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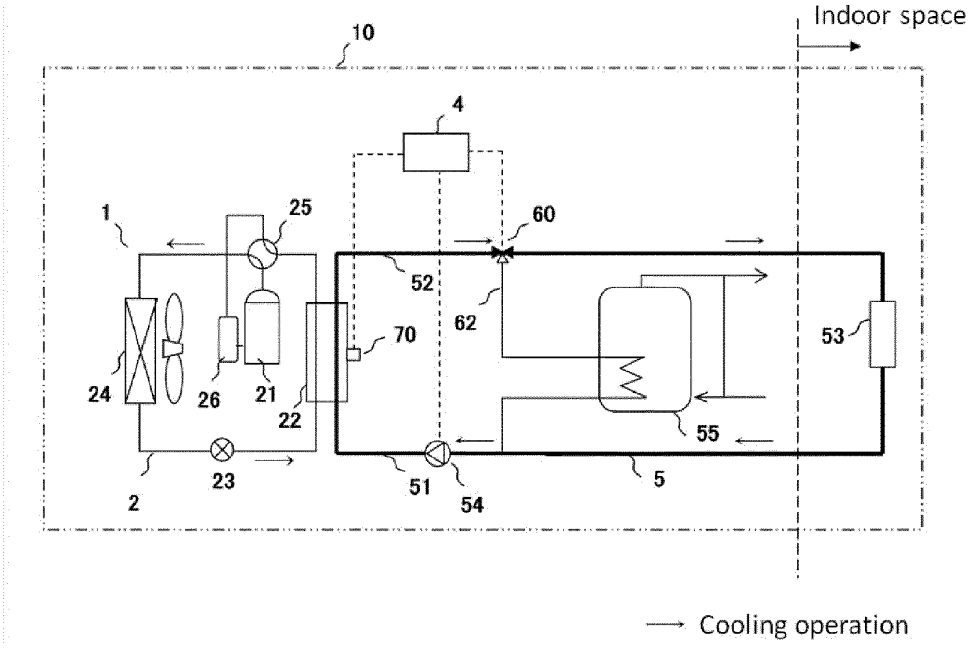
(54) Cold/hot water supply apparatus

(57) According to a cold/hot water supply apparatus 10 of the present invention, when it is requested to change the operation mode from the cooling operation mode to the heat-accumulation operation mode and the fluid temperature detected by the temperature sensor 70 is lower than a predetermined temperature, the control apparatus 4 continues the cooling operation mode, and when the fluid temperature detected by the temperature sensor is equal to or higher than the predetermined temperature, the control apparatus switches the operation mode from the cooling operation mode to the heat-accumulation operation mode. It is possible to suppress the reduction in a temperature (accumulated heat amount) of the heat accumulator tank 55 caused by low temperature fluid, and energy loss can be reduced.

[Fig. 1]



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Description

[Technical Field]

[0001] The present invention relates to a cold/hot water supply apparatus for carrying out air conditioning in an indoor space using a heat pump and for accumulating heat in a heat accumulator tank.

[Background Technique]

[0002] There is a conventionally known cold/hot water supply apparatus having a cooling operation mode for cooling an indoor space and a heat-accumulation operation mode for heating a heat accumulator tank (see patent document 1 for example).

[0003] Fig. 6 shows a refrigeration cycle apparatus 100 which carries out an air conditioning operation in an indoor space and accumulates heat in a heat accumulator tank 300.

The refrigeration cycle apparatus 100 includes a refrigerant circuit 110 through which refrigerant circulates, a compressor 111, a four-way valve 112, a first heat exchanger 113, expansion means 114 and a air convection body heat exchanger 115, and these members are annularly connected to one another through pipes.

The first heat exchanger 113 includes a refrigerant circuit 110 and a fluid circuit 210. The fluid circuit 210 includes a first heat exchanger 113, circulation means 220 and a fluid path-switching valve 230. Fluid flowing through the fluid circuit 210 flows to a third heat exchanger 400 or a heat accumulator tank 300 by switching operation of the fluid path-switching valve 230. The third heat exchanger 400 is a fan coil unit having a heat exchanger and a blast fan.

[0004] In the case of the cooling operation mode, low temperature fluid is produced in the first heat exchanger 113. This low temperature fluid flows to the third heat exchanger 400 through the fluid path-switching valve 230, absorbs heat from the indoor space by the third heat exchanger 400, cools the indoor space and then, returns into the first heat exchanger 113.

In the case of the heat-accumulation operation mode, the refrigeration cycle apparatus 100 switches the four-way valve 112. According to this, the refrigerant flows in a direction opposite from that of the cooling operation mode. Therefore, in the case of the heat-accumulation operation mode, high temperature fluid is produced in the first heat exchanger 113. This high temperature fluid flows to the heat accumulator tank 300 through the fluid path-switching valve 230, dissipates heat in the heat accumulator tank 300 and then, returns to the first heat exchanger 113. Hot water heated in the heat accumulator tank 300 is supplied.

[0005] The cooling operation mode is switched to the heat-accumulation operation mode and the heat-accumulation operation mode is switched to the cooling operation mode by switching the fluid path-switching valve 230.

The low temperature fluid and the high temperature fluid produced by the first heat exchanger 113 are conveyed by switching the fluid path-switching valve 230.

That is, by switching the fluid path-switching valve 230, fluid which flows out of the first heat exchanger 113 cools an indoor space in the case of the cooling operation mode, and heats water in the heat accumulator tank 300 in the case of the heat-accumulation operation mode.

[Prior Art Document]

[Patent Document]

[0006] [Patent Document 1] Specification of EPC Patent Application Publication No.2204620

[Summary of the Invention]

[Problem to be Solved by the Invention]

[0007] According to the conventional configuration, however, when the cooling operation mode is switched to the heat-accumulation operation mode, low temperature fluid accumulated between the first heat exchanger 113 and the fluid path-switching valve 230 flows into the heat accumulator tank 300.

As a result, since the low temperature fluid absorbs heat from the heat accumulator tank 300, the heat accumulator tank 300 is cooled and a temperature thereof is lowered immediately after the operation mode is switched to the heat-accumulation operation mode. Since the heat accumulator tank 300 whose temperature is lowered is heated by the heat pump, it takes time to heat the heat accumulator tank 300, and energy utilizing efficiency is deteriorated.

[0008] The present invention has been accomplished to solve the conventional problem, and it is an object of the present invention to provide a cold/hot water supply apparatus capable of suppressing reduction of a temperature (accumulated heat amount) of a heat accumulator tank caused by low temperature fluid and capable of reducing energy loss when a cooling operation mode is switched to a heat-accumulation operation mode.

