 located between outdoor heat exchanger 2 and six-way valve 3, and expansion valves 10a and 10b located between six-way valve 3 and indoor heat exchangers 1a and 1b are provided between outdoor heat exchanger 2 and indoor heat exchangers 1a and 1b. Accordingly, the refrigerant to be delivered to indoor heat exchangers 1a and 1b only needs to be expanded at least in expansion valves 10a and 10b. Since expansion valve 8 is completely opened at the time of cooling operation, liquid refrigerant can flow from port 35 to port 36 of six-way valve 3, rather than refrigerant in a two-phase state of a liquid phase and a gaseous phase. As a result, the flow of the refrigerant in six-way valve 3 can be stabilized. Further, since the refrigerant which flows in six-way valve 3 at the time of cooling operation is liquid refrigerant rather than refrigerant in a two-phase state of a liquid phase and a gaseous phase, pressure loss of the refrigerant can be reduced.

[0036] It should be understood that the embodiments disclosed herein are illustrative and non-restrictive in every respect. The scope of the present invention is defined by the scope of the claims, rather than the description above, and is intended to include any modifications within the scope and meaning equivalent to the scope of the claims.

INDUSTRIAL APPLICABILITY

[0037] The refrigeration cycle apparatus in accordance with the present invention is particular advantageously applicable to a refrigeration cycle apparatus including a plurality of indoor units provided to be individually switchable between an operation action and a stop action.

REFERENCE SIGNS LIST

[0038] 1, 1a, 1b: indoor heat exchanger; 2: outdoor heat exchanger; 3: six-way valve; 4, 4a, 4b: shut-off valve; 5, 5a, 5b, 6, 6a, 6b: extension pipe; 7: compressor; 8: expansion valve; 10a, 10b: expansion valve; 9a, 9b, 9c: fan; 30: valve main body; 30A: first valve body; 30B: second valve body; 31, 32, 33, 34, 35, 36: port; 39: slide valve body; 41, 42, 43: pipeline; 100, 101: refrigeration cycle apparatus.

Claims

1. A refrigeration cycle apparatus comprising:

a plurality of indoor heat exchangers exchanging heat between refrigerant and indoor air;
an outdoor heat exchanger exchanging heat between the refrigerant and outdoor air;
a six-way valve switching a flow path of the refrigerant;
a compressor for compressing the refrigerant; and
a shut-off valve configured to be capable of shutting off a flow of the refrigerant,
the plurality of indoor heat exchangers being connected with the outdoor heat exchanger via the six-way valve,
the plurality of indoor heat exchangers being arranged in parallel and connected with the six-way valve, and
at least one of the plurality of indoor heat exchangers being connected with the six-way valve via the shut-off valve.

2. The refrigeration cycle apparatus according to claim 1, wherein the shut-off valve is a first expansion valve.

3. The refrigeration cycle apparatus according to claim 2, further comprising a second expansion valve arranged between the outdoor heat exchanger and the six-way valve, wherein
at a time of cooling operation, the six-way valve is controlled to direct the flow path of the refrigerant from the outdoor heat exchanger to the six-way valve, and the second expansion valve is completely opened.

4. The refrigeration cycle apparatus according to claim 1, wherein the shut-off valve is a solenoid valve.

5. The refrigeration cycle apparatus according to any one of claims 1 to 4, wherein the refrigerant is a mixed refrigerant prepared by mixing at least two or more types of refrigerants.

6. The refrigeration cycle apparatus according to claim 5, wherein the refrigerant is an non-azeotropic mixed refrigerant.

