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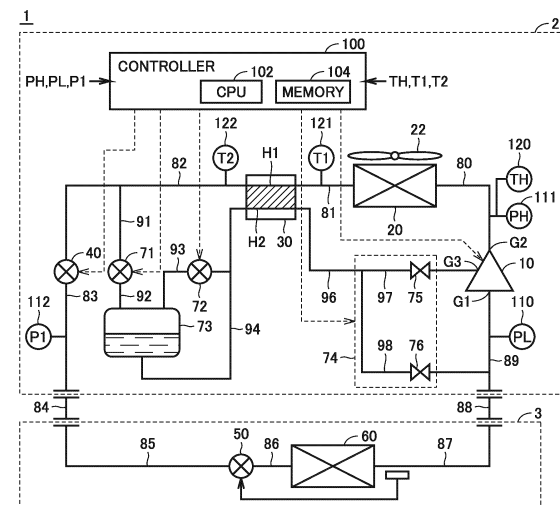
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(54) **OUTDOOR UNIT, REFRIGERATION CYCLE DEVICE, AND REFRIGERATING MACHINE**

(57) An outdoor unit (2) includes a compressor (10), a condenser (20), a heat exchanger (30) configured to exchange heat between refrigerant flowing in a first passage (H1) and the refrigerant flowing in a second passage (H2), and a second expansion valve (40). The outdoor unit (2) further includes a first refrigerant flow path (91 to 94) configured to cause the refrigerant to flow from a portion of a circulation flow path between an outlet of the first passage (H1) and the second expansion valve (40) to an inlet of the second passage (H2), a second refrigerant flow path (96 to 98) configured to cause the refrigerant to flow from an outlet of the second passage (H2) to a suction port (G1) or an intermediate pressure port (G3) of the compressor (10), and a flow path switching unit (74) disposed on the second refrigerant flow path and configured to switch, to one of the suction port (G1) and the intermediate pressure port (G3), a destination of the refrigerant flowing out from the outlet of the second passage (H2).

FIG.1



Description

TECHNICAL FIELD

[0001] The present disclosure relates to an outdoor unit, a refrigeration cycle apparatus, and a refrigerating machine.

BACKGROUND ART

[0002] Japanese Patent Laying-Open No. 2017-187189 (PTL 1) discloses a refrigeration apparatus that prevents refrigerant discharged from a compressor from having an excessively high temperature by controlling a torque for a motor embedded in the compressor.

CITATION LIST

PATENT LITERATURE

[0003] PTL 1: Japanese Patent Laying-Open No. 2017-187189

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004] In recent years, natural refrigerants such as CO₂ attract attention as refrigerants. Since CO₂ has a low critical temperature of 31°C, for example in summer when outside air has a high temperature, the condensation process of a refrigeration cycle apparatus using CO₂ is performed in a supercritical pressure condition. Thus, there is a problem that the entire system has a high pressure. When the system is designed such that the entire system can withstand the high pressure, the cost of the system becomes higher than the cost of a conventional system using chlorofluorocarbon or an alternative for chlorofluorocarbon. For cost reduction, it is desirable that at least a load device that has been conventionally used can be used unchanged.

[0005] However, when the load device has a low design pressure, it is necessary to perform decompression beforehand at an expansion valve in a liquid pipe which delivers liquid refrigerant from an outdoor unit to the load device. On this occasion, if gas refrigerant mixes into the liquid refrigerant before the expansion valve of the load device, the flow rate of the expansion valve significantly decreases. Thus, it is necessary to ensure a sufficient subcool (SC) to avoid capability degradation.

[0006] Further, it is also conceivable to adopt an intermediate pressure injection circuit in which an internal heat exchanger is provided to increase a subcool, and refrigerant on a cooling side is returned to an intermediate pressure port of a compressor, in order to improve performance. However, when an evaporation temperature is high, an intermediate pressure is also high, and thus it becomes difficult to ensure a subcool by the internal

heat exchanger. Accordingly, the capability of the refrigeration cycle apparatus may be degraded.

