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Takayama et al.

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(54) **REFRIGERATING CYCLE DEVICE USED IN AN AIR CONDITIONING APPARATUS, A REFRIGERATING DEVICE AND THE LIKE**

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F25B 40/02	(2006.01)
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(52) **U.S. Cl.**

CPC ***F25B 40/00*** (2013.01); *F25B 2313/0233* (2013.01); *F25B 25/005* (2013.01); *F25B 2313/006* (2013.01); *F25B 40/02* (2013.01); *B60H 2001/00928* (2013.01); *F25B 2400/05* (2013.01)

USPC **62/513**; 62/185

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CPC F25B 40/00; F25B 40/02; F25B 25/005; F25B 2400/05; F25B 2313/0233; F25B 2313/006; B60H 2001/00928

USPC 62/18

See application file for complete search history.

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(57) **ABSTRACT**

Energy saving of a refrigerating cycle device is achieved by equalizing heat-medium inlet temperatures of a plurality of use-side heat exchangers. There are provided with a plurality of use-side heat exchangers, inter-heat-medium heat exchangers, a channel that connects the inter-heat-medium heat exchanger and the use-side heat exchanger, a heat-medium circulation circuit having heat-medium channel switching devices that switch between a first heat-medium channel, which connects the inter-heat-medium heat exchanger and the use-side heat exchanger, and a second heat-medium channel, which connects the inter-heat-medium heat exchanger and the use-side heat exchanger, and a heat source unit that heats or cools the heat medium with the inter-heat-medium heat exchangers, in which an auxiliary heat exchanger that performs heat exchange between the heat mediums flowing out from the inter-heat-medium heat exchangers is disposed so as to equalize the heat-medium temperatures flowing into the use-side heat exchangers to realize energy saving of the refrigerating cycle device.

7 Claims, 7 Drawing Sheets

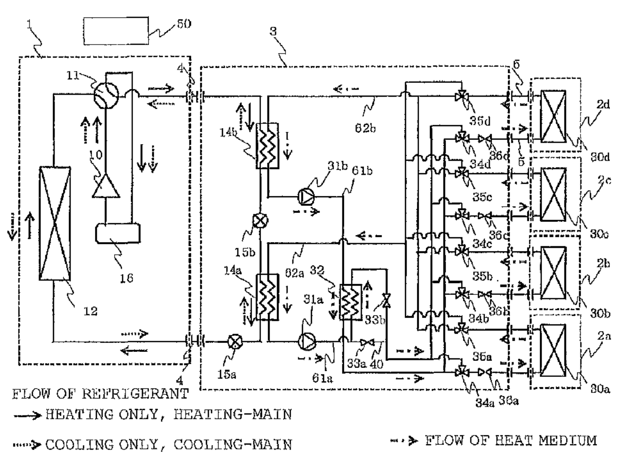

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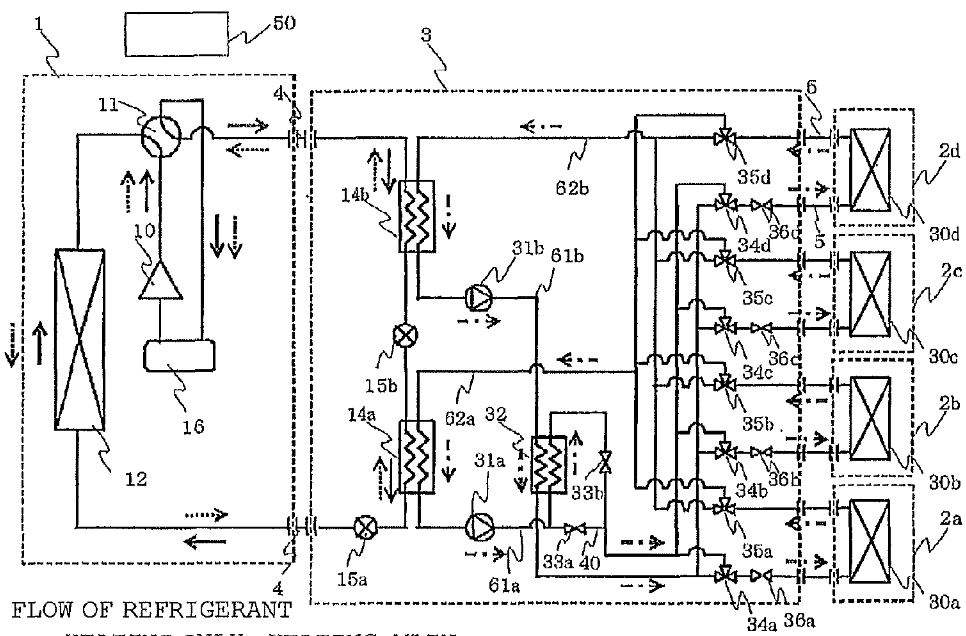
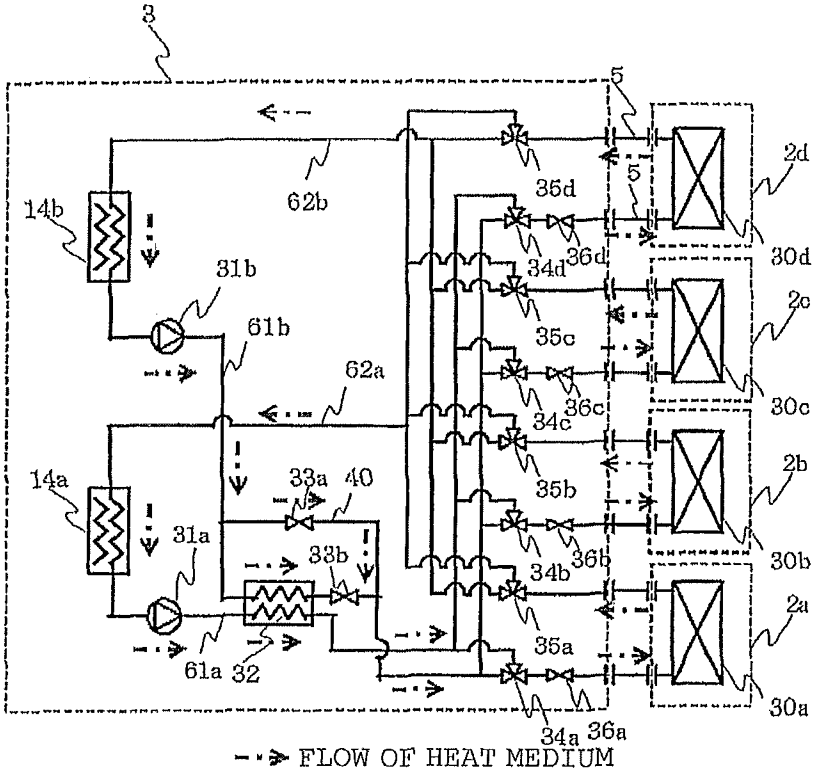
FIG. 1

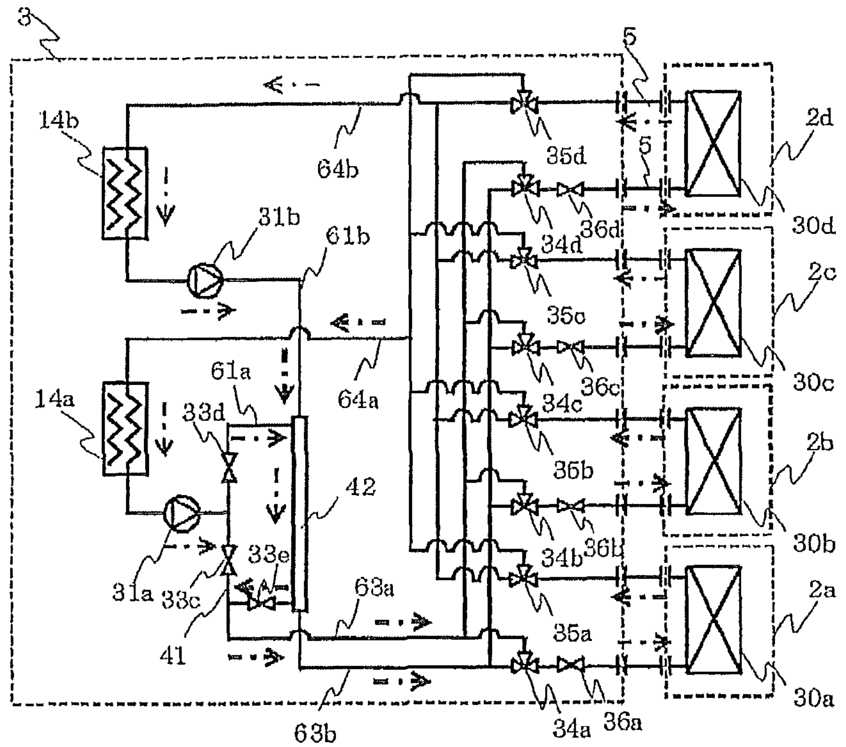


FLOW OF REFRIGERANT
→ HEATING ONLY, HEATING-MAIN
⋯→ COOLING ONLY, COOLING-MAIN
-·→ FLOW OF HEAT MEDIUM

F I G. 2

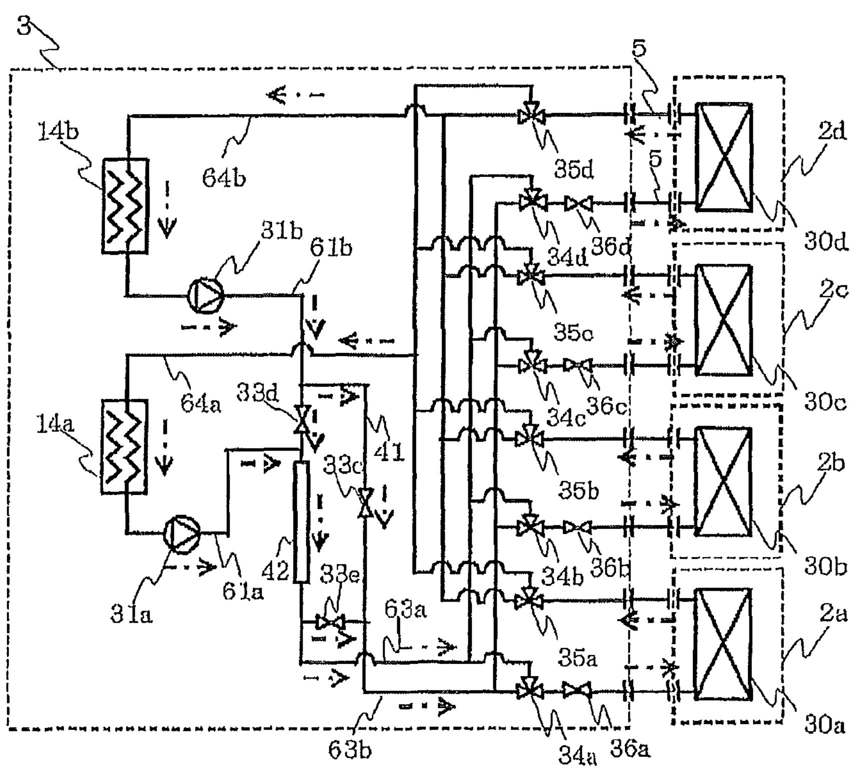

3
5
2d
35d
62b
14b
5
30d
34d
36d
31b
2c
61b
35c
62a
30c
34c
36c
2b
35b
14a
33a
40
31a
33b
30b
34b
36b
2a
35a
61a
32
30a
34a
36a
FLOW OF HEAT MEDIUM

F I G. 3



FLOW OF HEAT MEDIUM

F I G. 4



FLOW OF HEAT MEDIUM

FIG. 5

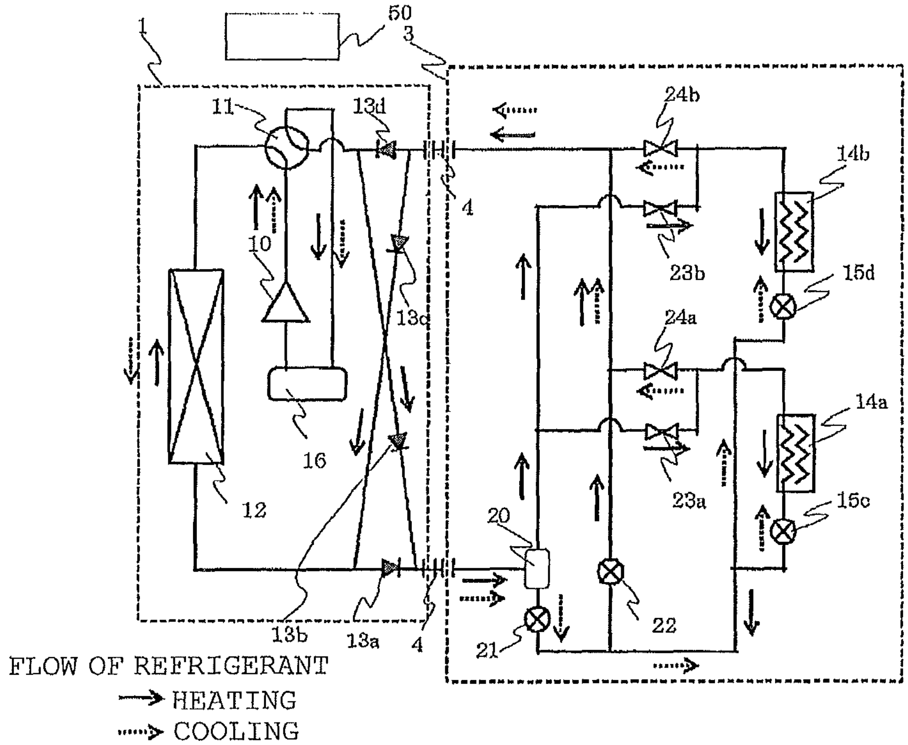


FIG. 6

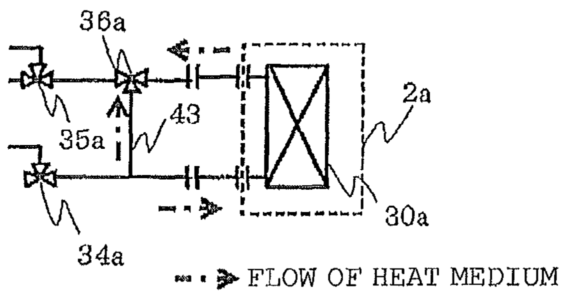
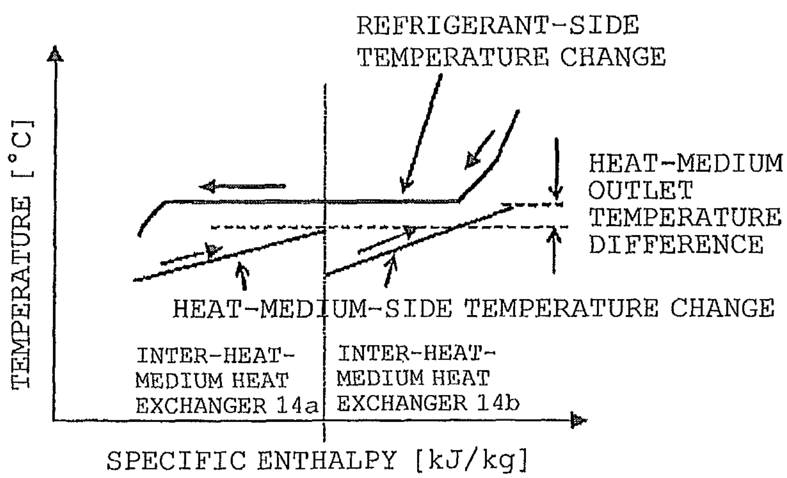
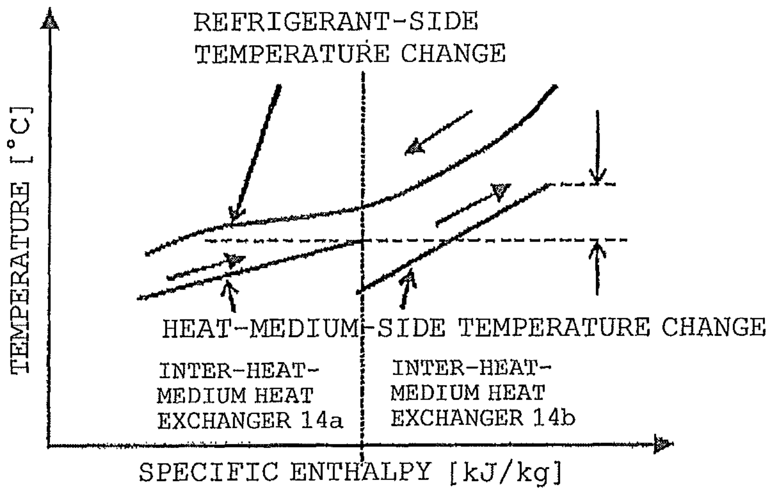