[Means for Solving the Problem]

[0009] To solve the conventional problem, the present invention provides a cold/hot water supply apparatus comprising: a refrigerant circuit formed by annularly connecting, to one another, a compressor, a first heat exchanger, decompressing means and a second heat exchanger, and a refrigerant flowing through the refrigerant circuit; a fluid circuit formed by annularly connecting, to one another, circulating means, the first heat exchanger, a fluid path switching means and a third heat exchanger, and fluid flowing through the fluid circuit; a heat accumulation circuit which branches off from the fluid circuit

through the fluid path switching means, and which is connected to the fluid circuit between the third heat exchanger and the first heat exchanger through a heat accumulator tank; a temperature sensor which detects a temperature of fluid heated by the first heat exchanger; and a control apparatus which switches between a flow of the fluid to the third heat exchanger and a flow of the fluid to the heat accumulator tank; in which the cold/hot water supply apparatus has a heat-accumulation operation mode for flowing the fluid to the heat accumulation circuit to heat water in the heat accumulator tank, and a cooling operation mode for flowing the fluid to the third heat exchanger to absorb heat in air, wherein when it is requested to change an operation mode from the cooling operation mode to the heat-accumulation operation mode and the fluid temperature detected by the temperature sensor is lower than a predetermined temperature, the control apparatus continues the cooling operation mode.

According to this configuration, when the fluid temperature is lower than the predetermined temperature, it is determined that if fluid flows into the heat accumulator tank, hot water in the heat accumulator tank is cooled, connection of the fluid path switching means to the third heat exchanger is maintained, fluid whose temperature is lower than the predetermined temperature is made to flow into the third heat exchanger. Therefore, fluid whose temperature is lower than the predetermined temperature does not flow into the heat accumulator tank.

As a result, fluid whose temperature is lower than the predetermined temperature does not flow into the heat accumulator tank, it is possible to prevent the temperature of the heat accumulator tank from lowering, and the accumulated heat amount in the heat accumulator tank can be reduced, i.e., energy loss can be prevented.

[0010] The present invention also provides a cold/hot water supply apparatus comprising: a refrigerant circuit formed by annularly connecting, to one another, a compressor, a first heat exchanger, decompressing means and a second heat exchanger, and a refrigerant flowing through the refrigerant circuit; a fluid circuit formed by annularly connecting, to one another, circulating means, the first heat exchanger, a fluid path switching means and a third heat exchanger, and fluid flowing through the fluid circuit; a heat accumulation circuit which branches off from the fluid circuit through the fluid path switching means, and which is connected to the fluid circuit between the third heat exchanger and the first heat exchanger through a heat accumulator tank; a temperature sensor which detects a temperature of fluid heated by the first heat exchanger; and a control apparatus which switches between a flow of the fluid to the third heat exchanger and a flow of the fluid to the heat accumulator tank; in which the cold/hot water supply apparatus has a heat-accumulation operation mode for flowing the fluid to the heat accumulation circuit to heat water in the heat accumulator tank, and a cooling operation mode for flowing the fluid to the third heat exchanger to absorb heat in air, wherein after the cooling operation mode is changed to the heat-accumulation operation mode, when the fluid temperature detected by the temperature sensor is equal to or higher than a predetermined temperature, the control apparatus continues the heat-accumulation operation mode, and when the fluid temperature detected by the temperature sensor is lower than the predetermined temperature, the control apparatus changes the operating action of the circulating means, and stops the circulation of the fluid or reduces the circulation amount of the fluid.

According to this configuration, fluid in the first heat exchanger is heated and conveyed to the heat accumulator tank. Thereafter, when the fluid temperature becomes equal to or higher than the predetermined temperature, it is determined that even if fluid flows into the heat accumulator tank, hot water in the heat accumulator tank is not cooled, and the heated fluid is made to flow into the heat accumulator tank.

On the other hand, if the fluid temperature is lower than the predetermined temperature, the circulating means is intermittently operated, thereby suppressing a volume of low temperature fluid conveyed to the heat accumulator tank to a volume existing in a connection pipe between an outlet of the first heat exchanger and the fluid path switching valve. Even if the fluid temperature is lower than the predetermined temperature, the volume of low temperature fluid conveyed to the heat accumulator tank is reduced as compared with the conventional technique.

As a result, even if the fluid temperature is lower than the predetermined temperature, since an amount of heat absorbed from the heat accumulator tank is reduced, it is possible to suppress the reduction in a temperature of the heat accumulator tank, the accumulated heat amount in the heat accumulator tank can be reduced, i.e., the energy loss can be prevented.

[Effect of the Invention]

[0011] According to the present invention, it is possible to provide a cold/hot water supply apparatus capable of suppressing reduction in a temperature (accumulated heat amount) of a heat accumulator tank caused by low temperature fluid and capable of reducing energy loss when a cooling operation mode is switched to a heat-accumulation operation mode.

[Brief Description of the Drawings]

[0012]

Fig. 1 is a schematic explanatory diagram (cooling operation mode) of a fluid circuit of a cold/hot water supply apparatus according to a first embodiment of the present invention;

Fig. 2 is a schematic explanatory diagram (heat-accumulation operation mode) of a fluid circuit of the cold/hot water supply apparatus;

Fig. 3 is a flowchart of an operating action of the

cold/hot water supply apparatus;

Fig. 4 is a flowchart of an operating action of a cold/hot water supply apparatus according to a second embodiment of the invention;

Fig. 5 is a schematic explanatory diagram of a fluid circuit of the cold/hot water supply apparatus according to a third embodiment of the invention; and

Fig. 6 is a schematic block diagram of a conventional cold/hot water supply apparatus.

[Explanation of Symbols]

[0013]

2	refrigerant circuit
4	control apparatus
5	fluid circuit
10	cold/hot water supply apparatus
21	compressor
22	first heat exchanger
23	decompreesing means
24	second heat exchanger
53	third heat exchanger
54	circulating means
55	heat accumulator tank
60	fluid path switching valve (fluid path switching means)
71	heat accumulator tank temperature sensor

[Mode for Carrying out the Invention]

[0014] According to a first aspect of the present invention, when it is requested to change an operation mode from the cooling operation mode to the heat-accumulation operation mode and the fluid temperature detected by the temperature sensor is lower than a predetermined temperature, the control apparatus continues the cooling operation mode.

According to this configuration, when the fluid temperature is lower than the predetermined temperature, it is determined that if fluid flows into the heat accumulator tank, hot water in the heat accumulator tank is cooled, connection of the fluid path switching means to the third heat exchanger is maintained, fluid whose temperature is lower than the predetermined temperature is made to flow into the third heat exchanger. Therefore, fluid whose temperature is lower than the predetermined temperature does not flow into the heat accumulator tank.

As a result, fluid whose temperature is lower than the predetermined temperature does not flow into the heat accumulator tank, it is possible to prevent the temperature of the heat accumulator tank from lowering, and the accumulated heat amount in the heat accumulator tank can be reduced, i.e., energy loss can be prevented.

[0015] According to a second aspect of the invention, in the cold/hot water supply apparatus of the first aspect, when it is requested to change the operation mode from the cooling operation mode to the heat-accumulation operation mode and the fluid temperature detected by the temperature sensor is equal to or higher than the predetermined temperature, the control apparatus switches the operation mode from the cooling operation mode to the heat-accumulation operation mode.