FIG.1

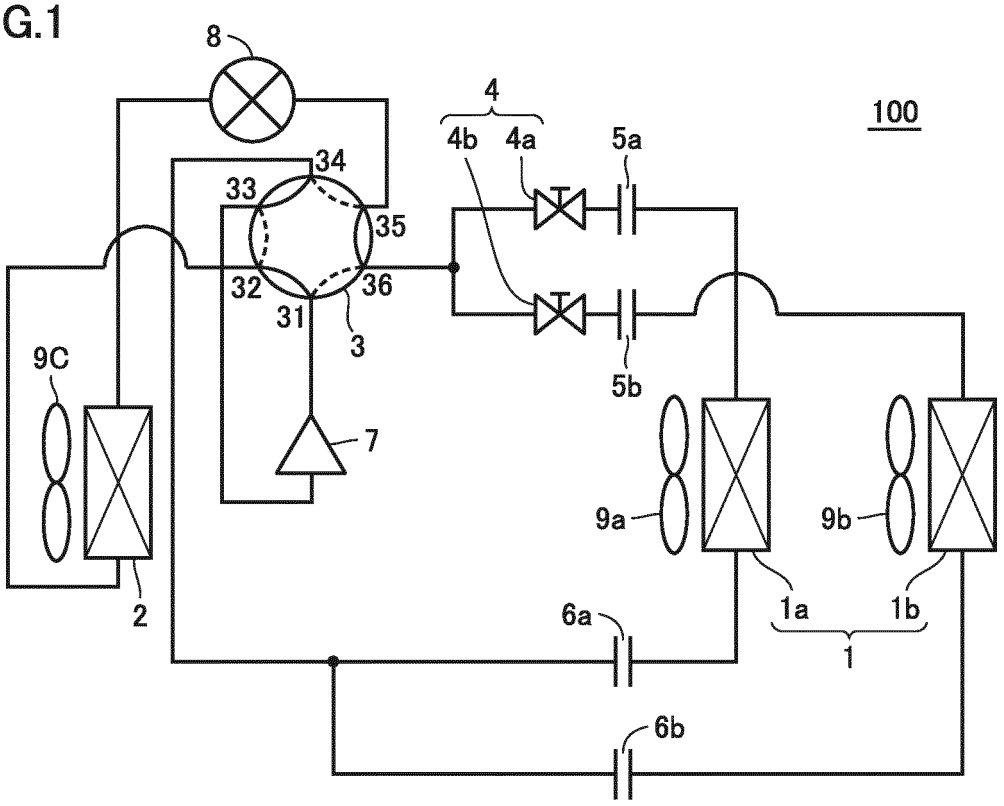

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FIG.2

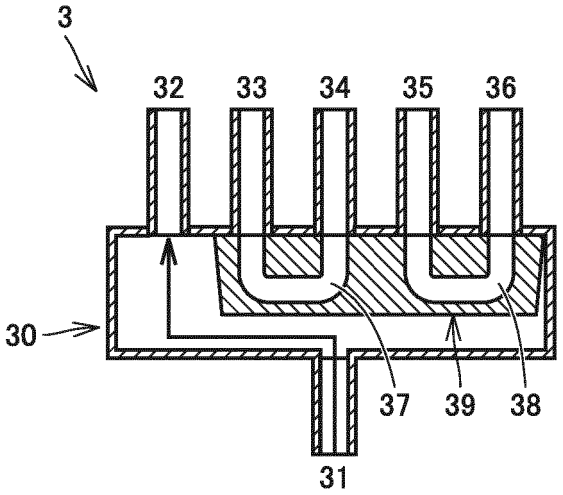
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FIG.3