FIG. 7



F I G. 8


REFRIGERANT-SIDE
TEMPERATURE CHANGE
TEMPERATURE [°C]
HEAT-MEDIUM-SIDE TEMPERATURE CHANGE
INTER-HEAT-MEDIUM HEAT EXCHANGER 14a
INTER-HEAT-MEDIUM HEAT EXCHANGER 14b
SPECIFIC ENTHALPY [kJ/kg]

F I G. 9

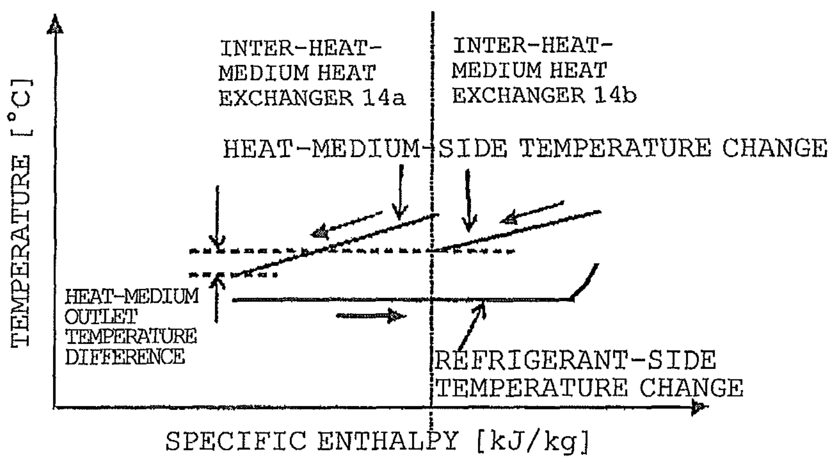

INTER-HEAT-MEDIUM HEAT EXCHANGER 14a
INTER-HEAT-MEDIUM HEAT EXCHANGER 14b
HEAT-MEDIUM-SIDE TEMPERATURE CHANGE
TEMPERATURE [°C]
HEAT-MEDIUM OUTLET TEMPERATURE DIFFERENCE
REFRIGERANT-SIDE
TEMPERATURE CHANGE
SPECIFIC ENTHALPY [kJ/kg]

FIG. 10

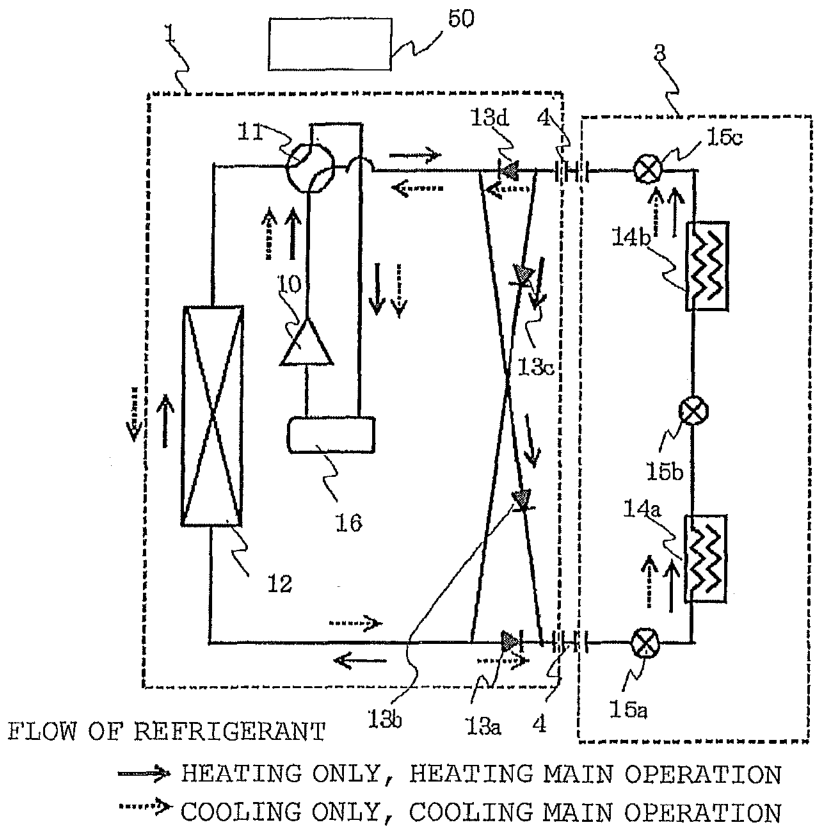
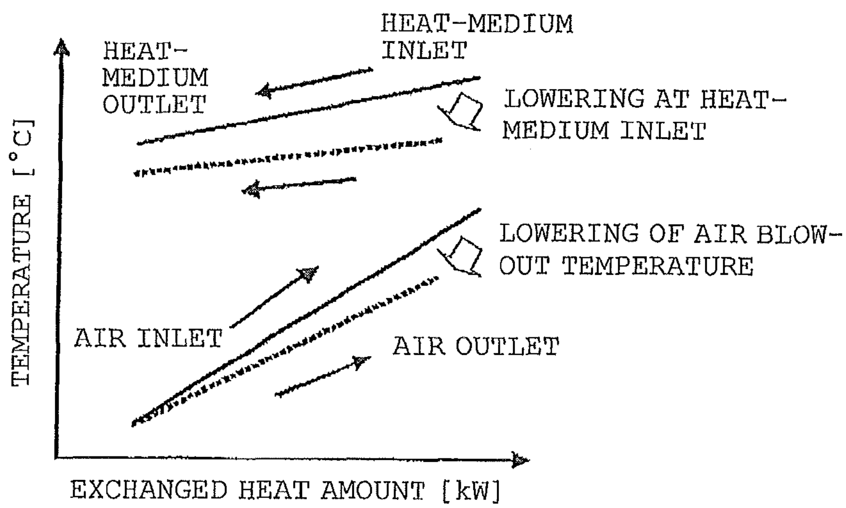
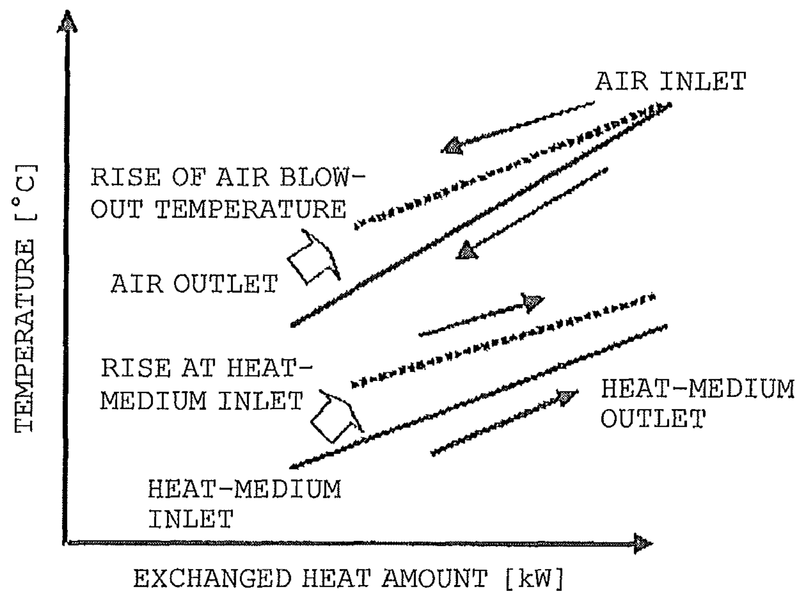

50
1
3
11
13d
4
15c
14b
10
13c
15b
14a
16
12
13b
13a
4
15a
FLOW OF REFRIGERANT
HEATING ONLY, HEATING MAIN OPERATION
COOLING ONLY, COOLING MAIN OPERATION

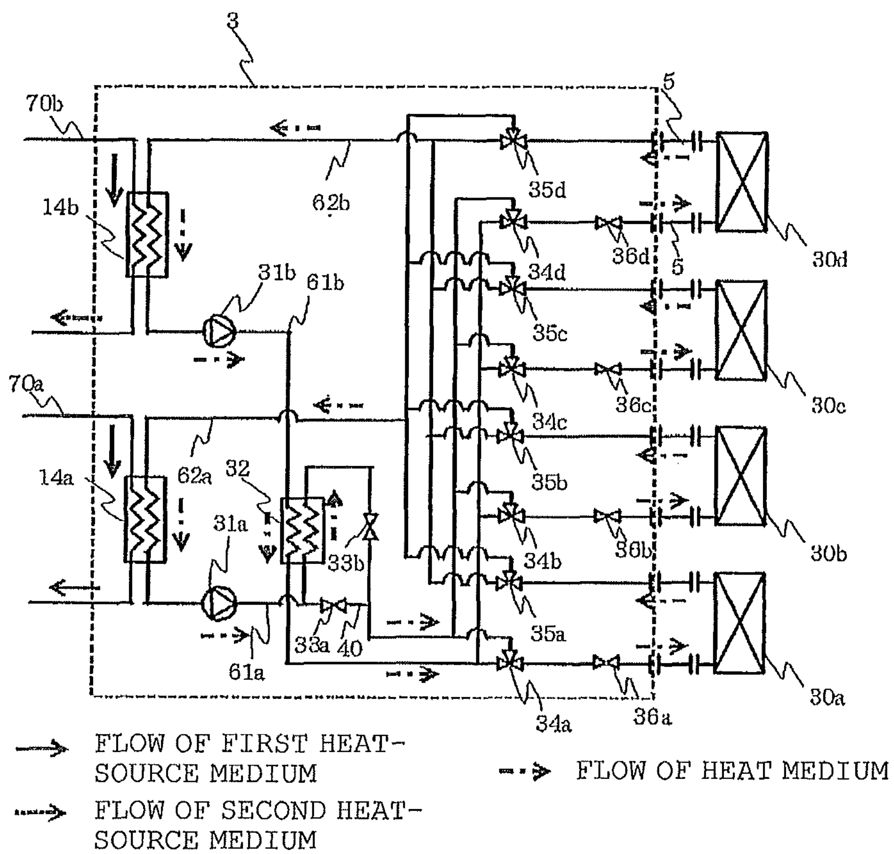
FIG. 11


HEAT-MEDIUM INLET
HEAT-MEDIUM OUTLET
LOWERING AT HEAT-MEDIUM INLET
LOWERING OF AIR BLOW-OUT TEMPERATURE
AIR INLET
AIR OUTLET
TEMPERATURE [°C]
EXCHANGED HEAT AMOUNT [kW]

F I G. 1 2


AIR INLET
RISE OF AIR BLOW-OUT TEMPERATURE
AIR OUTLET
RISE AT HEAT-MEDIUM INLET
HEAT-MEDIUM OUTLET
HEAT-MEDIUM INLET
TEMPERATURE [°C]
EXCHANGED HEAT AMOUNT [kW]

F I G. 1 3


3
5
70b
14b
62b
31b
61b
35d
34d
36d
35c
34c
36c
35b
34b
36b
35a
34a
36a
30d
30c
30b
30a
70a
14a
62a
32
31a
33b
33a
40
61a
FLOW OF FIRST HEAT-SOURCE MEDIUM
FLOW OF SECOND HEAT-SOURCE MEDIUM
FLOW OF HEAT MEDIUM

REFRIGERATING CYCLE DEVICE USED IN AN AIR CONDITIONING APPARATUS, A REFRIGERATING DEVICE AND THE LIKE

TECHNICAL FIELD

The present invention relates to a refrigerating cycle device used in an air conditioning apparatus, a refrigerating device and the like such as a multiple-unit air conditioning apparatus for a building and an air conditioner.

BACKGROUND ART

Some prior-art refrigerating cycle devices provided with a plurality of indoor units (use-side heat exchangers) used as a multiple-unit air conditioning apparatus for a building or the like heat or cool a heat medium in the secondary side in an inter-heat-medium heat exchanger of a heat source device and distribute the heat medium to each use-side heat exchangers. As for such a refrigerating cycle device, with indoor units that can each perform a cooling operation and a heating operation individually, a multiple-chamber cooling/heating device provided with a heat-source cycle having a first auxiliary heat exchanger for heating and a first auxiliary heat exchanger for cooling, a use-side refrigerant cycle for heating, and a use-side refrigerant cycle for cooling has been proposed, for example (See Patent Literature 1, for example). When all the use-side heat exchangers, which are secondary cycles, are performing a cooling operation, a part of the refrigerant discharged from a refrigerant conveying device for cooling is made to flow through a third auxiliary heat exchanger for cooling, and when in the use-side refrigerant cycle for heating, the refrigerant discharged from a refrigerant conveying device for heating is made to flow through a fourth auxiliary heat exchanger for cooling, for heat exchange with each other so as to perform the cooling operation in the use-side refrigerant cycle for heating, too.

Also, as another example, a multiple-room heating device provided with a heat source cycle having a first auxiliary heat exchanger and a second auxiliary heat exchanger, a first use-side refrigerant cycle and a second use-side refrigerant cycle, which are secondary cycles, has been proposed (See Patent Literature 2, for example). When all the use-side heat exchangers are performing a cooling operation, a heat-source side refrigerant is evaporated both by the first auxiliary heat exchanger and the second auxiliary heat exchanger, and both the first use-side refrigerant cycle and the second use-side refrigerant cycle are performing a cooling operation. Also, when all the use-side heat exchangers are performing a heating operation, both the two auxiliary heat exchangers are condensing the heat-source side refrigerant.

CITATION LIST

Patent Literature

Patent Literature 1: Japanese Unexamined Patent Application Publication No. 6-82110 (FIG. 1 and the like)

Patent Literature 2: Japanese Unexamined Patent Application Publication No. 6-337138 (FIG. 1 and the like)

SUMMARY OF INVENTION

Technical Problem

However, with the conventional refrigerating cycle device illustrated in Patent Literature 1, only one of the auxiliary heat exchangers that perform heat exchange between the primary-side refrigerant and the secondary-side refrigerant is used when performing a cooling only operation, and thus, the amount of heat exchanged between the primary-side refrigerant and the secondary-side refrigerant cannot be increased. If the amount of heat exchanged is to be increased in order to increase cooling capacity, for example, an output of the heat source device needs to be increased by increasing the speed of a compressor in the heat source device, and energy cannot be saved, which is a problem.