According to this configuration, after the operation mode is changed from the cooling operation mode to the heat-accumulation operation mode, fluid is heated through the first heat exchanger and the fluid temperature rises. Thereafter, the fluid temperature becomes equal to or higher than the predetermined temperature, and it is determined that even if the fluid flows into the heat accumulator tank, hot water in the heat accumulator tank is not cooled, the fluid path switching means is switched toward the heat accumulation circuit, and the heated fluid is made to flow into the heat accumulator tank.

As a result, fluid whose temperature is equal to or higher than the predetermined temperature can flow into the heat accumulator tank, and it is possible to effectively accumulate heat into the heat accumulator tank.

[0016] According to a third aspect of the invention, after the cooling operation mode is changed to the heat-accumulation operation mode, when the fluid temperature detected by the temperature sensor is equal to or higher than a predetermined temperature, the control apparatus continues the heat-accumulation operation mode, and when the fluid temperature detected by the temperature sensor is lower than the predetermined temperature, the control apparatus changes the operating action of the circulating means, and stops the circulation of the fluid or reduces the circulation amount of the fluid.

According to this configuration, fluid in the first heat exchanger is heated and conveyed to the heat accumulator tank. Thereafter, when the fluid temperature becomes equal to or higher than the predetermined temperature, it is determined that even if fluid flows into the heat accumulator tank, hot water in the heat accumulator tank is not cooled, and the heated fluid is made to flow into the heat accumulator tank.

On the other hand, if the fluid temperature is lower than the predetermined temperature, the circulating means is intermittently operated, thereby suppressing a volume of low temperature fluid conveyed to the heat accumulator tank to a volume existing in a connection pipe between an outlet of the first heat exchanger and the fluid path switching valve. Even if the fluid temperature is lower than the predetermined temperature, the volume of low temperature fluid conveyed to the heat accumulator tank is reduced as compared with the conventional technique.

As a result, even if the fluid temperature is lower than the predetermined temperature, since an amount of heat absorbed from the heat accumulator tank is reduced, it is possible to suppress the reduction in a temperature of the heat accumulator tank, the accumulated heat amount in the heat accumulator tank can be reduced, i.e., the energy loss can be prevented.

[0017] Embodiments of the present invention will be described with reference to the drawings. The invention

is not limited to the embodiments.

(First Embodiment)

[0018] A cold/hot water supply apparatus according to a first embodiment of the present invention will be described using Figs. 1 to 3.
Figs. 1 to 2 are schematic block diagrams of the cold/hot water supply apparatus of the embodiment. Fig. 1 is a schematic block diagram showing a flow of fluid in a cooling operation mode, Fig. 2 is a schematic block diagram showing a flow of fluid when the cooling operation mode is switched to a heat-accumulation operation mode, Fig. 3 is a schematic block diagram showing a flow of fluid in the heat-accumulation operation mode, and Fig. 4 is a flowchart of an operating action of the cold/hot water supply apparatus of the embodiment.

[0019] A configuration of the cold/hot water supply apparatus of the embodiment will be described using Fig. 1.
The cold/hot water supply apparatus 10 includes a refrigeration cycle apparatus 1, a fluid circuit 5, a third heat exchanger 53 and a heat accumulator tank 55.
The refrigeration cycle apparatus 1 includes a refrigerant circuit 2 through which refrigerant circulates. As the refrigerant, it is possible to use pseudo-azeotropic mixture refrigerant such as R410A and single refrigerant such as R32.
The refrigerant circuit 2 includes a compressor 21, a first heat exchanger 22, an expansion means 23 and a second heat exchanger 24 and these members are annularly connected to one another through pipes. The first heat exchanger 22 exchanges heat between refrigerant and fluid. An expansion valve or a capillary tube is used as the expansion means 23. The second heat exchanger 24 exchanges heat between refrigerant and air.
In this embodiment, an accumulator 26 which separates gas and liquid from each other is provided in an inflow side pipe of the compressor 21. In the heat-accumulation operation mode, the heat accumulator tank 55 is heated. In the cooling operation mode, the third heat exchanger 53 absorbs heat. The refrigerant circuit 2 is provided with a four-way valve 25 which switches between the heat-accumulation operation mode and the cooling operation mode.

[0020] In this embodiment, the refrigeration cycle apparatus 1 configures a low temperature water producing apparatus. This low temperature water producing apparatus utilizes low temperature fluid produced by the first heat exchanger 22 for absorbing heat by the third heat exchanger 53, and utilizes high temperature fluid produced by the first heat exchanger 22 for heating the heat accumulator tank 55. The first heat exchanger 22 exchanges heat between refrigerant and fluid.

[0021] The fluid circuit 5 includes an inflow pipe 51, a first heat exchanger 22, an outflow pipe 52, a fluid path switching valve 60, a third heat exchanger 53, and circulating means 54. The fluid circuit 5 also includes a heat accumulation circuit 62 and a control apparatus 4. The heat accumulation circuit 62 branches off from the fluid path switching valve 60, and is connected to the fluid circuit 5 between the first heat exchanger 22 and the third heat exchanger 53 through a heat accumulator tank 55. A temperature sensor 70 which detects a fluid temperature is disposed in the first heat exchanger 22.

[0022] Operation and effect of the cold/hot water supply apparatus having the above-described configuration will be described.
In the cooling operation mode, low temperature fluid produced by the first heat exchanger 22 absorbs heat in the third heat exchanger 53. Fig. 1 shows, with arrows, a flow direction of refrigerant and fluid in the cooling operation mode.
The fluid path-switching valve 60 is switched by the control apparatus 4 such that fluid flows to the third heat exchanger 53.
High pressure gas refrigerant discharged from the compressor 21 flows into the second heat exchanger 24 through the four-way valve 25, and dissipates heat of condensation and condenses. High pressure liquid refrigerant cooled by the condensation flows out from the second heat exchanger 24.

[0023] High pressure liquid refrigerant which flows out of the second heat exchanger 24 is decompressed and expanded by the expansion means 23 and then, the refrigerant flows into the first heat exchanger 22. Low pressure air-liquid two-phase refrigerant which flows into the first heat exchanger 22 absorbs vaporization heat from the fluid and evaporates, and becomes low pressure two-phase refrigerant or overheated refrigerant and flows out of the first heat exchanger 22.
The low pressure refrigerant which flows out of the first heat exchanger 22 passes through the four-way valve 25, gas and liquid are separated from each other by the accumulator 26, and gas-phase refrigerant is sucked into the compressor 21.
Fluid cooled by the first heat exchanger 22 flows through the outflow pipe 52, and flows into the third heat exchanger 53 disposed in an indoor space through the flow path switching valve 60. The fluid absorbs heat from the third heat exchanger 53, flows into the inflow pipe 51 through the circulation means 54, and flows into the first heat exchanger 22 and is circulated.
The control device 4 controls to switch the fluid path-switching valve 60 to the switching pipe 62 or the third heat exchanger 53.