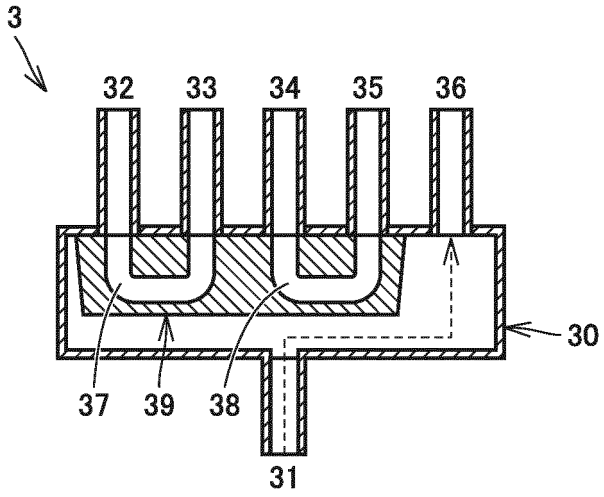

FIG.4

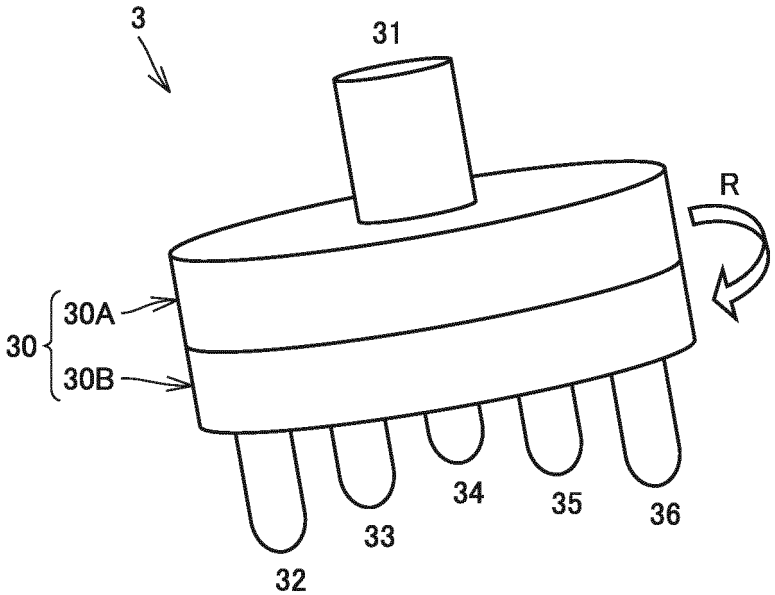

FIG.5

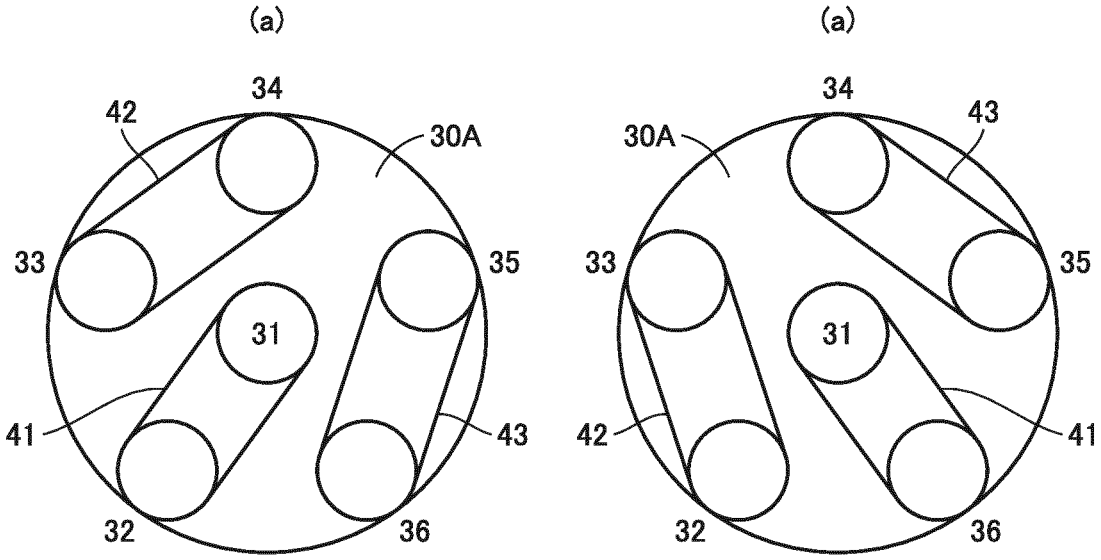
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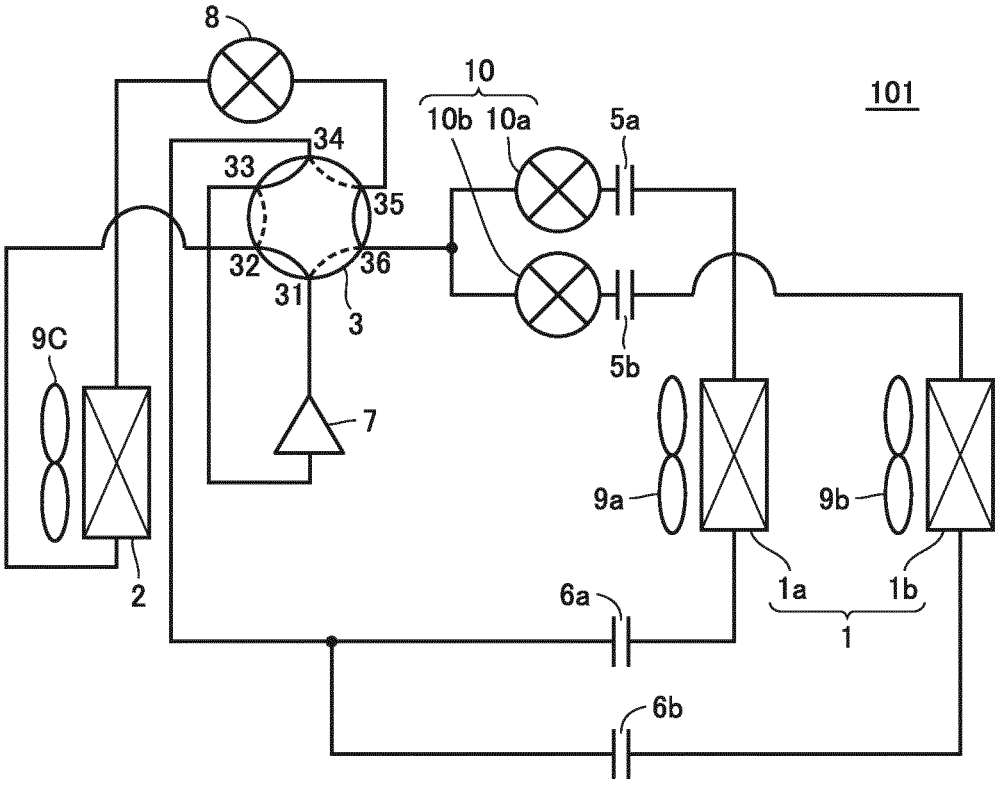
FIG.6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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/082790