Also, with the conventional refrigerating cycle device shown in Patent Literature 2, if all the use-side heat exchangers are performing a heating operation, the heat-source-side refrigerant discharged from the compressor is condensed by the second auxiliary heat exchanger and then, condensed by the first auxiliary heat exchanger. As a result, discharged gas from the compressor at a high temperature flows into the second auxiliary heat exchanger, but since the condensed heat-source-side refrigerant flows into the first auxiliary heat exchanger, the temperature of the refrigerant becomes lower than an inlet temperature of the second auxiliary heat exchanger. Thus, the temperatures of each use-side refrigerants discharged from the first refrigerant conveying device and the second refrigerant conveying device, supplied to a plurality of use-side heat exchangers are different, and a problem is caused in that large difference of temperature between each refrigerant inlet of the plurality of indoor heat exchangers. In order to raise the use-side refrigerant temperature in the first auxiliary heat exchanger, an output of the heat source device needs to be increased by increasing the speed of the compressor in the heat source device, whereby the use-side refrigerant is excessively heated in the second auxiliary heat exchanger. As a result, energy saving cannot be accomplished and excessive heating undermines comfort of users, which is a problem. Thus, as in Patent Literature 2, the two indoor heat exchangers connected to the first use-side refrigerant cycle and the second use-side refrigerant cycle need to be contained in one heating/cooling indoor unit, which causes a problem of size increase of the indoor unit.

Moreover, when the first use-side refrigerant and the second use-side refrigerant are made to perform heat exchange in order to solve the difference of the use-side refrigerant temperatures, if the use-side refrigerant circuit is constituted as in the example described in Patent Literature 1, concern of the following problems rises. For example, since only a part of the refrigerant discharged from the refrigerant conveying device contributes to heat exchange, the constitution is not effective in making the difference of the plurality of use-side refrigerant temperatures small. Moreover, in the use-side refrigerant circuit on the side where a part of the use-side refrigerant is bypassed in order to perform heat exchange, the heat-exchanged use-side refrigerant does not circulate through the indoor unit but returns to the auxiliary heat exchanger. At this time, a high-temperature use-side refrigerant returns during heating and a low-temperature use-side refrigerant returns during cooling, which causes a problem of lowered heat-exchange efficiency of the auxiliary heat exchanger.

The present invention was made to solve the above-described problems and an object thereof is to provide an efficient refrigerating cycle device with less waste of energy by performing heat exchange between the heat mediums flowing out of the plurality of inter-heat-medium heat exchangers so as to equalize the outlet temperatures of the heat mediums when the heat mediums are heated or cooled in the plurality of inter-heat-medium heat exchangers and made to flow through the plurality of indoor units, which are a plurality of use-side heat exchangers. Also, another object is to obtain a small-sized air conditioning apparatus in which load adjustment of a plurality of indoor unit is easy.

Solution to Problem

A refrigerating cycle device according to the present invention is provided with:

a plurality of use-side heat exchangers;

a first inter-heat-medium heat exchanger having one port connected to each heat-medium inlet of the use-side heat exchangers by a pipeline and the other port connected to each heat-medium outlet of the use-side heat exchangers;

a second inter-heat-medium heat exchanger having one port connected to each heat-medium inlet of the use-side heat exchangers by a pipeline and the other port connected to each heat-medium outlet of the use-side heat exchangers;

a plurality of first heat-medium channel switching devices, each of which is disposed on the heat-medium inflow side of each of the use-side heat exchangers, switches between a first inflow-side channel, which connects the first inter-heat-medium heat exchanger and the heat-medium inlets of the use-side heat exchangers, and a second inflow-side channel, which connects the second inter-heat-medium heat exchanger and the heat-medium inlets of the use-side heat exchangers;

a plurality of second heat-medium channel switching devices, each of which is disposed on the heat-medium outflow side of each of the use-side heat exchangers, switches between a first outflow-side channel, which connects the first inter-heat-medium heat exchanger and the heat-medium outlets of the use-side heat exchangers, and a second outflow-side channel, which connects the second inter-heat-medium heat exchanger and the heat-medium outlets of the use-side heat exchangers;

a first heat-medium feeding device that allows a heat medium to flow through the first inflow-side channel that connects the first inter-heat-medium heat exchanger and the use-side heat exchangers;

a second heat-medium feeding device that allows a heat medium to flow through the second inflow-side channel that connects the second inter-heat-medium heat exchanger and the use-side heat exchangers;

a plurality of heat-medium flow-rate regulation units, which are disposed between the heat-medium outlets of the first heat-medium channel switching devices and the heat-medium inlets of the second heat-medium channel switching devices, controlling flow rates of the heat mediums flowing through each of the use-side heat exchangers;

a heat source device that is connected to the first inter-heat-medium heat exchanger and the second inter-heat-medium heat exchanger and supplies heating energy or cooling energy to the first inter-heat-medium heat exchanger and the second inter-heat-medium heat exchanger so as to heat or cool the heat medium flowing from the first inter-heat-medium heat exchanger and the second inter-heat-medium heat exchanger to the use-side heat exchanger;

an auxiliary heat exchanger having a first heat-medium inlet which is connected to the first inter-heat-medium heat exchanger by a pipeline and which the heat medium is allowed to flow into and a second heat-medium inlet which is connected to the second inter-heat-medium heat exchanger by a pipeline and which the heat medium is allowed to flow into, having a first heat-medium outlet and a second heat-medium outlet which allow the heat medium having flowed in from the first heat-medium inlet and the second heat-medium inlet to flow out to the use-side heat exchanger through a plurality of the first heat-medium channel switching devices, and performing heat exchange between a first heat medium flowing from the first heat-medium inlet to the first heat-medium outlet and a second heat medium flowing from the second heat-medium inlet to the second heat-medium outlet through a heat transfer material or performing heat exchange by mixing the first heat medium flowing in from the first heat-medium inlet and the second heat medium flowing in from the second heat-medium inlet and allowing the mixture to flow out of the first heat-medium outlet and the second heat-medium outlet; and

a circulation circuit that connects a bypass pipeline that bypasses the auxiliary heat exchanger and the opening/closing valve disposed in the bypass pipeline to the heat-medium outlet of either the first inter-heat-medium heat exchanger or the second inter-heat-medium heat exchanger that the heat medium flows out from.

Advantageous Effects of Invention

The present invention realizes heat exchange of a heat medium flowing out of the first inter-heat-medium heat exchanger and the heat medium flowing out of the second inter-heat-medium heat exchanger by an auxiliary heat exchanger and can substantially equalize the temperatures of the heat mediums flowing into the plurality of use-side heat exchangers even if there is a temperature difference in the heat mediums flowing out of the two inter-heat-medium heat exchangers. Therefore, a refrigerating cycle device that is efficient and can be easily used without waste of energy can be obtained. Also, an air conditioning apparatus in which a load of an indoor unit can be adjusted easily and user comfort can be easily obtained can be obtained.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is an entire circuit diagram according to Embodiment 1 of the present invention.

FIG. **2** is a diagram illustrating another form of a heat-medium side circuit according to Embodiment 1 of the present invention.

FIG. **10** is a diagram illustrating another form of a refrigerant-side circuit according to Embodiment 1 of the present invention.

FIG. **3** is a heat-medium-side circuit diagram according to Embodiment 2 of the present invention.

FIG. **4** is a diagram illustrating another form of a heat-medium side circuit according to Embodiment 2 of the present invention.

FIG. **5** is a refrigerant-side circuit diagram according to Embodiment 3 of the present invention.

FIG. **6** is a diagram illustrating another form of a heat-medium flow-rate regulating device according to Embodiments 1 to 4.

FIG. **7** is a diagram illustrating temperature changes of a refrigerant and a heat medium if the heat medium is heated by inter-heat-medium heat exchangers **14***a* and **14***b* according to Embodiment 1.

FIG. **8** is a diagram illustrating temperature changes of the refrigerant (supercritical cycle) and the heat medium if the heat medium is heated by the inter-heat-medium heat exchangers **14***a* and **14***b* according to Embodiment 1.

FIG. **9** is a diagram illustrating temperature changes of the refrigerant and the heat medium if the heat medium is cooled by the inter-heat-medium heat exchangers **14***a* and **14***b* according to Embodiment 1.

FIG. **11** is a diagram illustrating a change of an air blow-out temperature if a heat-medium inlet temperature is lowered in a use-side heat exchanger performing heating according to Embodiment 1.

FIG. **12** is a diagram illustrating a change of the air blow-out temperature if the heat-medium inlet temperature is raised in a use-side heat exchanger performing cooling according to Embodiment 1.

FIG. **13** is a heat-medium side circuit diagram of a refrigerating cycle device according to Embodiment 4.

DESCRIPTION OF EMBODIMENTS

Embodiment 1

FIG. **1** is a system circuit diagram of a refrigerating cycle device according to Embodiment 1 of the present invention. The refrigerating cycle device of Embodiment 1 constitute a refrigerating cycle circuit constituted by a compressor **10**, a four-way valve **11**, which is a refrigerant channel switching device, a heat-source-side heat exchanger **12**, inter-heat-medium heat exchangers **14***a* and **14***b*, expansion devices **15***a* and **15***b* such as electronic expansion valves and the like, and an accumulator **16** connected by a pipeline. Here, the inter-heat-medium heat exchanger **14***a* corresponds to a first inter-heat-medium heat exchanger. The inter-heat-medium heat exchanger **14***b* corresponds to a second inter-heat-medium heat exchanger.

Also, a heat-medium circulation circuit is constituted by the inter-heat-medium heat exchangers **14***a* and **14***b*, use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*, pumps **31***a* and **31***b*, which are heat-medium feeding devices, heat-medium channel switching devices **34***a*, **34***b*, **34***c*, **34***d*, **35***a*, **35***b*, **35***c*, and **35***d*, and heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d* are connected by a pipeline. Here, the pump **31***a* corresponds to a first heat-medium feeding device. The pump **31***b* corresponds to a second heat-medium feeding device. The heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* correspond to first heat-medium channel switching devices. The heat-medium channel switching devices **35***a*, **35***b*, **35***c*, and **35***d* correspond to second heat-medium channel switching devices. The heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d* correspond to a heat-medium flow-rate regulation unit. In Embodiment 1, the number of indoor units **2** (use-side heat exchangers **30**) is four, but the number of the indoor units **2** (the use-side heat exchanges **30**) is arbitrary.

In this embodiment, the compressor **10**, the four-way valve **11**, the heat-source-side heat exchanger **12** and the accumulator **16** are contained in a heat source unit **1** (outdoor unit). Also, the heat source unit **1** contains a controller **50** that supervises control of the entire refrigerating cycle device. The use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* are each contained in the indoor units **2***a*, **2***b*, **2***c*, and **2***d*, respectively. The inter-heat-medium heat exchangers **14***a* and **14***b* and the expansion devices **15***a* and **15***b* are contained in a heat-medium converter **3** (branch unit), which is also a heat-medium branch unit. The heat-medium channel switching devices **34***a*, **34***b*, **34***c*, **34***d*, **35***a*, **35***b*, **35***c*, and **35***d* and the heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d* are also contained in the heat-medium converter **3**.

Also, the heat source unit **1** and the heat-medium converter **3** are connected by a refrigerant pipeline **4**. Also, the heat-medium converter **3** and each of the indoor units **2***a*, **2***b*, **2***c*, and **2***d* (each of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*) are connected by a heat-medium pipeline **5** through which a safe heat medium such as water, anti-freezing fluid and the like flows. That is, the heat-medium converter **3** and each of the indoor units **2***a*, **2***b*, **2***c*, and **2***d* (each of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*) are connected by one heat-medium path.

The compressor **10** pressurizes and discharges (feeds out) a sucked-in refrigerant. Also, the four-way valve **11**, which becomes a refrigerant channel switching device, switches a valve corresponding to an operation mode concerning the cooling/heating on the basis of an instruction of the controller **50** so as to which the path of the refrigerant. In Embodiment 1, a circulation path is made to be switched in a cooling only operation (an operation in which all the operating indoor units **2** are performing cooling (including dehumidifying. The same applies in the following)), a cooling-main operation (an operation in which cooling is mainly performed if there are indoor units **2** performing cooling and heating at the same time), a heating only operation (an operation in which all the performing indoor units **2** are performing heating), and a heating-main operation (an operation in which heating is mainly performed if there are indoor units **2** performing heating and cooling at the same time).

The heat-source-side heat exchanger **12** has a heat transfer pipe through which the refrigerant flows and a fin (not shown) that enlarges a heat transfer area between the refrigerant flowing through the heat transfer pipe and the outside air and performs heat exchange between the refrigerant and the air (outside air), for example. The heat-source-side heat exchanger **12** functions as an evaporator during the heating only operation and the heating-main operation and evaporates and gasifies the refrigerant, for example. On the other hand, the heat-source-side heat exchanger **12** functions as a condenser or a gas cooler (hereinafter referred to as a condenser) during the cooling only operation and the cooling-main operation. In some cases, the heat-source-side heat exchanger **12** does not fully gasify or liquefy but brings the refrigerant into a two-phase mixed state of a liquid and gas (gas-liquid two-phase refrigerant).

The inter-heat-medium heat exchangers **14***a* and **14***b* has a heat transfer portion through which the refrigerant passes and a heat transfer portion through which the heat medium passes and performs heat exchange between the refrigerant and the heat medium. In Embodiment 1, the inter-heat-medium heat exchanger **14***a* functions as an evaporator in the cooling only operation and the heating-main operation and allows the refrigerant to absorb heat and the heat medium to be cooled. On the other hand, the inter-heat-medium heat exchanger **14***a* functions as a condenser in the heating only operation and the cooling-main operation and allows the refrigerant to radiate heat and the heat medium to be heated. The inter-heat-medium heat exchanger **14***b* functions as an evaporator in the cooling only operation and the cooling-main operation and functions as a condenser in the heating only operation and the heating-main operation. The expansion devices **15***a* and **15***b* such as electronic expansion valves and the like decompress the refrigerant by regulating the refrigerant flow rate, for example. The accumulator **16** serves to store excess refrigerant in the refrigerating cycle circuit and to prevent breakage of the compressor **10** caused by return of a large amount of refrigerant liquid to the compressor **10**.

The pumps **31***a* and **31***b*, which are the heat-medium feeding devices, pressurize the heat medium for circulation. Here, with regard to the pumps **31***a* and **31***b*, a flow rate at which the heat medium is fed out (discharge flow rate) can be changed by changing a rotation speed of a built-in motor (not shown) within a certain range. Also, each of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* perform heat exchange between the heat medium and the air in the air space of the air conditioning apparatus in each of the indoor units **2***a*, **2***b*, **2***c*, and **2***d* so as to heat or cool the air in the air space of the air conditioning apparatus.

The heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d*, which are three-way switching valves or the like, for example, are connected to the heat-medium inlets of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*, respectively, by a pipeline and perform switching of the channels on the inlet sides (heat-medium inflow sides) of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*. Also, the heat-medium channel switching devices **35**, **35***b*, **35***c*, and **35***d*, which are three-way switching valves or the like, for example, are connected to the heat-medium outflow sides of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*, respectively, by a pipeline and perform switching of the channels on the outlet sides (heat-medium outflow sides) of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*. These switching devices perform switching so that either one of the heat medium flowing through the inter-heat-medium heat exchanger **14***a* or the heat medium flowing through the inter-heat-medium heat exchanger **14***b* passes through the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*.