[0024] If a heat-accumulation operation in which fluid heats the heat accumulator tank 55 is requested, a high pressure refrigerant discharged from the compressor 21 flows into the first heat exchanger 22 through the four-way valve 25, and heats fluid which flows through the first heat exchanger 22. The fluid is water or anti-freeze.
High pressure liquid refrigerant which flows out of the first heat exchanger 22 is decompressed and expanded by the expansion means 23 and then flows into the second heat exchanger 24. The low pressure two-phase re-

frigerant which flows into the second heat exchanger 24 absorbs vaporization heat from air and evaporates, and becomes low pressure two-phase refrigerant or overheated refrigerant, and flows out of the second heat exchanger 24.

[0025] The low pressure refrigerant which flows out of the second heat exchanger 24 passes through the four-way valve 25 and gas and liquid are separated from each other by the accumulator 26 and then, the gas-phase refrigerant is sucked into the compressor 21.

High temperature fluid is produced in the first heat exchanger 22 by the above-described operation. The high temperature fluid produced in the first heat exchanger 22 flows out from the outflow pipe 52.

[0026] Fig. 2 shows, with arrows, a flow direction of fluid in the heat-accumulation operation mode.

When a fluid temperature Tw detected by the temperature sensor 70 disposed in the first heat exchanger 22 is lower than a predetermined temperature To, the flow path switching valve 60 is switched to the third heat exchanger 53 to maintain the cooling operation mode. If the fluid temperature Tw is equal to or higher than the predetermined temperature To, the fluid path switching valve 60 is switched to the heat accumulation circuit 62 to circulate fluid through the first heat exchanger 22 and the heat accumulation circuit 62.

Here, as an environment where the heat accumulator tank 55 is installed, since the temperature is set to about 20 degrees Celsius in many cases, the predetermined temperature To is set to 20 degrees Celsius in this embodiment also.

[0027] Operation and effect of the cold/hot water supply apparatus having the above-described configuration will be described below.

Control operation in the case of a heat-accumulation operation mode and a cooling operation mode will be described in detail using a flowchart in Fig. 3.

The control apparatus 4 controls the fluid path-switching valve 60 based on temperature detected by the temperature sensor 70.

[0028] First, the control apparatus 4 determines whether heat accumulation driving is requested (step 1). If the heat accumulation driving is not requested, the current state is maintained, and if the heat accumulation driving is requested, the temperature sensor 70 in the first heat exchanger 22 detects the fluid temperature Tw (step 2), and compares the fluid temperature Tw and the predetermined temperature To with each other (step 3).

When the fluid temperature Tw is lower than the predetermined temperature To, it is determined that a possibility that low temperature fluid flows through the first switching pipe 62 to absorb heat from the heat accumulator tank 55 and to cool the heat accumulator tank 55 is high, and the fluid path-switching valve 60 is switched to the third heat exchanger 53 (step 4).

When the fluid temperature Tw is equal to or higher than the predetermined temperature To, it is determined that a possibility that the low temperature fluid flows through the first switching pipe 62 to absorb heat from the heat accumulator tank 55 and to cool the heat accumulator tank 55 is low, and the fluid path-switching valve 60 is switched from the third heat exchanger 53 to the first switching pipe 62 (step 5). The control apparatus 4 continues the current state until the heat accumulation driving is requested (step 1).

[0029] As described above, in this embodiment, when it is requested to change the operation mode from the cooling operation mode in which the third heat exchanger 53 absorbs heat to the heat-accumulation operation mode in which fluid flowing through the fluid path switching valve 60 heats the heat accumulator tank 55 and when the fluid temperature Tw detected by the temperature sensor 70 is lower than the predetermined temperature To, the cooling operation mode is maintained.

According to this configuration, after the cooling operation mode is changed to the heat-accumulation operation mode, fluid is heated through the first heat exchanger 22, and a fluid temperature rises.

Thereafter, when the fluid temperature Tw is lower than the predetermined temperature To, it is determined that if fluid flows into the heat accumulator tank 55, hot water in the heat accumulator tank 55 is cooled, the fluid path switching valve 60 is maintained on the side of the third heat exchanger 53, and the fluid whose temperature is lower than the predetermined temperature To is made to flow into the third heat exchanger 53. Therefore, the fluid whose temperature is lower than the predetermined temperature To does not flow into the heat accumulator tank 55.

As a result, since the fluid whose temperature is lower than the predetermined temperature To does not flow into the heat accumulator tank 55 and it is possible to prevent a temperature of the heat accumulator tank 55 from lowering, it is possible to reduce the accumulated heat amount in the heat accumulator tank 55, i.e., energy loss can be prevented.

[0030] When it is requested to change the cooling operation mode to the heat-accumulation operation mode and the fluid temperature Tw detected by the temperature sensor 70 is equal to or higher than the predetermined temperature To, the fluid path switching valve 60 is switched to the heat accumulation circuit 62 to make fluid circulate through the first heat exchanger 22 and the heat accumulation circuit 62.

According to this configuration, after the cooling operation mode is changed to the heat-accumulation operation mode, fluid is heated through the first heat exchanger 22 and the fluid temperature rises. Thereafter, the fluid temperature Tw becomes equal to or higher than the predetermined temperature To, it is determined that even if the fluid flows into the heat accumulator tank 55, hot water in the heat accumulator tank 55 is not cooled. Then, the fluid path switching valve 60 is switched to the heat accumulation circuit, and heated fluid is made to flow into the heat accumulator tank.

As a result, fluid whose temperature is equal to or higher

than the predetermined temperature To can flow into the heat accumulator tank 55, and heat can effectively be accumulated in the heat accumulator tank 55.

(Second Embodiment)

[0031] Fig. 4 is a flowchart of an operating action of a cold/hot water supply apparatus according to a second embodiment of the present invention. The control apparatus 4 controls the flow path switching valve 60 based on a temperature detected by the temperature sensor 70. Control of the control apparatus 4 will be explained with reference to the flowchart shown in Fig. 4. In the second embodiment, the same constituent parts as those of the first embodiment are designated with the same symbols, and explanation thereof will be omitted.

[0032] First, the control apparatus 4 determines whether the heat-accumulation operation is requested (step 1). When the heat-accumulation operation is not requested, the current state is maintained, and when the heat-accumulation operation is requested, the flow path switching valve 60 is switched from the third heat exchanger 53 to the heat accumulation circuit 62 (step 2).

The temperature sensor 70 in the first heat exchanger 22 detects the fluid temperature Tw (step 3), and compares the fluid temperature Tw and the predetermined temperature To with each other (step 4).

[0033] If the fluid temperature Tw detected by the temperature sensor 70 is equal to or higher than the predetermined temperature To, fluid is made to circulate between the first heat exchanger 22 and the heat accumulation circuit 62.