A. CLASSIFICATION OF SUBJECT MATTER
F25B41/04(2006.01)i, *F25B5/02*(2006.01)i, *F25B13/00*(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)
F25B41/04, F25B5/02, F25B13/00

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 1996-2016
Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

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 8-170865 A (Sanyo Electric Co., Ltd.), 02 July 1996 (02.07.1996), entire text; all drawings (particularly, paragraphs [0011] to [0023]; fig. 1, 4) (Family: none)	1-6
Y	JP 63-108164 A (Hitachi, Ltd.), 13 May 1988 (13.05.1988), entire text; all drawings (particularly, specification, page 2, upper right column, line 6 to lower right column, line 19; fig. 1) (Family: none)	1-6

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

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

Date of the actual completion of the international search	Date of mailing of the international search report
02 February 2016 (02.02.16)	16 February 2016 (16.02.16)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/082790

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 59-104051 A (Tokyo Shibaura Electric Co., Ltd.), 15 June 1984 (15.06.1984), entire text; all drawings (particularly, specification, page 1, lower right column, line 2 to page 2, lower left column, line 19; fig. 1, 6) (Family: none)	1-6
Y	JP 11-94385 A (Hitachi, Ltd.), 09 April 1999 (09.04.1999), entire text; all drawings (particularly, paragraphs [0001], [0012]) & TW 416000 B & CN 1212352 A	5-6
A	WO 00/55551 A1 (Hitachi, Ltd.), 21 September 2000 (21.09.2000), entire text; all drawings (particularly, fig. 1 to 9) (Family: none)	1-4
A	JP 2014-81159 A (Denso Corp.), 08 May 2014 (08.05.2014), entire text; all drawings (Family: none)	1-4

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 8170864 A **[0002] [0003]**
- JP 8170865 A **[0002] [0003]**