Moreover, the heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c* and **36***d*, which are two-way flow-rate regulator valves, for example, regulate flow rates of the heat mediums flowing into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*, respectively.

<Operation Mode>

Subsequently, an operation of the refrigerating cycle device in each operation mode will be described on the basis of flows of the refrigerant and the heat medium. Now, the magnitude of the pressure in the refrigerating cycle circuit and the like is not determined in relation to a baseline pressure but is expressed as a high pressure and a low pressure in a relative manner in the course of compression of the compressor **10**, control of refrigerant flow-rate of the expansion devices **15***a* and **15***b* and the like. The same is applied to the temperature.

(Cooling Only Operation)

First, the flow of the refrigerant in the refrigerating cycle circuit will be described. In the heat source unit **1**, the refrigerant sucked into the compressor **10** is compressed and discharged as a high-pressure gas refrigerant. The refrigerant coming out of the compressor **10** flows into the heat-source-side heat exchanger **12** that functions as a condenser via the four-way valve **11**. The high-pressure gas refrigerant is condensed by heat exchange with the outside air while passing through the heat-source-side heat exchanger **12**, flows out as a high-pressure liquid refrigerant and flows into the heat-medium converter **3** through the refrigerant pipeline **4**.

The refrigerant having flowed into the heat-medium converter **3** is expanded by adjusting the opening degree of the expansion device **15***a*, and a low temperature and low pressure gas-liquid two-phase refrigerant flows into the inter-heat-medium heat exchanger **14***a*. Since the inter-heat-medium heat exchanger **14***a* functions as an evaporator for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchanger **14***a* cools the heat medium, which is the target of the heat exchange (absorbs heat from the heat medium). In the inter-heat-medium heat exchanger **14***a*, the refrigerant is not fully vaporized but flows out, as it is, as the gas-liquid two-phase refrigerant. At this time, the expansion device **15***b* is kept fully open so that pressure loss is not caused.

The low temperature and low pressure gas-liquid two-phase refrigerant further flows into the inter-heat-medium heat exchanger **14***b*. As described above, the gas-liquid two-phase refrigerant cools the heat medium, becomes a gas refrigerant in the inter-heat-medium heat exchanger **14***b* and flows out. The gas refrigerant having flowed out passes through the refrigerant pipeline **4** and flows out of the heat-medium converter **3**.

The refrigerant having flowed into the heat source unit **1** is sucked into the compressor **10** again via the four-way valve **11** and the accumulator **16**.

Subsequently, the flow of the heat medium in the heat-medium circulation circuit will be described. The heat medium is cooled by heat exchange with the refrigerant in the inter-heat-medium heat exchangers **14***a* and **14***b*. The heat medium having been cooled in the inter-heat-medium heat exchanger **14***a* is sucked by the pump **31***a* and fed out to a first heat-medium channel **61***a*. Also, the heat medium having been cooled in the inter-heat-medium heat exchanger **14***b* is sucked by the pump **31***b* and fed out to a second heat-medium channel **61***b*. The heat medium having been fed out to the first heat-medium channel **61***a* flows into one of inlets of an auxiliary heat exchanger **32**. The heat medium having been fed out to the second heat-medium channel **61***b* flows into the other inlet of the auxiliary heat exchanger **32**. Detailed effects of the auxiliary heat exchanger **32** will be described later. At this time, an opening/closing device **33***a* is closed, while an opening/closing device **33***b* is opened.

The heat mediums in the first heat-medium channel **61***a* and the second heat-medium channel **61***b* have their channels switched by the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* and flow into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*. Here, the channels of the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* are configured such that the heat medium in the first heat-medium channel **61***a* flows into the use-side heat exchangers **30***a* and **30***b* and the heat medium in the second heat-medium channel **61***b* flows into the use-side heat exchangers **30***c* and **30***d*, for example. At this time, it is only necessary that the cooling capacity obtained by totaling capacities of the indoor units **2***a* and **2***b* cooled by the heat medium of the first heat-medium channel **61***a* and the cooling capacity obtained by totaling capacities of the indoor units **2***c* and **2***d* cooled by the heat medium of the second heat-medium channel **61***b* constitute approximately half. The cooling capacity of the indoor units **2***a*, **2***b*, **2***c*, and **2***d* can be determined by the controller **50**, for example. In the above case, the heat-medium channel switching devices **34***a* and **34***b* are configured such that the heat medium of the first heat-medium channel **61***a* passes through them. The heat-medium channel switching devices **34***a* and **34***d* are configured such that the heat medium of the second heat medium channel **61***b* passes through them.

The heat medium having passed through the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* have their flow rates flowing into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* regulated by the heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d*. For example, by adjusting the opening degrees of the heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d* so that the heat-medium temperature difference between the inlets and the outlets of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* becomes constant, the flow rates of the heat mediums flowing into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* can be regulated even if the sizes or loads of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* are different from each other. If any one of the indoor units **2** is to be stopped, the heat-medium flow-rate regulating valve **36** will be fully closed.

The heat mediums having flowed out of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* pass through the heat-medium channel switching devices **35***a*, **35***b*, **35***c*, and **35***d*. At this time, the heat-medium channel switching devices **35***a* and **35***b* are configured such that the heat medium flowing out to a first heat-medium channel **62***a* pass through them. Also, the heat-medium channel switching devices **35***c* and **35***d* are configured such that the heat medium flowing out to a second heat-medium channel **62***b* passes through them.

(Heating Only Operation)

First, the flow of the refrigerant in the refrigerating cycle circuit will be described. In the heat source unit **1**, the refrigerant sucked into the compressor **10** is compressed and discharged as a high-pressure gas refrigerant. The refrigerant coming out of the compressor **10** flows through the four-way valve **11** and further flows into the heat-medium converter **3** through the refrigerant pipeline **4**.

The gas refrigerant having flowed into the heat-medium converter **3** flows into the inter-heat-medium heat exchanger **14***b*. Since the inter-heat-medium heat exchanger **14***b* functions as a condenser for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchanger **14***b* heats the heat medium, which is the target of the heat exchange (radiates heat to the heat medium). In the inter-heat-medium heat exchanger **14***b*, the refrigerant is not fully liquefied but flows out as a gas-liquid two-phase refrigerant.

The high temperature and high pressure gas-liquid two-phase refrigerant further flows into the inter-heat-medium heat exchanger **14***a*. At this time, the expansion device **15***b* is kept fully open so as not to cause pressure loss. As described above, the gas-liquid two-phase refrigerant heats the heat medium, becomes a liquid refrigerant in the inter-heat-medium heat exchanger **14***a* and flows out. The liquid refrigerant having flowed out is decompressed by the expansion device **15***a* and becomes a low temperature and low pressure gas-liquid two-phase refrigerant. The low temperature and low pressure refrigerant passes through the refrigerant pipeline **4** and flows out of the heat-medium converter **3**.

The refrigerant having flowed into the heat source unit **1** flows into the heat-source-side heat exchanger **12** and is evaporated by heat exchange with air and flows out as a gas refrigerant or gas-liquid two-phase refrigerant. The evaporated refrigerant is sucked into the compressor **10** again through the four-way valve **11** and the accumulator **16**.

Subsequently, the flow of the heat medium in the heat-medium circulation circuit will be described. The heat medium is heated by heat exchange with the refrigerant in the inter-heat-medium heat exchangers **14***a* and **14***b*. The heat medium having been heated in the inter-heat-medium heat exchanger **14***a* is sucked by the pump **31***a* and is fed out to the first heat-medium channel **61***a*. Also, the heat medium having been heated in the inter-heat-medium heat exchanger **14***b* is sucked by the pump **31***b* and is fed out to the second heat-medium channel **61***b*. The heat medium having been fed out to the first heat-medium channel **61***a* flows into one of the inlets of the auxiliary heat exchanger **32**. The heat medium having been fed out to the second heat-medium channel **61***b* flows into the other inlet of the auxiliary heat exchanger **32**. The detailed effects of the auxiliary heat exchanger **32** will be described later. At this time, the opening/closing device **33***a* is closed, while the opening/closing device **33***b* is opened.

The heat mediums in the first heat-medium channel **61***a* and the second heat-medium channel **61***b* have their channels switched by the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* and flow into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*. Here, the channels of the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* are configured such that the heat medium in the first heat-medium channel **61***a* flows into the use-side heat exchangers **30***a* and **30***b* and the heat medium in the second heat-medium channel **61***b* flows into the use-side heat exchangers **30***c* and **30***d*, for example. At this time, it is only necessary that the heating capacity obtained by totaling capacities of the indoor units **2***a* and **2***b* heated by the heat medium of the first heat-medium channel **61***a* and the heating capacity obtained by totaling capacities of the indoor units **2***c* and **2***d* heated by the heat medium of the second heat-medium channel **61***b* constitute approximately half. The heating capacity of the indoor units **2***a*, **2***b*, **2***c*, and **2***d* can be determined by the controller **50**, for example. In the above case, the heat-medium channel switching devices **34***a* and **34***b* are configured such that the heat medium of the first heat-medium channel **61***a* passes through them. The heat-medium channel switching devices **34***c* and **34***d* are configured such that the heat medium of the second heat medium channel **61***b* passes through them.

The heat mediums having passed through the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* have their flow rates flowing into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* regulated by the heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d*. For example, by adjusting the opening degrees of the heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d* so that the heat-medium temperature difference between the inlets and the outlets of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* becomes constant, the flow rates of the heat mediums flowing into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* can be regulated even if the sizes or loads of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* are different from each other. If any one of the indoor units **2** is to be stopped, the heat-medium flow-rate regulating valve **36** will be fully opened.

The heat mediums having flowed out of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* pass through the heat-medium channel switching devices **35***a*, **35***b*, **35***c*, and **35***d*. At this time, the heat-medium channel switching devices **35***a* and **35***b* are configured such that the heat medium flowing out to the first heat-medium channel **62***a* passes through them. Also, the heat-medium channel switching devices **35***c* and **35***d* are configured such that the heat medium flowing out to the second heat-medium channel **62***b* passes through them.

(Cooling-Main Operation)

First, the flow of the refrigerant in the refrigerating cycle circuit will be described. In the heat source unit **1**, the refrigerant sucked into the compressor **10** is compressed and discharged as a high-pressure gas refrigerant. The refrigerant coming out of the compressor **10** flows into the heat-source-side heat exchanger **12** that functions as a condenser via the four-way valve **11**. The high-pressure gas refrigerant is condensed by heat exchange with the outside air while passing through the heat-source-side heat exchanger **12**, but the refrigerant is not fully liquefied but flows out as a high-pressure gas-liquid two-phase refrigerant and flows into the heat-medium converter **3** via the refrigerant pipeline **4**.

The refrigerant having flowed into the heat-medium converter **3** flows into the inter-heat-medium heat exchanger **14***a*. At this time, the expansion device **15***a* is kept fully open so that pressure loss is not caused. Since the inter-heat-medium heat exchanger **14***a* functions as a condenser for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchanger **14***a* heats and liquefies the heat medium (radiates heat to the heat medium), which is the target of the heat exchange.

The liquefied refrigerant is decompressed by the expansion device **15***b* and becomes a low temperature and low pressure gas-liquid two-phase refrigerant. The low temperature and low pressure refrigerant flows into the inter-heat-medium heat exchanger **14***b*. Since the inter-heat-medium heat exchanger **14***b* functions as an evaporator for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchanger **14***b* cools and gasifies the heat medium (absorbs heat from the heat medium), which is the target of the heat exchange. The gas refrigerant having flowed out passes through the refrigerant pipeline **4** and flows out of the heat-medium converter **3**.

The refrigerant having flowed into the heat source unit **1** is again sucked into the compressor **10** through the four-way valve **11** and the accumulator **16**.

Subsequently, the flow of the heat medium in the heat-medium circulation circuit will be described. The heat medium is heated by heat exchange with the refrigerant in the inter-heat-medium heat exchanger **14***a*. The heat medium heated by the inter-heat-medium heat exchanger **14***a* is sucked by the pump **31***a* and fed out to the first heat-medium channel **61***a*. Also, in the inter-heat-medium heat exchanger **14***b*, the heat medium is cooled by heat exchange with the refrigerant. The heat medium heated by the inter-heat-medium heat exchanger **14***b* is sucked by the pump **31***b* and fed out to the second heat-medium channel **61***b*. At this time, the opening/closing device **33***b* is closed, and the opening/closing device **33***a* is opened so that the heated heat medium is made to bypass the auxiliary heat exchanger **32**. As a result, heat exchange between the cooled heat medium and the heated heat medium is prevented.

The heat mediums in the first heat-medium channel **61***a* and the second heat-medium channel **61***b* have their channels switched by the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* and flow into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*. Here, the channels of the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* are configured such that the heat medium in the second heat-medium channel **61***b* passes through the heat-medium channel switching devices **34***a*, **34***b*, and **34***c* if the indoor units **2***a*, **2***b*, and **2***c* are performing a cooling operation and an indoor unit **2***d* is performing a heating operation and the cooled heat medium is made to flow into the use-side heat exchangers **30***a*, **30***b*, and **30***c*. Also, the heat medium in the first heat-medium channel **61***a* is made to pass through the heat-medium channel switching device **34***d* and the heated heat medium is made to flow into the use-side heat exchanger **30***d*. At this time, whether the indoor units **2***a*, **2***b*, **2***c*, and **2***d* are performing a cooling operation or a heating operation can be determined by the controller **50**, for example, and the channels of the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* are switched.

The heat mediums having passed through the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* have their flow rates flowing into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* regulated by the heat-medium flow-rate regulating valves **36***a*, **36***b*, **36***c*, and **36***d*. For example, by adjusting the opening degrees of the heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d* so that the heat-medium temperature difference between the inlets and the outlets of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* becomes constant, the flow rates of the heat mediums flowing into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* can be regulated even if the sizes or loads of the use-side heat exchangers **30***a*, **30***b*, **30***d*, and **30***d* are different from each other. If any one of the indoor units **2** is to be stopped, the heat-medium flow-rate regulating valve **36** will be fully opened.

The heat mediums having flowed out of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* pass through the heat-medium channel switching devices **35***a*, **35***b*, **35***c*, and **35***d*. At this time, the heat-medium channel switching devices **35***a*, **35***b*, and **35***c* are configured such that the heat medium flowing out to the second heat-medium channel **62***b* pass through them. Also, the heat-medium channel switching device **35***d* is configured such that the heat medium flowing out to the first heat-medium channel **62***a* passes through it.

(Heating-Main Operation)

First, the flow of the refrigerant in the refrigerating cycle circuit will be described. In the heat source unit **1**, the refrigerant sucked into the compressor **10** is discharged as a high-pressure gas refrigerant. The refrigerant having flowed out of the compressor **10** flows through the four-way valve **11**, further passes through the refrigerant pipeline **4** and flows into the heat-medium converter **3**.

The gas refrigerant having flowed into the heat-medium converter **3** flows into the inter-heat-medium heat exchanger **14***b*. Since the inter-heat-medium heat exchanger **14***b* functions as a condenser for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchanger **14***b* heats the heat medium, which is the target of the heat exchange, and is liquefied (radiates heat to the heat medium).

The high-pressure liquid refrigerant is made into a low temperature and low pressure gas-liquid two-phase refrigerant by the expansion device **15***b* and flows into the inter-heat-medium heat exchanger **14***a*. Since the inter-heat-medium heat exchanger **14***a* functions as an evaporator for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchanger **14***a* cools the heat medium (absorbs heat from the heat medium), which is the target of the heat exchange, and flows out as a gas-liquid two-phase refrigerant. The gas-liquid two-phase refrigerant having flowed out passes through the refrigerant pipeline **4** and flows out of the heat-medium converter **3**. At this time, the expansion device **15***a* is kept fully open so that pressure loss is not caused. The gas-liquid two-phase refrigerant having flowed out passes through the refrigerant pipeline **4** and flows out of the heat-medium converter **3**.