If the fluid temperature Tw detected by the temperature sensor 70 is lower than the predetermined temperature To, the operating action of the circulating means 54 is stopped or the circulation amount in the fluid circuit 5 is reduced, and a flow rate is set smaller than a predetermined flow rate Go (step 5) .

The predetermined flow rate Go is a flow rate smaller than that of a rating operation. In this embodiment, the predetermined flow rate Go is set to 1/10 of the rating operation for example.

[0034] Thereafter, the temperature sensor 70 in the first heat exchanger 22 detects the fluid temperature Tw (step 6), and compares the fluid temperature Tw and the predetermined temperature To with each other (step 7). When the fluid temperature Tw is equal to or higher than the predetermined temperature To, it is determined that even if the fluid flows into the heat accumulator tank 55, hot water in the heat accumulator tank 55 is not cooled, the circulation amount in the fluid circuit 5 is set to the predetermined flow rate Go or higher (step 8), and heated fluid is made to flow into the heat accumulator tank 55. The control apparatus 4 maintains the current state until the heat-accumulation operation is requested (step 1).

When the fluid temperature Tw is lower than the predetermined temperature To, it is determined that fluid flows into the heat accumulator tank 55 and hot water in the heat accumulator tank 55 is cooled, the circulating means 54 is intermittently operated, the current state is maintained, and the fluid temperature Tw is detected (step 6).

[0035] As described above, in this embodiment, after the cooling operation mode in which the third heat exchanger 53 absorbs heat is changed to the heat-accumulation operation mode in which fluid which flows through the fluid path switching valve 60 heats the heat accumulator tank 55, if the fluid temperature Tw detected by the temperature sensor 70 is equal to or higher than the predetermined temperature To, the fluid is made to circulate between the first heat exchanger 22 and the heat accumulation circuit 62, and if the fluid temperature Tw detected by the temperature sensor 70 is lower than the predetermined temperature To, the operating action of the circulating means 54 is stopped or the circulation amount in the fluid circuit 5 is reduced.

According to this configuration, fluid in the first heat exchanger 22 is heated and conveyed to the heat accumulator tank 55. Thereafter, if the fluid temperature Tw becomes equal to or higher than the predetermined temperature To, it is determined that even if fluid flows into the heat accumulator tank 55, hot water in the heat accumulator tank 55 is not cooled, and the heated fluid is made to flow into the heat accumulator tank 55.

[0036] On the other hand, if the fluid temperature Tw is lower than the predetermined temperature To, the circulating means 54 is intermittently operated, thereby suppressing a volume of low temperature fluid conveyed to the heat accumulator tank 55 to a volume existing in a connection pipe between an outlet of the first heat exchanger 22 and the fluid path switching valve 60. Even if the fluid temperature Tw is lower than the predetermined temperature To, the volume of low temperature fluid conveyed to the heat accumulator tank 55 is reduced as compared with the conventional technique.

As a result, even if the fluid temperature is lower than the predetermined temperature To, since an amount of heat absorbed from the heat accumulator tank 55 is reduced, it is possible to suppress the reduction in a temperature of the heat accumulator tank 55, and the accumulated heat amount in the heat accumulator tank 55 can be reduced, i.e., the energy loss can be prevented.

(Third Embodiment)

[0037] Fig. 5 shows a cold/hot water supply apparatus according to a third embodiment of the present invention. In the third embodiment, the same constituent parts as those of the first and second embodiments are designated with the same symbols, and explanation thereof will be omitted.

In the third Embodiment a heat accumulator tank temperature sensor 71 for detecting a temperature of the heat accumulator tank 55 is provided. The predetermined temperature To is set equal to or lower than a temperature of the heat accumulator tank 55.

[0038] According to this configuration, the predeter-

mined temperature To of fluid is set lower than a temperature of the heat accumulator tank 55 when the heat-accumulation operation mode is started. Therefore, even if an operation condition is varied, time during which the operation state of the circulating means 54 is stopped or a circulation amount is reduced can be minimized.
As a result, when the predetermined temperature To of fluid is fixed, even if the operation condition is variously varied, heat accumulation time can be increased and thus, energy efficiency can be enhanced.

[Industrial Applicability]

[0039] According to the cold/hot water supply apparatus of the present invention, when the cooling operation mode is switched to the heat-accumulation operation mode, it is possible to suppress reduction of a temperature (accumulated heat amount) of the heat accumulator tank caused by low temperature fluid, and energy loss can be reduced. Therefore, the present invention can be applied also to a cold/hot water supply heating apparatus which heats fluid and utilizes the fluid for heating an indoor space.

Claims

1. A cold/hot water supply apparatus comprising:

a refrigerant circuit formed by annularly connecting, to one another, a compressor, a first heat exchanger, decompressing means and a second heat exchanger, and a refrigerant flowing through the refrigerant circuit;
a fluid circuit formed by annularly connecting, to one another, circulating means, the first heat exchanger, a fluid path switching means and a third heat exchanger, and fluid flowing through the fluid circuit;
a heat accumulation circuit which branches off from the fluid circuit through the fluid path switching means, and which is connected to the fluid circuit between the third heat exchanger and the first heat exchanger through a heat accumulator tank;
a temperature sensor which detects a temperature of fluid heated by the first heat exchanger; and
a control apparatus which switches between a flow of the fluid to the third heat exchanger and a flow of the fluid to the heat accumulator tank; in which
the cold/hot water supply apparatus has a heat-accumulation operation mode for flowing the fluid to the heat accumulation circuit to heat water in the heat accumulator tank, and
a cooling operation mode for flowing the fluid to the third heat exchanger to absorb heat in air, wherein
when it is requested to change an operation mode from the cooling operation mode to the heat-accumulation operation mode and the fluid temperature detected by the temperature sensor is lower than a predetermined temperature, the control apparatus continues the cooling operation mode.

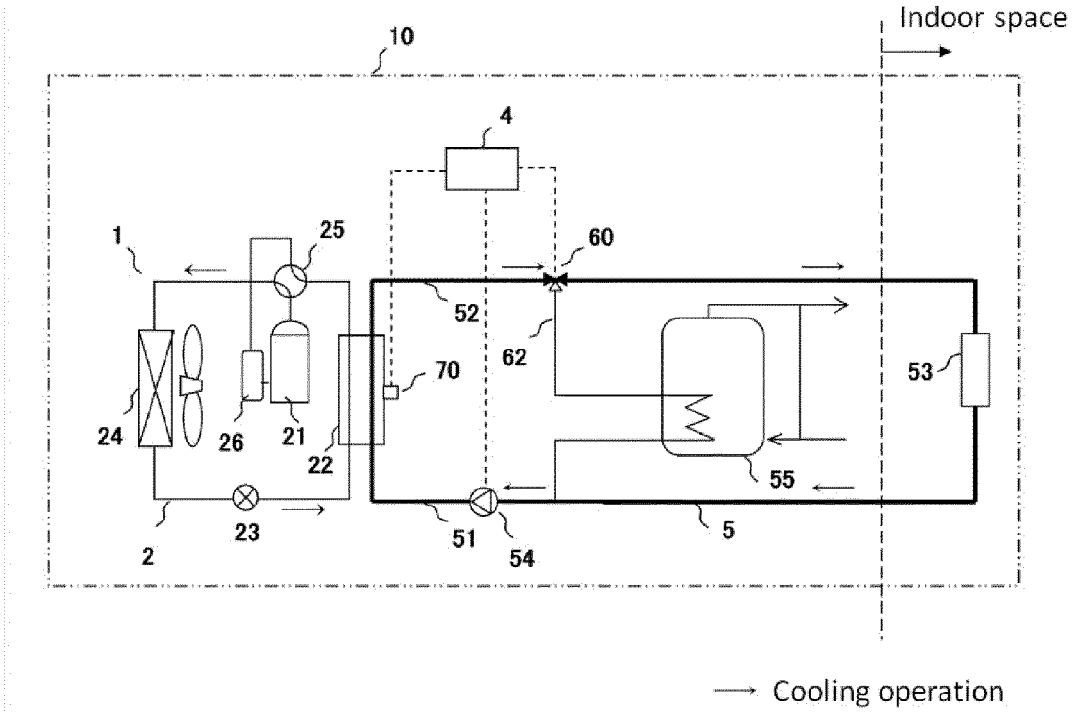
2. The cold/hot water supply apparatus according to claim 1 wherein, when it is requested to change the operation mode from the cooling operation mode to the heat-accumulation operation mode and the fluid temperature detected by the temperature sensor is equal to or higher than the predetermined temperature, the control apparatus switches the operation mode from the cooling operation mode to the heat-accumulation operation mode.

3. A cold/hot water supply apparatus comprising:

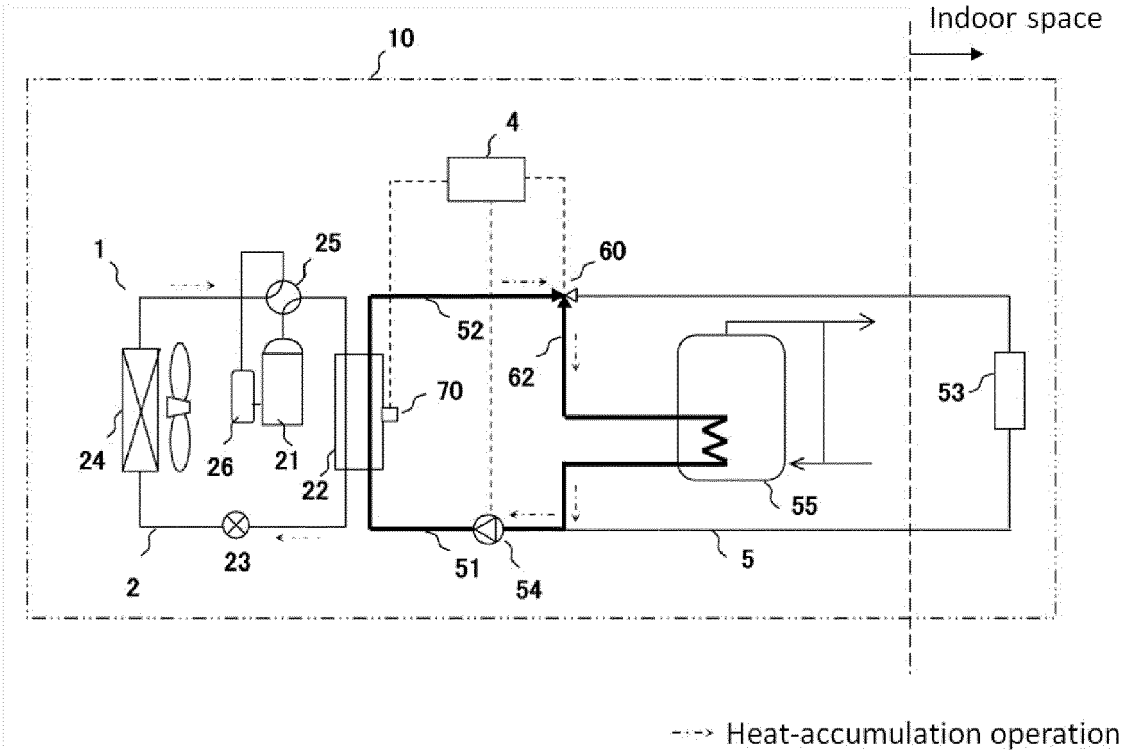
a refrigerant circuit formed by annularly connecting, to one another, a compressor, a first heat exchanger, decompressing means and a second heat exchanger, and a refrigerant flowing through the refrigerant circuit;
a fluid circuit formed by annularly connecting, to one another, circulating means, the first heat exchanger, a fluid path switching means and a third heat exchanger, and fluid flowing through the fluid circuit;
a heat accumulation circuit which branches off from the fluid circuit through the fluid path switching means, and which is connected to the fluid circuit between the third heat exchanger and the first heat exchanger through a heat accumulator tank;
a temperature sensor which detects a temperature of fluid heated by the first heat exchanger; and
a control apparatus which switches between a flow of the fluid to the third heat exchanger and a flow of the fluid to the heat accumulator tank; in which
the cold/hot water supply apparatus has a heat-accumulation operation mode for flowing the fluid to the heat accumulation circuit to heat water in the heat accumulator tank, and
a cooling operation mode for flowing the fluid to the third heat exchanger to absorb heat in air, wherein
after the cooling operation mode is changed to the heat-accumulation operation mode, when the fluid temperature detected by the temperature sensor is equal to or higher than a predetermined temperature, the control apparatus continues the heat-accumulation operation mode, and when the fluid temperature detected

by the temperature sensor is lower than the predetermined temperature, the control apparatus changes the operating action of the circulating means, and stops the circulation of the fluid or reduces the circulation amount of the fluid.