The refrigerant having flowed into the heat source unit **1** flows into the heat-source-side heat exchanger **12** and is evaporated by heat exchange with the air and flows out as a gas refrigerant or a gas-liquid two-phase refrigerant. The evaporated refrigerant is again sucked into the compressor **10** through the four-way valve **11** and the accumulator **16**.

Subsequently, the flow of the heat medium in the heat-medium circulation circuit will be described. The heat medium is cooled by heat exchange with the refrigerant in the inter-heat-medium heat exchanger **14***a*. The heat medium cooled by the inter-heat-medium heat exchanger **14***a* is sucked by the pump **31***a* and fed out to the first heat-medium channel **61***a*. Also, in the inter-heat-medium heat exchanger **14***b*, the heat medium is heated by heat exchange with the refrigerant. The heat medium heated by the inter-heat-medium heat exchanger **14***b* is sucked by the pump **31***b* and fed out to the second heat-medium channel **61***b*. At this time, the opening/closing device **33***b* is closed and the opening/closing device **33***a* is opened so that the heated heat medium is made to bypass the auxiliary heat exchanger **32**. As a result, heat exchange between the cooled heat medium and the heated heat medium is prevented.

The heat mediums in the first heat-medium channel **61***a* and the second heat-medium channel **61***b* have their channels switched by the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* and flow into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*. Here, the channels of the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* are configured, for example, such that the heat medium in the second heat-medium channel **61***b* passes through the heat-medium channel switching devices **34***a*, **34***b*, and **34***c* if the indoor units **2***a*, **2***b*, and **2***c* are performing a heating operation and the indoor unit **2***d* is performing a cooling operation and the heated heat medium is made to flow into the use-side heat exchangers **30**_a_, **30**_b_, and **30**_c_. Also, the heat medium in the first heat-medium channel **61**_a_ is made to pass through the heat-medium channel switching device **34**_d_ and the cooled heat medium is made to flow into the use-side heat exchanger **30**_d_, At this time, whether the indoor units **2**_a_, **2**_b_, **2**_c_, and **2**_d_ are performing a cooling operation or a heating operation can be determined by the controller **50**, for example, and the channels of the heat-medium channel switching devices **34**_a_, **34**_b_, **34**_c_, and **34**_d_ are switched.

The heat mediums having passed through the heat-medium channel switching devices **34**_a_, **34**_b_, **34**_c_, and **34**_d_ have their flow rates flowing into the use-side heat exchangers **30**_a_, **30**_b_, **30**_c_, and **30**_d_ regulated by the heat-medium flow-rate regulating devices **36**_a_, **36**_b_, **36**_c_, and **36**_d_. For example, by adjusting the opening degrees of the heat-medium flow-rate regulating devices **36**_a_, **36**_b_, **36**_c_, and **36**_d_ so that the heat-medium temperature difference between the inlets and the outlets of the use-side heat exchangers **30**_a_, **30**_b_, **30**_c_, and **30**_d_ becomes constant; the flow rates of the heat mediums flowing into the use-side heat exchangers **30**_a_, **30**_b_, **30**_c_, and **30**_d_ can be regulated even if the sizes or loads of the use-side heat exchangers **30**_a_, **30**_b_, **30**_c_, and **30**_d_ are different from each other. If any one of the indoor units **2** is to be stopped, the heat-medium flow-rate regulating valve **36** will be fully opened.

The heat mediums having flowed out of the use-side heat exchangers **30**_a_, **30**_b_, **30**_c_, and **30**_d_ pass through the heat-medium channel switching devices **35**_a_, **35**_b_, **35**_c_, and **35**_d_. At this time, the heat-medium channel switching devices **35**_a_, **35**_b_, and **35**_c_ are configured such that the heat medium flowing out to the second heat-medium channel **62**_b_ pass through them. Also, the heat-medium channel switching device **35**_d_ is configured such that the heat medium flowing out to the first heat-medium channel **62**_a_ passes through it.

<Heat Medium Temperature Equalizing Method>

Subsequently a method of substantially equalizing the inlet heat-medium temperature of the use-side heat exchanger **30** when the heating only operation and the cooling only operation are performed will be described.

As described above, the refrigerating cycle device according to Embodiment 1 can increase a heat radiation amount from the refrigerant to the heat medium by increasing a heat transfer area between the refrigerant and the heat medium by using both the inter-heat-medium heat exchangers **14**_a_ and **14**_b_ during the heating only operation as condensers. However, the high temperature refrigerant gas discharged from the compressor **10** is condensed to some degree in the inter-heat-medium heat exchanger **14**_b_ and then, flows into the inter-heat-medium heat exchanger **14**_a_ again. An exchanged heat amount and temperature changes of the refrigerant and the heat medium are shown in FIG. **7**.

In FIG. **7**, in the inter-heat-medium heat exchangers **14**_a_ and **14**_b_, the temperature change on the refrigerant side and the temperature change of the heat medium are shown. Here, it is assumed that the heat-medium inlet temperatures are substantially equal.

At this time, the refrigerant inlet temperature of the inter-heat-medium heat exchanger **14**_b_ is approximately 80° C., for example, since the refrigerant is a discharge gas of the compressor **10**. Thus, the outlet temperature of the heat medium can be raised to approximately a condensation temperature or above in the inter-heat-medium heat exchanger **14**_b_. On the other hand, the refrigerant inlet temperature of the inter-heat-medium heat exchanger **14**_a_ is the condensation temperature and is approximately 50° C., for example. Thus, the heat-medium outlet temperature of the inter-heat-medium heat

exchanger **14**_a_ might become lower than the heat-medium outlet temperature of the inter-heat-medium heat exchanger **14**_b_ as in FIG. **7**.

For example, assume that the heat medium of the first heat-medium channel **61**_a_ having flowed out of the inter-heat-medium heat exchanger **14**_a_ flows into the use-side heat exchangers **30**_a_ and **30**_b_, while the heat medium of the second heat-medium channel **61**_b_ having flowed out of the inter-heat-medium heat exchanger **14**_b_ flows into the use-side heat exchangers **30**_c_ and **30**_d_. Then, the heat medium temperatures flowing into the use-side heat exchangers **30**_a_ and **30**_b_ become lower than those of the use-side heat exchangers **30**_c_ and **30**_d_. As shown in FIG. **11**, if the heat-medium inlet temperatures of the use-side heat exchangers **30**_a_ and **30**_b_ fall under a predetermined temperature, the exchanged heat amount between the heat medium and the air in the use-side heat exchangers **30**_a_ and **30**_b_ drop, the blow-out temperatures of the indoor units **2**_a_ and **2**_b_ become lower, and comfort of a user is lost. Also, assume that the velocity of the compressor **10** is increased, for example, in order to raise the temperatures of the heat mediums flowing into the use-side heat exchangers **30**_a_ and **30**_b_ to a predetermined temperature. Then, the temperatures of the heat mediums flowing into the use-side heat exchangers **30**_c_ and **30**_d_ become higher than the predetermined temperature and the heat medium is heated too much, thus energy cannot be saved.

Also, the refrigerant such as carbon dioxide that might enter a supercritical state on the high pressure side does not have a condensation temperature as shown in FIG. **8** and continuously causes a temperature change. Thus, the difference between the heat-medium outlet temperature of the inter-heat-medium heat exchanger **14**_a_ and the heat-medium outlet temperature of the inter-heat-medium heat exchanger **14**_b_ described above becomes large.

Also, in the refrigerating cycle device according to Embodiment 1 as described above, both the inter-heat-medium heat exchangers **14**_a_ and **14**_b_ are both used as evaporators during the cooling only operation and an absorbed heat amount from the heat medium to the refrigerant can be made larger by increasing the heat transfer area between the refrigerant and the heat medium. The exchanged heat amount and the temperature changes of the refrigerant and the heat medium at this time are shown in FIG. **9**.

In FIG. **9**, the temperature change on the refrigerant side and the temperature change of the heat medium in the inter-heat-medium heat exchangers **14**_a_ and **14**_b_ are shown. Here, it is assumed that the heat-medium inlet temperatures of the inter-heat-medium heat exchangers **14**_a_ and **14**_b_ are substantially equal.

At this time, the refrigerant outlet temperature of the inter-heat-medium heat exchanger **14**_a_ is an evaporation temperature and it is approximately 2° C., for example. On the other hand, the refrigerant outlet temperature of the inter-heat-medium heat exchanger **14**_b_ is a superheated gas and it is approximately 5° C., for example. With this superheated gas region, heat transfer performances are deteriorated, and further, the temperature difference between the heat medium and the refrigerant is reduced. As a result, the heat-medium outlet temperature of the inter-heat-medium heat exchanger **14**_b_ might become higher than the heat-medium outlet temperature of the inter-heat-medium heat exchanger **14**_a_ as shown in FIG. **9**.

Assume that the heat medium of the first heat-medium channel **61**_a_ having flowed out of the inter-heat-medium heat exchanger **14**_a_ flows into the use-side heat exchangers **30**_a_ and **30**_b_, while the heat medium of the second heat-medium channel **61**_b_ having flowed out of the inter-heat-medium heat exchanger **14***b* flows into the use-side heat exchangers **30***c* and **30***d*. Then, the temperatures of the heat-mediums flowing into the use-side heat exchangers **30***c* and **30***d* become higher than those of the use-side heat exchangers **30***a* and **30***b*. As shown in FIG. **12**, if the heat-medium inlet temperatures of the use-side heat exchangers **30***c* and **30***d* are raised higher than a predetermined temperature, the exchanged heat amount between the heat medium and the air drop in the use-side heat exchangers **30***c* and **30***d*, the blown-out temperature of the indoor units **2***a* and **2***b* becomes high, and comfort of a user is lost. Also, assume that the velocity of the compressor **10** is increased, for example, in order to lower the temperatures of the heat mediums flowing into the use-side heat exchangers **30***c* and **30***d* to a predetermined temperature. Then, the temperatures of the heat mediums flowing into the use-side heat exchangers **30***a* and **30***b* become lower than the predetermined temperature and the heat medium is cooled too much, thus energy cannot be saved.

Thus, in the refrigerating cycle device according to Embodiment 1, the heat-medium inlet temperatures of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* are made substantially equal by the following method. Specifically, the auxiliary exchanger **32** is provided, one inlet is connected to a discharge port of the pump **31***a* by a pipeline, while the other inlet is connected to a discharge port of the pump **31***b* by a pipeline so that when the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* are performing the heating only operation or the cooling only operation, the heat mediums flowing through the first heat-medium channel **61***a* and the second heat-medium channel **61***b* perform heat exchange and the heat-medium inlet temperatures of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* are made substantially equal.

First, during the heating-main operation and the cooling-main operation, the opening/closing device **33***b* is closed, and the opening/closing device **33***a* is opened so that the heat medium of the first heat-medium channel **61***a* flows through a heat-medium bypass pipeline **40**. As a result, the auxiliary heat exchanger **32** is bypassed.

Subsequently, during the heating only operation and the cooling only operation, the opening/closing device **33***b* is opened, and the opening/closing device **33***a* is closed so that the heat medium of the first heat-medium channel **61***a* is made to flow through the auxiliary heat exchanger **32**. As a result, heat exchange is performed with the heat medium of the second heat-medium channel **61***b*.

As described above, since the heat medium discharged from the pump **31***a* and the heat medium discharged from the pump **31***b* are made to perform heat exchange, the heat-medium temperatures of the first heat-medium channel **61***a* and the second heat-medium channel **61***b* after flowing out of the auxiliary heat exchanger **32** become substantially equal. Here, assume that the heat medium of the first heat-medium channel **61***a* flows into the use-side heat exchangers **30***a* and **30***b* and the heat medium of the second heat-medium channel **61***b* flows into the use-side heat exchangers **30***c* and **30***d*, for example.

The heat medium flowing through the first heat-medium channel **61***a* passes through the heat-medium channel switching devices **34***a* and **34***b*, has the heat-medium flow rates regulated by the heat-medium flow-rate regulating devices **36***a* and **36***b* and flows into the use-side heat exchangers **30***a* and **30***b*. Also, the heat medium flowing through the second heat-medium channel **61***b* passes through the heat-medium channel switching devices **34***c* and **34***d*, has the heat-medium flow rates regulated by the heat-medium flow-rate regulating devices **36***c* and **36***d* and flows into the use-side heat exchangers **30***c* and **30***d*.

Here, the heat medium is a fluid such as water and an anti-freezing fluid and temperature drop is scarce even if the heat medium is decompressed by the heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d*. Thus, the heat-medium inlet temperatures of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* can be made substantially equal.

Also, in FIG. **1**, the opening/closing devices **33***a* and **33***b* and the heat-medium bypass pipeline **40** are disposed in the first heat-medium channel **61***a*, and the effect will be the same when they are disposed in the second heat-medium channel **61***b* as shown in FIG. **2**.

Also, in Embodiment 1, the heat-medium bypass pipeline **40** that bypasses the auxiliary heat exchanger **32** is disposed in either the first heat-medium channel **61***a* or the second heat-medium channel **61***b*. As a result, as compared with the case in which the heat-medium bypass pipeline **40** that bypasses the auxiliary heat exchanger **32** is disposed in both the first heat-medium channel **61***a* and the second heat-medium channel **61***b*, complication of the circuit due to increase in the number of heat-medium pipelines and opening/closing devices can be prevented.

As described above, even if the temperature difference in heat mediums flowing out of the inter-heat-medium heat exchangers **14***a* and **14***b* is large, by allowing the auxiliary heat exchanger **32** to perform heat exchange of the heat medium, the heat-medium inlet temperatures of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* can be made substantially equal. As a result, overheating or overcooling of the heat medium can be prevented, and an energy-saving refrigerating cycle device can be realized.

Also, a refrigerant circuit diagram when check valves **13***a*, **13***b*, **13***c*, and **13***d* are disposed in the heat source unit **1** is shown in FIG. **10**.

The check valves **13***a*, **13***b*, **13***c*, and **13***d* rectify the flow of the refrigerant by preventing backflow of the refrigerant and make the circulation path in inflow/outflow of the refrigerant in the heat source unit **1** constant. The inter-heat-medium heat exchanger **14***a* functions as an evaporator during the cooling only operation and allows the refrigerant to absorb heat so as to cool the heat medium. During the cooling-main operation, the heating-main operation, and the heating only operation, the heat exchanger **14***a* functions as a condenser and allows the refrigerant to radiate heat so as to heat the heat medium. The inter-heat-medium heat exchanger **14***b* functions as an evaporator during the cooling only operation, the cooling-main operation, and the heating-main operation. The heat exchanger **14***b* functions as a condenser during the heating only operation.

(Cooling Only Operation)

In the heat source unit **1**, the refrigerant sucked into the compressor **10** is compressed and discharged as a high-pressure gas refrigerant. The refrigerant coming out of the compressor **10** flows into the heat-source-side heat exchanger **12** that functions as a condenser via the four-way valve **11**. The high-pressure gas refrigerant is condensed by heat exchange with the outside air while passing through the heat-source-side heat exchanger **12**, flows out as a high-pressure liquid refrigerant and flows through the check valve **13***a* (does not flow through the check valves **13***b* and **13***c* side due to the pressure of the refrigerant). Moreover, the refrigerant flows into the heat-medium converter **3** through the refrigerant pipeline **4**.