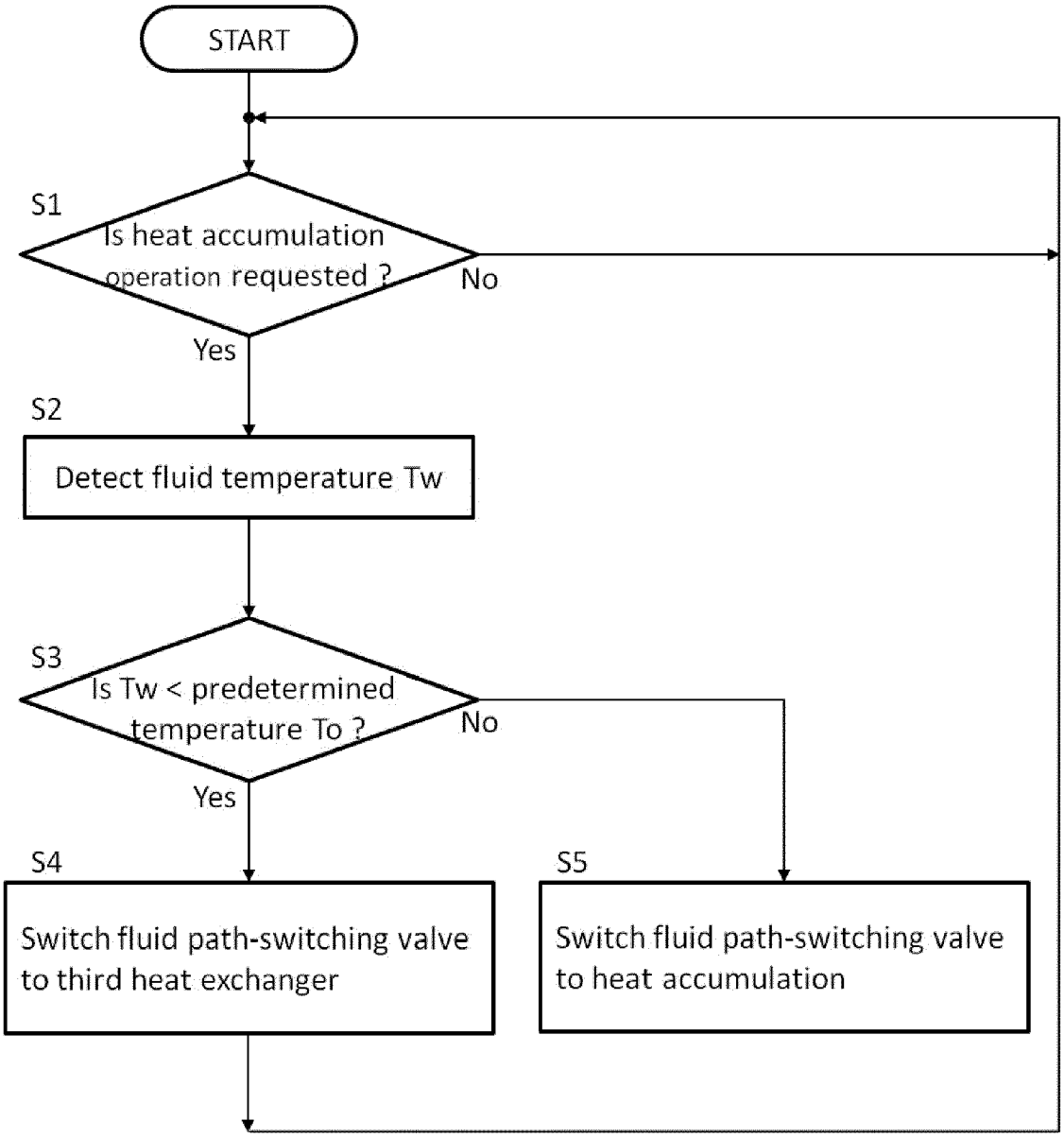
[Fig. 1]


Indoor space
10
4
1
25
60
52
62
53
70
24
26
21
22
55
23
51
54
5
2
Cooling operation

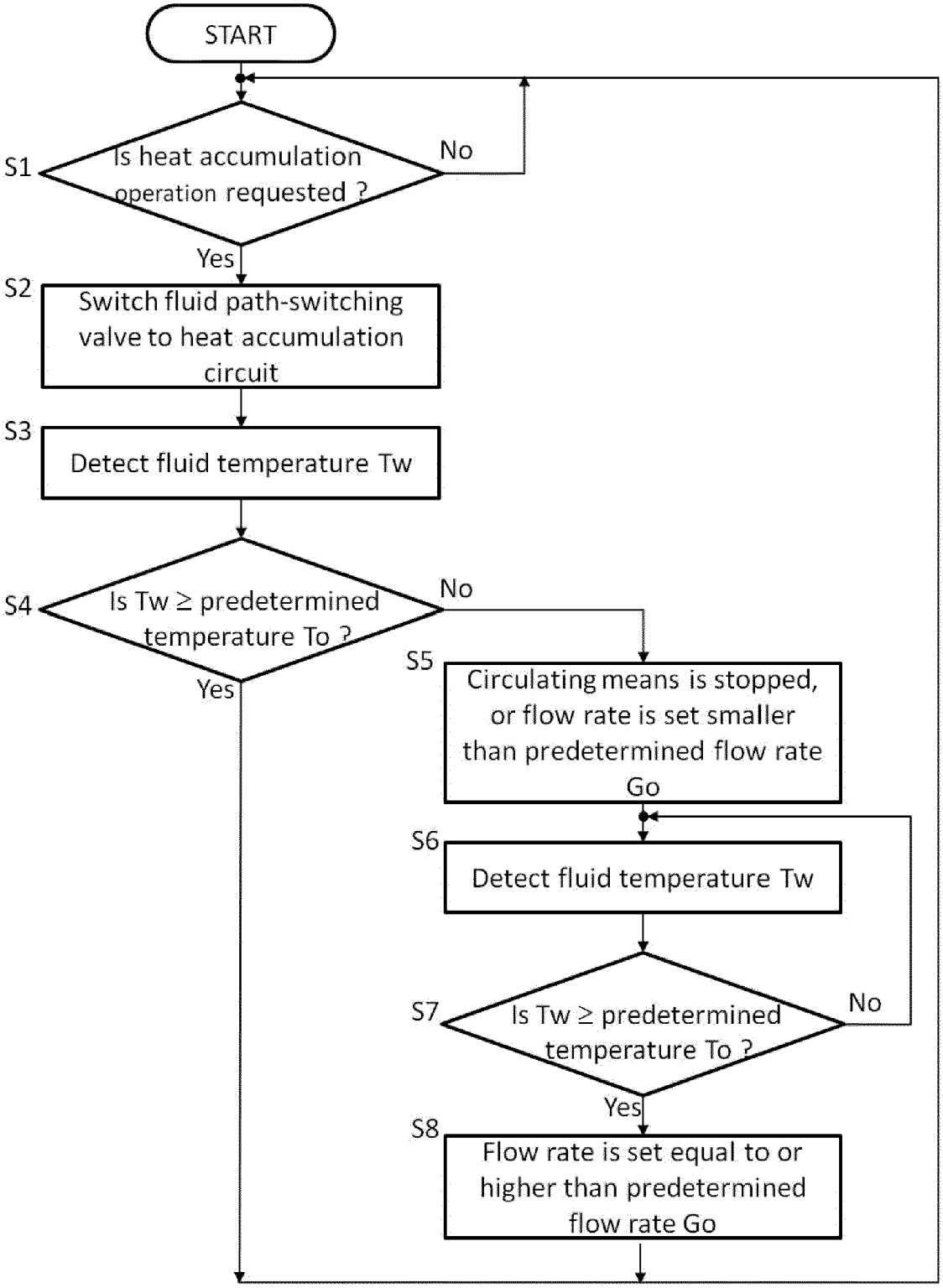
[Fig. 2]


Indoor space
10
4
1
25
60
52
62
70
53
24
26
21
22
55
23
51
54
5
2
Heat-accumulation operation

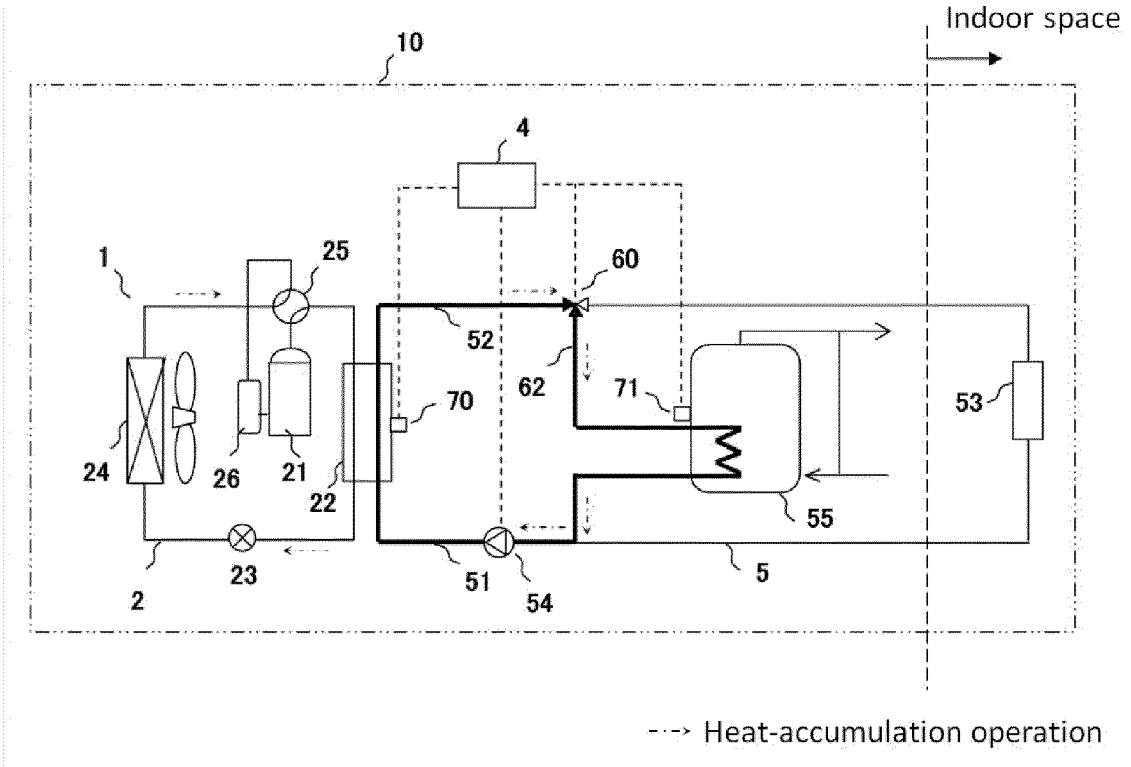
[Fig. 3]


START
S1
Is heat accumulation operation requested ?
No
Yes
S2
Detect fluid temperature Tw
S3
Is Tw < predetermined temperature To ?
No
Yes
S4
Switch fluid path-switching valve to third heat exchanger
S5
Switch fluid path-switching valve to heat accumulation

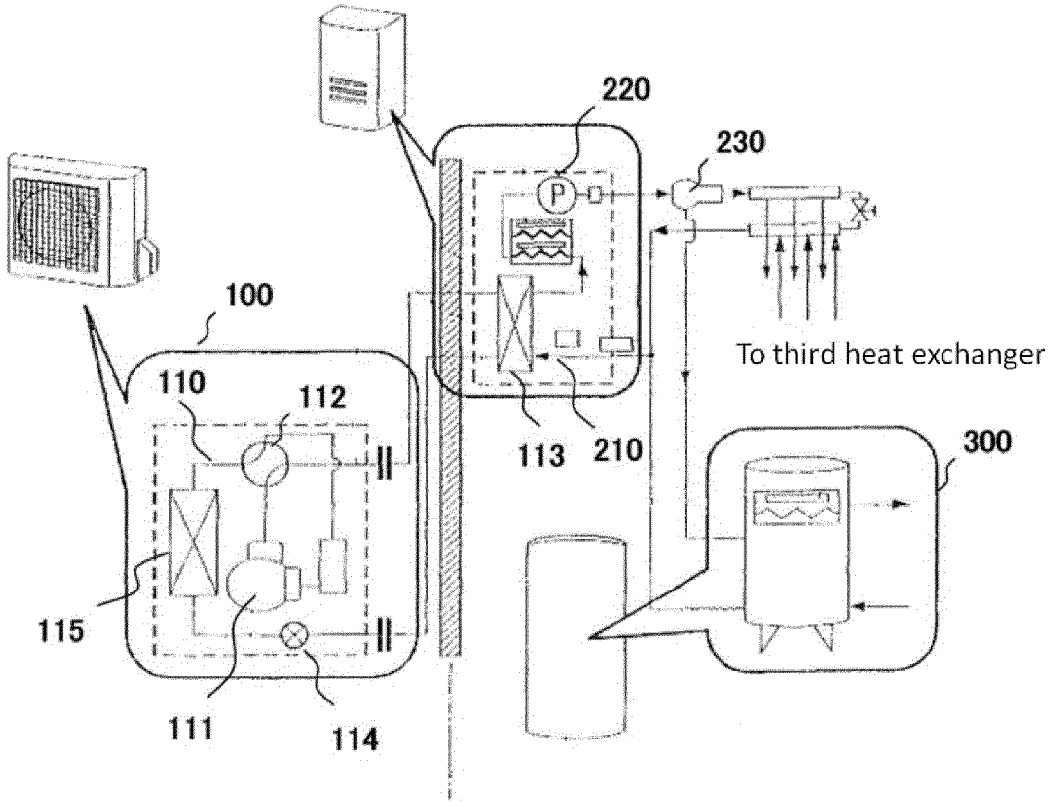
[Fig. 4]


START
S1
Is heat accumulation operation requested ?
No
Yes
S2
Switch fluid path-switching valve to heat accumulation circuit
S3
Detect fluid temperature Tw
S4
Is Tw ≥ predetermined temperature To ?
No
Yes
S5
Circulating means is stopped, or flow rate is set smaller than predetermined flow rate Go
S6
Detect fluid temperature Tw
S7
Is Tw ≥ predetermined temperature To ?
No
Yes
S8
Flow rate is set equal to or higher than predetermined flow rate Go

[Fig. 5]


Indoor space
10
4
1
25
60
52
62
71
53
70
24
26
21
22
55
23
51
54
5
2
Heat-accumulation operation

[Fig. 6]


220
230
100
110
112
113
210
300
To third heat exchanger
115
111
114

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 2204620 C **[0006]**