The refrigerant having flowed into the heat-medium converter **3** is expanded by adjusting the opening degree of the expansion device **15***a*, and a low temperature and low pressure gas-liquid two-phase refrigerant flows into the inter-heat-medium heat exchanger **14***a*. Since the inter-heat-medium heat exchanger **14***a* functions as an evaporator for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchanger **14***a* cools the heat medium, which is the target of the heat exchange (absorbs heat from the heat medium). In the inter-heat-medium heat exchanger **14***a*, the refrigerant is not fully vaporized but flows out, as it is, as the gas-liquid two-phase refrigerant. At this time, the expansion device **15***b* is kept fully open so that pressure loss is not caused.

The low temperature and low pressure gas-liquid two-phase refrigerant further flows into the inter-heat-medium heat exchanger **14***b*. As described above, the gas-liquid two-phase refrigerant cools the heat medium, becomes a gas refrigerant in the inter-heat-medium heat exchanger **14***b* and flows out. The gas refrigerant having flowed out passes through the refrigerant pipeline **4** and flows out of the heat-medium converter **3**.

The refrigerant having flowed into the heat source unit **1** passes through the check valve **13***d* and is further sucked again into the compressor **10** via the four-way valve **11** and the accumulator **16**.

(Heating Only Operation)

In the heat source unit **1**, the refrigerant sucked into the compressor **10** is compressed and discharged as a high-pressure gas refrigerant. The refrigerant coming out of the compressor **10** flows through the four-way valve **11** and the check valve **13***b*. The refrigerant further flows into the heat-medium converter **3** through the refrigerant pipeline **4**.

The gas refrigerant having flowed into the heat-medium converter **3** flows into the inter-heat-medium heat exchanger **14***a*. At this time, the expansion device **15***a* is kept fully open so as not to cause pressure loss. Since the inter-heat-medium heat exchanger **14***a* functions as a condenser for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchanger **14***a* heats the heat medium(radiates heat to the heat medium), which is the target of the heat exchange. In the inter-heat-medium heat exchanger **14***a*, the refrigerant is not fully liquefied but flows out as the gas-liquid two-phase refrigerant.

The high temperature and high pressure gas-liquid two-phase refrigerant further flows into the inter-heat-medium heat exchanger **14***b*. At this time the expansion device **15***b* is kept fully open so as not to cause pressure loss. As described above, the gas-liquid two-phase refrigerant heats the heat medium, becomes a liquid refrigerant in the inter-heat-medium heat exchanger **14***b* and flows out. The liquid refrigerant having flowed out is decompressed by an expansion device **15***c* and becomes a low temperature and low pressure gas-liquid two-phase refrigerant. The low temperature and low pressure refrigerant passes through the refrigerant pipeline **4** and flows out of the heat-medium converter **3**.

The refrigerant having flowed into the heat source unit **1** flows into the heat-source-side heat exchanger **12** that functions as an evaporator via the check valve **13***c* and is evaporated by heat exchange with air and flows out as a gas refrigerant or gas-liquid two-phase refrigerant. The evaporated refrigerant is sucked into the compressor **10** again through the four-way valve **11** and the accumulator **16**.

(Cooling-Main Operation)

In the heat source unit **1**, the refrigerant sucked into the compressor **10** is compressed and discharged as a high-pressure gas refrigerant. The refrigerant coming out of the compressor **10** flows into the heat-source-side heat exchanger **12** that functions as a condenser via the four-way valve **11**. The high-pressure gas refrigerant is condensed by heat exchange with the outside air while passing through the heat-source-side heat exchanger **12**. Here, during the cooling-main operation, it is configured such that the gas-liquid two-phase refrigerant flows out of the heat-source-side heat exchanger **12**. The gas-liquid two-phase refrigerant having flowed out of the heat-source-side heat exchanger **12** flows through the check valve **13***a*. The refrigerant further flows into the heat-medium converter **3** via the refrigerant pipeline **4**.

The refrigerant having flowed into the heat-medium converter **3** flows into the inter-heat-medium heat exchanger **14***a*. At this time, the expansion device **15***a* is kept fully open so that pressure loss is not caused. Since the inter-heat-medium heat exchanger **14***a* functions as a condenser for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchanger **14***a* heats and liquefies the heat medium (radiates heat to the heat medium), which is the target of the heat exchange.

The liquefied refrigerant is decompressed by the expansion device **15***b* and becomes a low temperature and low pressure gas-liquid two-phase refrigerant. The low temperature and low pressure refrigerant flows into the inter-heat-medium heat exchanger **14***b*. Since the inter-heat-medium heat exchanger **14***b* functions as an evaporator for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchanger **14***b* cools and gasifies the heat medium (absorbs heat from the heat medium), which is the target of the heat exchange. The gas refrigerant having flowed out passes through the refrigerant pipeline **4** and flows out of the heat-medium converter **3**.

The refrigerant having flowed into the heat source unit **1** is again sucked into the compressor **10** through the four-way valve **11** and the accumulator **16**.

(Heating-Main Operation)

In the heat source unit **1**, the refrigerant sucked into the compressor **10** is compressed and discharged as a high-pressure gas refrigerant. The refrigerant having flowed out of the compressor **10** flows through the four-way valve **11** and the check valve **13***b*. The refrigerant further passes through the refrigerant pipeline **4** and flows into the heat-medium converter **3**.

The gas refrigerant having flowed into the heat-medium converter **3** flows into the inter-heat-medium heat exchanger **14***a*. At this time, the expansion device **15***a* is kept fully open so as not to cause pressure loss. Since the inter-heat-medium heat exchanger **14***a* functions as a condenser for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchanger **14***a* heats the heat medium, which is the target of the heat exchange, and is liquefied (radiates heat to the heat medium).

The high-pressure liquid refrigerant is made into a low temperature and low pressure gas-liquid two-phase refrigerant by the expansion device **15***b* and flows into the inter-heat-medium heat exchanger **14***b*. Since the inter-heat-medium heat exchanger **14***b* functions as an evaporator for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchanger **14***b* cools the heat medium (absorbs heat from the heat medium), which is the target of the heat exchange, and flows out as a gas-liquid two-phase refrigerant. The gas-liquid two-phase refrigerant having flowed out passes through the refrigerant pipeline **4** and flows out of the heat-medium converter **3**.

The refrigerant having flowed into the heat source unit **1** flows into the heat-source-side heat exchanger **12** that functions as an evaporator via the check valve **13***c* and is evaporated by heat exchange with the air and flows out as a gas refrigerant or a gas-liquid two-phase refrigerant. The evaporated refrigerant is again sucked into the compressor **10** through the four-way valve **11** and the accumulator **16**.

As shown in FIG. **10**, since the direction in which the refrigerant flows in the heat-medium converter **3** is the same in all the operation conditions, the inter-heat-medium heat exchanger **14***a* constantly functions as a condenser and the inter-heat-medium heat exchanger **14***b* constantly functions as an evaporator while in the cooling/heating simultaneous operation. Thus, though the flows of the refrigerant are different in the heat source unit **1** between the heating-main operation and the cooling-main operation, the flow of the refrigerant does not change in the heat-medium converter **3**.

In the above-described refrigerant circuit, even if the operation is switched from the heating-main operation, in which the use-side heat exchangers **30***a*, **30***b*, and **30***c* perform a heating operation and the use-side heat exchanger **30***d* performs a cooling operation, to the cooling-main operation, in which the use-side heat exchangers **30***b*, **30***c*, and **30***d* perform a cooling operation and the use-side heat exchanger **30***a* performs a heating operation, for example, the condenser and the evaporator are not switched. Thus, the warm heat medium for heating always flows through the first heat-medium channel **61***a* and the cool heat medium for cooling always flows through the second heat-medium channel **61***b*, and thus, the heating-main operation and the cooling-main operation can be switched to one other without stopping the flow of the heat medium.

Embodiment 2

In the above-described Embodiment 1, the heat mediums having flowed out of the two inter-heat-medium heat exchangers are made to perform heat exchange, but Embodiment 2 in which the heat mediums are directly brought into contact with each other will be illustrated below. FIG. **3** is a circuit diagram on the heat medium side of this case.

Specifically, a mixer **42** is provided, and one of inlets is connected to the discharge port of the pump **31***a* by a pipeline, while the other inlet is connected to a discharge port of the pump **31***b* by a pipeline so that when the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* are performing the heating only operation or the cooling only operation, the heat mediums flowing through the first heat-medium channel **61***a* and the second heat-medium channel **61***b* are mixed and the heat-medium inlet temperatures of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* are made substantially equal.

First, during the heating-main operation and the cooling-main operation, opening/closing devices **33***d* and **33***e* are closed, and an opening/closing device **33***c* is opened so that the heat medium of the first heat-medium channel **61***a* flows through a heat-medium bypass pipeline **41**. As a result, the mixer **42** is bypassed.

Subsequently, during the heating only operation, the opening/closing devices **33***d* and **33***e* are opened, and the opening/closing device **33***c* is closed. Then, the heat medium discharged from the pump **31***a* flowing through the first heat-medium channel **61***a* flows into the mixer **42**. Also, the heat medium of the second heat-medium channel **61***b* discharged from the pump **31***b* constantly flows into the mixer **42**. As a result, the heat mediums of the first heat-medium channel **61***a* and the second heat-medium channel **61***b* are mixed in the mixer **42**.

The heat mediums which have been mixed and whose temperatures have been made equal pass through the opening/closing device **33***e* from one of the outlets of the mixer and flow into a first heat-medium channel **63***a*. The heat medium having flowed out of the other outlet flows into a second heat-medium channel **63***b*. At this time, the temperatures and the pressures of the heat mediums in the first heat-medium channel **63***a* and the second heat-medium channel **63***b* are substantially equal.

The heat medium of the first heat-medium channel **63***a* and the heat medium of the second heat-medium channel **63***b* have their channels switched by the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* and flow into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*. Here, the channels of the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* are configured such that the heat medium of the first heat-medium channel **61***a* flows into the use-side heat exchangers **30***a* and **30***b* and the heat medium of the second heat-medium channel **61***b* flows into the use-side heat exchangers **30***c* and **30***d*, for example. At this time, it is only necessary that the heating capacity obtained by totaling capacities of the indoor units **2***a* and **2***b* heated by the heat medium of the first heat-medium channel **63***a* and the heating capacity obtained by totaling capacities of the indoor units **2***c* and **2***d* heated by the heat medium of the second heat-medium channel **63***b* constitute approximately half. The heating capacity of the indoor units **2***a*, **2***b*, **2***c*, and **2***d* can be determined by the controller **50**, for example. In the above case, the heat-medium channel switching devices **34***a* and **34***b* are configured such that the heat medium of the first heat-medium channel **63***a* passes through them. The heat-medium channel switching devices **34***c* and **34***d* are configured such that the heat medium of the second heat medium channel **63***b* passes through them.

The heat medium having passed through the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* have their flow rates flowing into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* regulated by the heat-medium flow-rate regulating valves **36***a*, **36***b*, **36***c*, and **36***d*. For example, by adjusting the opening degrees of the heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d* so that the heat-medium temperature difference between the inlets and the outlets of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* becomes constant, the flow rates of the heat mediums flowing into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* can be regulated even if the sizes or loads of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* are different from each other. If any one of the indoor units **2** is to be stopped, the heat-medium flow-rate regulating valve **36** will be fully closed.

The heat medium flowing through the first heat-medium channel **63***a* passes through the heat-medium channel switching devices **34***a* and **34***b*, has the heat-medium flow rates regulated by the heat-medium flow-rate regulating devices **36***a* and **36***b* and flows into the use-side heat exchangers **30***a* and **30***b*. Also, the heat medium flowing through the second heat-medium channel **63***b* passes through the heat-medium channel switching devices **34***c* and **34***d*, has the heat-medium flow rates regulated by the heat-medium flow-rate regulating devices **36***c* and **36***d* and flows into the use-side heat exchangers **30***c* and **30***d*.

Here, the heat medium is a fluid such as water and an anti-freezing fluid and the temperature drop is scarce even if the heat medium is decompressed by the heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d*. Thus, the heat-medium inlet temperatures of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* can be made substantially equal.

The heat mediums having flowed out of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* pass through the heat-medium channel switching devices **35***a*, **35***b*, **35***c*, and **35***d*. At this time, the heat-medium channel switching devices **35***a* and **35***b* are configured such that the heat medium flowing out to a first heat-medium channel **64***a* passes through them. Also, the heat-medium channel switching devices **35***c* and **35***d* are configured such that the heat medium flowing out to a second heat-medium channel **64***b* passes through them.

Also, in FIG. **3**, the opening/closing devices **33***c*, **33***d*, and **33***e* and the heat-medium bypass pipeline **41** are disposed in the first heat-medium channel **61***a*, and the effect will be the same when they are disposed in the second heat-medium channel **61***b* as shown in FIG. **4**.

Also, in Embodiment 2, the heat-medium bypass pipeline **40** that bypasses the mixer **42** is disposed in either the first heat-medium channel **61***a* or the second heat-medium channel **61***b*. As a result, as compared with the case in which the heat-medium bypass pipeline **40** that bypasses the mixer **42** is disposed in both of the first heat-medium channel **61***a* and the second heat-medium channel **61***b*, complication of the circuit due to increase in the number of heat-medium pipelines and opening/closing devices can be prevented.

As described above, even if the temperature difference in heat mediums flowing out of the inter-heat-medium heat exchangers **14***a* and **14***b* is large, by allowing the mixer **42** to perform heat exchange of the heat medium, the heat-medium inlet temperatures of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* can be made substantially equal. As a result, overheating or overcooling of the heat medium can be prevented, and an energy saving refrigerating cycle device can be realized.

Also, during the cooling only operation, too, the effect in which the heat-medium inlet temperatures of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* are made substantially equal can be obtained similarly to Embodiment 1.

Embodiment 3

In the above-described Embodiment 1, the inter-heat-medium heat exchangers are arranged so that the refrigerant flows in series on the heat source unit side, but Embodiment 3 in which the two inter-heat-medium heat exchangers are arranged so that the refrigerant flows in parallel during the heating only operation and the cooling only operation will be described below. FIG. **5** is a circuit diagram of the heat source side in this case.

In Embodiment 3, the compressor **10**, the four-way valve **11**, the heat-source-side heat exchanger **12**, the check valves **13***a*, **13***b*, **13***c*, and **13***d* and the accumulator **16** are contained in the heat source unit **1** (outdoor unit). Also, the heat source unit **1** contains the controller **50** that supervises control of the entire refrigerating cycle device. The inter-heat-medium heat exchangers **14***a* and **14***b*, a gas-liquid separator **20**, the expansion devices **15***c*, **15***d*, **21**, and **22**, and opening/closing devices **23***a*, **23***b*, **24***a*, and **24***b* are contained in the heat-medium converter **3**.

The gas-liquid separator **20** separates the refrigerant flowing from the refrigerant pipeline **4** into a gasified refrigerant (gas refrigerant) and a liquefied refrigerant (liquid refrigerant). The opening/closing devices **23***a*, **23***b*, **24***a*, and **24***b* perform opening/closing of a valve in accordance with the operation mode according to cooling/heating and switch the channel of the refrigerant.

The inter-heat-medium heat exchanger **14***a* functions as an evaporator during the cooling only operation and has the refrigerant absorb heat so as to cool the heat medium. During the cooling-main operation, the heating-main operation, and the heating only operation, the heat exchanger **14***a* functions as a condenser and allows the refrigerant to radiate heat so as to heat the heat medium. The inter-heat-medium heat exchanger **14***b* functions as an evaporator during the cooling only operation, the cooling-main operation, and the heating-main operation. The heat exchanger **14***b* functions as a condenser during the heating only operation.

(Cooling Only Operation)

In the heat source unit **1**, the refrigerant sucked into the compressor **10** is compressed and discharged as a high-pressure gas refrigerant. The refrigerant coming out of the compressor **10** flows into the heat-source-side heat exchanger **12** that functions as a condenser via the four-way valve **11**. The high-pressure gas refrigerant is condensed in the heat-source-side heat exchanger **12** and flows out as a high-pressure liquid refrigerant. After that, the refrigerant flows through the check valve **13***a* and flows into the heat-medium converter **3** through the refrigerant pipeline **4**.

The refrigerant having flowed into the heat-medium converter **3** passes through the gas-liquid separator **20**. From the gas-liquid separator **20**, only the liquid refrigerant flows out. During the cooling only operation, the opening/closing devices **23***a* and **23***b* are closed so that the refrigerant does not flow. Also, an expansion device **22** is set to such an opening degree that the refrigerant does not flow. The liquid refrigerant having passed through an expansion device **21** is decompressed while passing through the expansion devices **15***c* and **15***d*, becomes a low temperature and low pressure gas-liquid two-phase refrigerant and flows into the inter-heat-medium heat exchangers **14***a* and **14***b*. Since the inter-heat-medium heat exchangers **14***a* and **14***b* function as evaporators for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchangers **14***a* and **14***b* cools the heat medium (absorbs heat from the heat medium), which is the target of the heat exchange, and flows out as a low pressure gas refrigerant. The gas refrigerant having flowed out passes through the opening/closing devices **24***a* and **24***b* and the refrigerant pipeline **4** and flows out of the heat-medium converter **3**.

The refrigerant having flowed into the heat source unit **1** passes through the check valve **13***d* and is further sucked again into the compressor via the four-way valve **11** and the accumulator **16**.

(Heating Only Operation)

In the heat source unit **1**, the refrigerant sucked into the compressor **10** is compressed and discharged as a high-pressure gas refrigerant. The refrigerant coming out of the compressor **10** flows through the four-way valve **11** and the check valve **13***b*. The refrigerant further flows into the heat-medium converter **3** through the refrigerant pipeline **4**.

The gas refrigerant having flowed into the heat-medium converter **3** passes through the gas-liquid separator **20**. From the gas-liquid separator **20**, only the gas refrigerant flows out. The gas refrigerant flows into the inter-heat-medium heat exchangers **14***a* and **14***b* through the opening/closing devices **23***a* and **23***b*. At this time, the opening/closing devices **24***a* and **24***b* are closed so that the refrigerant does not flow. Also, the expansion device **21** is set to such an opening degree that the refrigerant does not flow. Since the inter-heat-medium heat exchangers **14***a* and **14***b* function as condensers for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchangers **14***a* and **14***b* heats the heat medium (radiates heat to the heat medium), which is the target of the heat exchange, and flows out as a liquid refrigerant.

The refrigerant having flowed out of the inter-heat-medium heat exchangers **14***a* and **14***b* passes through the expansion devices **15***c*, **15***d*, and **22** and flows out of the heat-medium converter **3** and flows into the heat source unit **1** via the refrigerant pipeline **4**. At this time, the opening degrees of the expansion devices **15***c*, **15***d*, and **22** are controlled so as to regulate the flow rate of the refrigerant and to decompress the refrigerant, the low temperature and low pressure gas-liquid two-phase refrigerant flows out of the heat-medium coverer **3**.

The refrigerant having flowed into the heat source unit **1** flows into the heat-source-side heat exchanger **12** via the check valve **13***c* and performs heat exchange with the air and is evaporated and flows out as a gas refrigerant or a gas-liquid two-phase refrigerant. The evaporated refrigerant is sucked into the compressor again via the four-way valve **11** and the accumulator **16**.

(Cooling-Main Operation)

In the heat source unit **1**, the refrigerant sucked into the compressor **10** is compressed and discharged as a high-pressure gas refrigerant. The refrigerant coming out of the compressor **10** flows into the heat-source-side heat exchanger **12** that functions as a condenser via the four-way valve **11**. The high-pressure gas refrigerant is condensed by heat exchange with the outside air while passing through the heat-source-side heat exchanger **12**. Here, during the cooling-main operation, it is configured such that the gas-liquid two-phase refrigerant flows out of the heat-source-side heat exchanger **12**. The gas-liquid two-phase refrigerant having flowed out of the heat-source-side heat exchanger **12** flows through the check valve **13***a*. The refrigerant further flows into the heat-medium converter **3** via the refrigerant pipeline **4**.

The gas-liquid two-phase refrigerant having flowed into the heat-medium converter **3** is separated into a gas refrigerant and a liquid refrigerant in the gas-liquid separator **20**. The gas refrigerant separated in the gas-liquid separator **20** passes through the opening/closing device **23***a* and flows into the inter-heat-medium heat exchanger **14***a*. Since the inter-heat-medium heat exchanger **14***a* functions as a condenser for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchanger **14***a* heats and liquefies the heat medium, which is the target of the heat exchange (radiates heat to the heat medium). The liquid refrigerant having flowed out of the inter-heat-medium heat exchanger **14***a* passes through the expansion device **15***c*. Here, the opening degree of the expansion device **15***c* is controlled so as to regulate the flow rate of the refrigerant passing through the inter-heat-medium heat exchanger **14***a*.

On the other hand, the liquid refrigerant separated in the gas-liquid separator **20** passes through the expansion device **21**, merges with the liquid refrigerant passing through the expansion device **15***c*, passes through the expansion device **15***d* and flows into the inter-heat-medium heat exchanger **14***b*. Here, the opening degree of the expansion device **15***d* is controlled and the flow rate of the refrigerant is regulated so as to decompress the refrigerant, and thus, the low temperature and low pressure gas-liquid two-phase refrigerant flows into the inter-heat-medium heat exchanger **14***b*. Since the inter-heat-medium heat exchanger **14***b* functions as an evaporator for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchanger **14***b* cools and gasifies the heat medium, which is the target of the heat exchange (absorbs heat from the heat medium). Here, the expansion device **21** is kept fully open. The opening degree of the expansion device **22** is set such that the refrigerant does not flow. Also, the opening/closing devices **24***a* and **23***b* are closed. The refrigerant having passed through the opening/closing device **24***b* passes through the refrigerant pipeline **4** and flows out of the heat-medium converter **3**.

The refrigerant having flowed into the heat source unit **1** passes through the check valve **13***d* and is again sucked into the compressor through the four-way valve **11** and the accumulator **16**.

(Heating-Main Operation)

In the heat source unit **1**, the refrigerant sucked into the compressor **10** is compressed and discharged as a high-pressure gas refrigerant. The refrigerant having flowed out of the compressor **10** flows through the four-way valve **11** and the check valve **13***b*. The refrigerant further passes through the refrigerant pipeline **4** and flows into the heat-medium converter **3**.

The refrigerant having flowed into the heat-medium converter **3** passes through the gas-liquid separator **20**. The gas refrigerant having passed through the gas-liquid separator **20** passes through the opening/closing device **23***a* and flows into the inter-heat-medium heat exchanger **14***a*. Since the inter-heat-medium heat exchanger **14***a* functions as a condenser for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchanger **14***a* heats and liquefies the heat medium, which is the target of the heat exchange (radiates heat to the heat medium). The liquid refrigerant having flowed out of the inter-heat-medium heat exchanger **14***a* passes through the expansion device **15***c*. Here, the opening degree of the expansion device **15***c* is controlled, and the flow rate of the refrigerant passing through the inter-heat-medium heat exchanger **14***a* is regulated. The expansion device **21** is set to such an opening degree that the refrigerant does not flow.

The refrigerant having passed through the expansion device **15***c* further passes through the expansion devices **15***d* and **22**. The refrigerant having passed through the expansion device **15***d* flows into the inter-heat-medium heat exchanger **14***b*. Here, the opening degree of the expansion device **15***d* is controlled and the flow rate of the refrigerant is regulated so as to decompress the refrigerant, and thus, the low temperature and low pressure gas-liquid two-phase refrigerant flows into the inter-heat-medium heat exchanger **14***b*. Since the inter-heat-medium heat exchanger **14***b* functions as an evaporator for the refrigerant, the refrigerant passing through the inter-heat-medium heat exchanger **14***b* cools the heat medium, which is the target of the heat exchange, and becomes a gas refrigerant (absorbs heat from the heat medium) and flows out. The gas refrigerant having flowed out of the inter-heat-medium heat exchanger **14***b* passes through the opening/closing device **24***b*. On the other hand, the refrigerant having passed through the expansion device **22** also controls the opening degree of the expansion device **22** and thus, becomes a low temperature and low pressure gas-liquid two-phase refrigerant and merges with the gas refrigerant having passed through the opening/closing device **24***b*. Therefore, the refrigerant becomes a low temperature and low pressure refrigerant with higher dryness. The merged refrigerant passes through the refrigerant pipeline **4** and flows out of the heat-medium converter **3**. Here, the opening/closing devices **23***b* and **24***a* are closed so that the refrigerant does not flow.

The refrigerant having flowed into the heat source unit **1** flows into the heat-source-side heat exchanger **12** and is evaporated by heat exchange with the air and flows out as a gas refrigerant or a gas-liquid two-phase refrigerant. The evaporated refrigerant is sucked into the compressor **10** again through the four-way valve **11** and the accumulator **16**.

As described above, if the inter-heat-medium heat exchanger **14***a* and the inter-heat-medium heat exchanger **14***b* are arranged in parallel in a heat-source-side circuit, a high-temperature gas refrigerant flows into both the inter-heat-medium heat exchanger **14***a* and the inter-heat-medium heat exchanger **14***b* during the heating only operation. Thus, since the high-temperature gas refrigerant can perform heat exchange with the heat medium both in the inter-heat-medium heat exchanger **14***a* and the inter-heat-medium heat exchanger **14***b*, the heat-medium outlet temperatures of both the inter-heat-medium heat exchanger **14***a* and the inter-heat-medium heat exchanger **14***b* can be made high. Also, since the gas-liquid two-phase refrigerant with the same dryness can be made to flow into both the inter-heat-medium heat exchanger **14***a* and the inter-heat-medium heat exchanger **14***b* during the cooling only operation, the heat-medium outlet temperatures of both the inter-heat-medium heat exchanger **14***a* and the inter-heat-medium heat exchanger **14***b* can be made low. Also, since the refrigerant flow rates flowing into both the inter-heat-medium heat exchanger **14***a* and the inter-heat-medium heat exchanger **14***b* can be made substantially half of the total refrigerant flow rate flowing into the heat-medium converter **3** both in the heating only operation and the cooling only operation, pressure loss of the refrigerant can be reduced. Moreover, during the cooling/heating simultaneous operation, since the flow rates of the refrigerants flowing into the inter-heat-medium heat exchanger **14***a* and the inter-heat-medium heat exchanger **14***b* can be controlled separately, the heat amount radiated by the refrigerant into the heat medium in the inter-heat-medium heat exchanger **14***a* functioning as a condenser and the heat amount absorbed by the refrigerant from the heat medium in the inter-heat-medium heat exchanger **14***b* functioning as an evaporator can be easily controlled.

Here, the opening degrees of the expansion devices **15***c* and **15***d* are controlled so that the supercooling degrees of the refrigerant outlets of the inter-heat-medium heat exchanger **14***a* and the inter-heat-medium heat exchanger **14***b* are adjusted during the heating only operation and the superheating degrees of the refrigerant outlets of the inter-heat-medium heat exchanger **14***a* and the inter-heat-medium heat exchanger **14***b* are adjusted during the cooling only operation. At this time, when the differences in the temperatures and the flow rates of the heat mediums flowing into the inter-heat-medium heat exchangers **14***a* and **14***b* become large, the difference in the exchanged heat amount becomes large between the inter-heat-medium heat exchanger **14***a* and the inter-heat-medium heat exchanger **14***b*. As a result, the difference in the heat-medium outlet temperature of the inter-heat-medium heat exchanger **14***a* and the heat-medium outlet temperature of the inter-heat-medium heat exchanger **14***b* might become large.

Thus, as shown in Embodiment 1, by allowing the heat mediums flowing out of the two inter-heat-medium heat exchangers to be heat-exchanged with each other, the heat-medium outlet temperatures of the two inter-heat-medium heat exchangers can be substantially equalized. Alternatively, as shown in Embodiment 2, by bringing the heat mediums flowing out of the two inter-heat-medium heat exchangers into contact and mixing them, the heat-medium outlet temperatures of the two inter-heat-medium heat exchangers can be substantially equalized. As described above, the heat-medium inlet temperatures of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* can be substantially equalized.

Also, the refrigerant-side circuit of Embodiment 3 does not depend on the heat-medium-side circuit, and any of the heat-medium-side circuit shown in Embodiment 1 (FIGS. **1** and **2**) and the heat-medium-side circuit shown in Embodiment 2 (FIGS. **3** and **4**) can be combined.

Also, in the heat-medium-side circuits in Embodiments 1 to 3, the heat-medium flow rate flowing into each indoor unit **2** is regulated by the heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d*. Instead of that, as shown in FIG. **6**, a bypass pipeline **43** for the heat medium to bypass the use-side heat exchanger **30***a* may be disposed, and the heat-medium flow-rate regulating device **36***a*, which is a three-way valve, for example, may be installed at a heat-medium outlet of the bypass pipeline **43** and the use-side heat exchanger **30***a*. In this case, by regulating the flow rate of the heat medium flowing through the bypass pipeline **43**, the heat-medium flow rate flowing into the use-side heat exchanger **30***a* can be regulated.

Also, in Embodiments 1 to 3, the heat source of the heat source unit is a refrigerating cycle circuit but various heat sources including a heater can be used.

Also, by substantially equalizing the heat-medium temperature, user comfort is improved by the following reasons. Here, assume that the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* are performing a heating operation and the heat-medium inlet temperatures of the use-side heat exchangers **30***a* and **30***b* are lower than a predetermined temperature and the difference in the heat-medium inlet temperatures of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* is large.

As described above, load adjustment of the use-side heat exchanger **30** is performed by controlling the heat-medium flow-rate regulating device **36** so as to adjust the difference between the heat-medium inlet temperature and the outlet temperature of the use-side heat exchanger **30** by regulating the flow rate of the heat medium. However, if the heat-medium inlet temperatures (40° C., for example) of the use-side heat exchangers **30***a* and **30***b* are lower than the predetermined temperature (45° C., for example), the temperature difference between the heat medium and the air is made small in the use-side heat exchangers **30***a* and **30***b*. Thus, even if the opening degrees of the heat-medium flow-rate regulating devices **36***a* and **36***b* are fully open, the loads required by the indoor units **2***a* and **2***b* cannot be satisfied, and user comfort is lost.

On the other hand, in order to set the heat-medium inlet temperatures of the use-side heat exchangers **30***a* and **30***b* to a predetermined temperature, the output of the heat source unit needs to be raised by increasing the velocity of the compressor **10**, for example. Then, in the use-side heat exchangers **30***c* and **30***d* whose heat-medium inlet temperatures are originally at the predetermined temperature or above, the heat-medium inlet temperatures are further raised (to 50° C., for example), the blow-out temperature of the indoor unit **2** can become too high even if the flow rate of the heat medium is decreased, whereby user comfort is lost. Also, the heat medium is heated to a temperature higher than necessary, which is not energy-saving. Due to the above reasons, the heat-medium inlet temperatures of the use-side heat exchangers need to be substantially equalized for comfortability.

For example, as a system, assume that the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* are installed in each room. At this time, also assume that the refrigerating cycle device is performing a heating only operation. The flow rates of the heat mediums flowing into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* are regulated by the heat-medium flow-rate regulating valves **36***a*, **36***b*, **36***c*, and **36***d* in accordance with the loads of the indoor units **2***a*, **2***b*, **2***c*, and **2***d*. Here, by substantially equalizing the heat-medium inlet temperatures of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* to a predetermined temperature, even if the sizes of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* are different or a load in each room is different from each other, by controlling the opening degrees of the heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d* and adjusting the temperature difference between the heat-medium inlet temperature and the outlet temperature of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*, the load adjustment of the indoor units **2***a*, **2***b*, **2***c*, and **2***d* can be made. As a result, user comfort can be obtained. Also, by substantially equalizing the heat-medium inlet temperatures of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*, the refrigerating cycle device can be operated at a heat-medium inlet temperatures of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* at which the COP is high, whereby energy can be saved.

Embodiment 4

FIG. **13** is a system circuit diagram of a refrigerating cycle device according to Embodiment 4 of the present invention. The refrigerating cycle device of Embodiment 4 is provided with a first heat-source medium pipeline **70***a* and a second heat-source medium pipeline **70***b*. Through the first heat-source medium pipeline **70***a*, a first heat-source medium flows. Through the second heat-source medium pipeline **70***b*, a second heat-source medium flows. Here, the first heat-source medium and the second heat-source medium may be the same or may be different. Also, the heat-source medium may be any type of medium such as water, brine, steam, a refrigerant and the like as long as it is fluid.

Also, the inter-heat-medium heat exchangers **14***a* and **14***b*, the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*, the pumps **31***a* and **31***b*, which are heat-medium feeding devices, the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, **34***d*, **35***a*, **35***b*, **35***c*, and **35***d*, and the heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d* are connected by a pipeline so as to constitute a heat-medium circulation circuit. Here, the pump **31***a* corresponds to the first heat-medium feeding device. The pump **31***b* corresponds to the second heat-medium feeding device. The heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* correspond to the first heat-medium channel switching devices. The heat-medium channel switching devices **35***a*, **35***b*, **35***c*, and **35***d* correspond to the second heat-medium channel switching devices. The heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d* correspond to the heat-medium flow-rate regulation unit. In Embodiment 4, the number of the use-side heat exchangers **30** is four, but the number of the use-side heat exchangers **30** is arbitrary.

Each of the use-side heat exchangers **30** has a heat transfer pipe through which the heat medium passes and a fin (not shown) that enlarges the heat transfer area between the heat medium flowing through the heat transfer pipe and the air and performs heat exchange between the heat medium and the air.

In Embodiment 4, the inter-heat-medium heat exchangers **14***a* and **14***b* are contained in the heat-medium converter **3** (branch unit), which is also a heat-medium branch unit. Also, the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, **34***d*, **35***a*, **35***b*, **35***c*, and **35***d* and the heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d* are also contained in the heat-medium converter **3**.

Each of the heat-medium converter **3** and the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* is connected to each other by the heat-medium pipeline **5** through which a safe heat medium such as water, an anti-freezing fluid and the like flows. That is, each of the heat-medium converter **3** and the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* is connected by a single heat-medium path.

Each of the inter-heat-medium heat exchangers **14***a* and **14***b* has a heat transfer portion through which a heat-source medium passes and a heat transfer portion through which a heat medium passes and performs heat exchange between the heat mediums, that is, the heat-source medium and the heat medium. In Embodiment 4, in the inter-heat-medium heat exchanger **14***a*, the first heat-source medium heats or cools the heat medium. In the inter-heat-medium heat exchanger **14***b*, the second heat-source medium heats or cools the heat medium.

The auxiliary heat exchanger **32** has a heat transfer portion through which the heat medium passes and performs heat exchange between heat mediums flowing through the first heat-medium channel **61***a* and the second heat-medium channel **61***b*. One inlet is connected to the outlet of the pump **31***a* by a pipeline, and the other inlet is connected to the outlet of the pump **31***b* by a pipeline. In the channel on a first heat-medium pipeline **61***a* side, the heat-medium bypass pipeline **40** that has the auxiliary heat exchanger **32** bypassed and the opening/closing devices **33***a* and **33***b* are disposed.

For example, the first heat-source medium cools the heat medium in the inter-heat-medium heat exchanger **14***a*, the second heat-source medium cools the heat medium in the inter-heat-medium heat exchanger **14***b*, and the inlet temperature (5° C., for example) of the inter-heat-medium heat exchanger **14***b* of the second heat-source medium might be higher than the inlet temperature (2° C., for example) of the inter-heat-medium heat exchanger **14***a* of the first heat-source medium.

At this time, the heat-medium outlet temperature (10° C., for example) of the inter-heat-medium heat exchanger **14***b* becomes higher than the heat-medium outlet temperature (7° C., for example) of the inter-heat-medium heat exchanger **14***a*.

In Embodiment 4, in order to substantially equalize the heat-medium inlet temperatures of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*, the auxiliary heat exchanger **32** is provided. At this time, the opening/closing device **33***a* is closed, and the opening/closing device **33***b* is opened. Then, heat exchange is performed between heat mediums in the auxiliary heat exchanger **32**, and if the flow rates of the heat mediums in the first heat-medium channels **61***a* and **61***b* are substantially the same, for example, the heat-medium outlet temperature of the auxiliary heat exchanger **33** becomes approximately an average value (8.5° C., for example) of the heat-medium outlet temperatures of the inter-heat-medium heat exchangers **14***a* and **14***b* both in the first heat-medium channels **61***a* and **61***b*.

The heat mediums in the first heat-medium channel **61***a* and the second heat-medium channel **61***b* have their channels switched by the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* and flow into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d*. Here, the channels of the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* are configured such that the heat medium in the first heat-medium channel **61***a* flows into the use-side heat exchangers **30***a* and **30***b* and the heat medium in the second heat-medium channel **61***b* flows into the use-side heat exchangers **30***c* and **30***d*, for example. In the above case, the heat-medium channel switching devices **34***a* and **34***b* are configured such that the heat medium of the first heat-medium channel **61***a* passes through them. The heat-medium channel switching devices **34***c* and **34***d* are configured such that the heat medium of the first heat-medium channel **61***b* passes through them.

The heat medium having passed through the heat-medium channel switching devices **34***a*, **34***b*, **34***c*, and **34***d* have their flow rates flowing into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* regulated by the heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d*. For example, by adjusting the opening degrees of the heat-medium flow-rate regulating devices **36***a*, **36***b*, **36***c*, and **36***d* so that the heat-medium temperature difference between the inlets and the outlets of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* becomes constant, the flow rates of the heat mediums flowing into the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* can be regulated even if the sizes or loads of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* are different. If any of the use-side heat exchangers **30** is to be stopped, the heat-medium flow-rate regulating valve **36** will be fully opened.

The heat mediums having flowed out of the use-side heat exchangers **30***a*, **30***b*, **30***c*, and **30***d* pass through the heat-medium channel switching devices **35***a*, **35***b*, **35***c*, and **35***d*. At this time, the heat-medium channel switching devices **35***a* and **35**_b_ are configured such that the heat medium flowing out to the first heat-medium channel **62**_a_ passes through them. Also, the heat-medium channel switching devices **35**_c_ and **35**_d_ are configured such that the heat medium flowing out to the second heat-medium channel **62**_b_ passes through them.

As described above, the auxiliary heat exchanger **33** equalizes the heat medium temperatures of the first heat-medium channels **61**_a_ and **62**_b_. Also, even if the flow rate of the heat medium is regulated in the heat-medium flow-rate regulating devices **36**_a_, **36**_b_, **36**_c_, and **36**_d_, a temperature change is rarely caused by decompression in water, an anti-freezing fluid or the like, the inlet temperatures of the use-side heat exchangers **30**_a_, **30**_b_, **30**_c_, and **30**_d_ are substantially equalized.

As described above, since heat exchange is performed between the heat mediums in the auxiliary heat exchanger **32**, even if the temperature difference is large between the heat-source mediums **70**_a_ and **70**_b_, the heat-medium inlet temperatures of the use-side heat exchangers **30**_a_, **30**_b_, **30**_c_, and **30**_d_ can be substantially equalized. Thus, it is useful when temperature control of the use-side heat exchanger **30** is required such as cold storage of foods and the like.

Industrial Applicability

As described above, the present invention is useful in a refrigerating cycle device using a heat medium such as water, an anti-freezing fluid and the like as a secondary medium and a refrigerating cycle device.

Reference Signs List

1 heat source unit (outdoor unit), **2**_a_, **2**_b_, **2**_c_, **2**_d_ indoor unit, **3** heat-medium converter, **4** refrigerant pipeline, **5** heat-medium pipeline, **10** compressor, **11** four-way valve (refrigerant channel switching device), **12** heat-source-side heat exchanger, **13**_a_, **13**_b_, **13**_c_, **13**_d_ check valve, **14**_a_, **14**_b_ inter-heat-medium heat exchanger, **15**_a_, **15**_b_, **15**_c_, **15**_d_ expansion device, **16** accumulator, **20** gas-liquid separator, **21**, **22** expansion device, **23**_a_, **23**_b_, **24**_a_, **24**_b_ opening/closing device, **30**_a_, **30**_b_, **30**_c_, **30**_d_ use-side heat exchanger, **31**_a_, **31**_b_ pump (heat-medium feeding device), **32** auxiliary heat exchanger, **33**_a_, **33**_b_, **33**_c_, **33**_d_ opening/closing device, **34**_a_, **34**_b_, **34**_c_, **34**_d_ heat-medium channel switching device, **35**_a_, **35**_b_, **35**_c_, **35**_d_ heat-medium channel switching device, **36**_a_, **36**_b_, **36**_c_, **36**_d_ heat-medium flow-rate regulating device, **40**, **41** heat-medium bypass pipeline, **42** mixer, **43** heat-medium bypass pipeline, **50** controller, **61**_a_, **62**_a_, **63**_a_, **64**_a_ first heat-medium channel, **61**_b_, **62**_b_, **63**_b_, **64**_b_ second heat-medium channel, **70**_a_ first heat-source medium pipeline, **70**_b_ second heat-source medium pipeline

The invention claimed is:

1. A refrigerating cycle device comprising:

a plurality of use-side heat exchangers;

a first inter-heat-medium heat exchanger having one port connected to each heat-medium inlet of the use-side heat exchangers by a pipeline and the other port connected to each heat-medium outlet of the use-side heat exchangers;

a second inter-heat-medium heat exchanger having one port connected to each heat-medium inlet of the use-side heat exchangers by a pipeline and the other port connected to each heat-medium outlet of the use-side heat exchangers;

a plurality of first heat-medium channel switching devices, each of which is disposed on the heat-medium inflow side of each of the use-side heat exchangers, switching between a first inflow-side channel, which connects the first inter-heat-medium heat exchanger and the heat-medium inlets of the use-side heat exchangers, and a second inflow-side channel, which connects the second inter-heat-medium heat exchanger and the heat-medium inlets of the use-side heat exchangers;

a plurality of second heat-medium channel switching devices, each of which is disposed on the heat-medium outflow side of each of the use-side heat exchangers, switching between a first outflow-side channel, which connects the first inter-heat-medium heat exchanger and the heat-medium outlets of the use-side heat exchangers, and a second outflow-side channel, which connects the second inter-heat-medium heat exchanger and the heat-medium outlets of the use-side heat exchangers;

a heat source device that is connected to the first inter-heat-medium heat exchanger and the second inter-heat-medium heat exchanger and supplies heating energy or cooling energy to the first inter-heat-medium heat exchanger and the second inter-heat-medium heat exchanger so as to heat or cool a first heat medium flowing from the first inter-heat-medium heat exchanger to the use-side heat exchangers and a second heat medium flowing from the second inter-heat-medium heat exchanger to the use-side heat exchangers;

an auxiliary heat exchanger having a first heat-medium inlet which is connected to the first inter-heat-medium heat exchanger by a pipeline and which the first heat medium flows into, a first heat-medium outlet which allows the first heat medium having flowed in from the first heat-medium inlet to flow out to the use-side heat exchangers through the plurality of first heat-medium channel switching devices, a second heat-medium inlet which is connected to the second inter-heat-medium heat exchanger by a pipeline and which the second heat medium flows into, and a second heat-medium outlet which allows the second heat medium having flowed in from the second heat-medium inlet to flow out to the use-side heat exchangers through a plurality of the first heat-medium channel switching devices, and performing heat between the first heat medium flowing from the first heat-medium inlet to the first heat-medium outlet and the second heat medium flowing from the second heat-medium inlet to the second heat-medium outlet through a heat transfer material or performing heat exchange by mixing the first heat medium flowing in from the first heat-medium inlet and the second heat medium flowing in from the second heat-medium inlet and allowing the mixture to flow out of the first heat-medium outlet and the second heat-medium outlet; and

a heat-medium channel that connects a bypass pipeline that bypasses the auxiliary heat exchanger and an opening/closing valve disposed in the bypass pipeline to the heat-medium outlet of either the first inter-heat-medium heat exchanger or the second inter-heat-medium heat exchanger that the heat medium flows out from.

2. The refrigerating cycle device of claim **1**, wherein

the auxiliary heat exchanger directly brings the heat medium having flowed in from the first heat-medium inlet and the heat medium having flowed in from the second heat-medium inlet into contact with each other to mix.

3. The refrigerating cycle device of claim **1**,

the heat source device further comprising a refrigerating cycle circuit provided with a compressor, a heat-source-side heat exchanger, at least one expansion device that regulates a pressure of a refrigerant, a refrigerant-side channel of the first inter-heat-medium heat exchanger, and a refrigerant-side channel of the second inter-heat-medium heat exchanger, connected by a pipeline.

4. The refrigerating cycle device of claim 1,

the heat source device further comprising

the refrigerant outlet of the first inter-heat-medium heat exchanger and the refrigerant inlet of the second inter-heat-medium heat exchanger being connected so that the refrigerant-side channel of the first inter-heat-medium heat exchanger and the refrigerant-side channel of the second inter-heat-medium heat exchanger are arranged in series, and

the expansion device being disposed in the refrigerant channel that connects the first inter-heat-medium heat exchanger and the second inter-heat-medium heat exchanger.

5. The refrigerating cycle device of claim 1,

the heat source device further comprising,

a heat source unit that contains the compressor and the heat-source-side heat exchanger, and

a heat-medium converter that contains any one of the first inter-heat-medium heat exchanger, the second inter-heat-medium heat exchanger, and the auxiliary heat exchanger.

6. The refrigerating cycle device of claim 1, wherein

the heat source device contains a refrigerant that forms a supercritical cycle such as carbon dioxide.

7. The refrigerating cycle device of claim 1, wherein

the heat source device includes

a first heat-source medium channel that is connected by a pipeline to the first inter-heat-medium heat exchanger, supplies a heat-source medium to the first heat-medium heat exchanger and heats or cools the heat medium flowing from the first inter-heat-medium heat exchanger to the use-side heat exchanger, and

a second heat-source medium channel that is connected by a pipeline to the second inter-heat-medium heat exchanger, supplies a heat-source medium to the second heat-medium heat exchanger and heats or cools the heat medium flowing from the second inter-heat-medium heat exchanger to the use-side heat exchanger.

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