[0007] An object of the present disclosure is to provide an outdoor unit, a refrigeration cycle apparatus, and a refrigerating machine capable of ensuring a subcool of refrigerant at an inlet portion of a load device even when an evaporation temperature is high.

SOLUTION TO PROBLEM

[0008] An outdoor unit of the present disclosure is an outdoor unit of a refrigeration cycle apparatus, the outdoor unit being connectable to a load device including a first expansion valve and an evaporator. The outdoor unit includes: a compressor having a suction port, a discharge port, and an intermediate pressure port; a condenser; a heat exchanger; and a second expansion valve. The heat exchanger has a first passage and a second passage, and is configured to exchange heat between refrigerant flowing in the first passage and the refrigerant flowing in the second passage. The load device and a flow path from the compressor to the second expansion valve via the condenser and the first passage of the heat exchanger form a circulation flow path through which the refrigerant circulates. The outdoor unit further includes: a first refrigerant flow path configured to cause the refrigerant to flow from a portion of the circulation flow path between an outlet of the first passage and the second expansion valve to an inlet of the second passage; a third expansion valve disposed on the first refrigerant flow path; a second refrigerant flow path configured to cause the refrigerant to flow from an outlet of the second passage to the suction port or the intermediate pressure port of the compressor; and a flow path switching unit disposed on the second refrigerant flow path and configured to switch, to one of the suction port and the intermediate pressure port, a destination of the refrigerant flowing out from the outlet of the first passage.

ADVANTAGEOUS EFFECTS OF INVENTION

[0009] According to the outdoor unit, and the refrigeration cycle apparatus and the refrigerating machine including the same of the present disclosure, a subcool of liquid refrigerant delivered from the outdoor unit to the load device can be ensured even when an evaporation temperature changes, and thereby degradation of refrigeration capability can be prevented.

BRIEF DESCRIPTION OF DRAWINGS

[0010]

Fig. 1 is an overall configuration diagram of a refrigeration cycle apparatus according to a first embodiment of the present disclosure.

Fig. 2 is a flowchart for illustrating control of a flow path switching unit 74.

Fig. 3 is a flowchart for illustrating control of a third expansion valve 71.

Fig. 4 is a flowchart for illustrating control of a fourth expansion valve 72.

Fig. 5 is a flowchart for illustrating control of a second expansion valve 40.

DESCRIPTION OF EMBODIMENTS

[0011] Hereinafter, embodiments of the present disclosure will be described in detail with reference to the drawings. Although a plurality of embodiments will be described below, it is originally intended from the time of filing the present application to combine features described in the embodiments as appropriate. It should be noted that identical or corresponding parts in the drawings will be designated by the same reference characters, and the description thereof will not be repeated.

[0012] Fig. 1 is an overall configuration diagram of a refrigeration cycle apparatus according to an embodiment of the present disclosure. It should be noted that Fig. 1 functionally shows the connection relation and the arrangement configuration of devices in the refrigeration cycle apparatus, and does not necessarily show an arrangement in a physical space.

[0013] Referring to Fig. 1, a refrigeration cycle apparatus 1 includes an outdoor unit 2, a load device 3, and extension pipes 84 and 88.

[0014] Outdoor unit 2 is an outdoor unit of refrigeration cycle apparatus 1, the outdoor unit being connectable to load device 3. Outdoor unit 2 includes a compressor 10 having a suction port G1, a discharge port G2, and an intermediate pressure port G3, a condenser 20, a fan 22, a heat exchanger 30, a second expansion valve 40, and pipes 80 to 83 and 89. Heat exchanger 30 has a first passage H1 and a second passage H2, and is configured to exchange heat between refrigerant flowing in first passage H1 and the refrigerant flowing in second passage H2.

[0015] Load device 3 includes a first expansion valve 50, an evaporator 60, and pipes 85, 86, and 87. First expansion valve 50 is, for example, a temperature expansion valve controlled independently of outdoor unit 2.

[0016] Compressor 10 compresses the refrigerant suctioned from pipes 89 and 97, and discharges the compressed refrigerant to pipe 80. Compressor 10 is configured to adjust a rotation speed according to a control signal from a controller 100. By adjusting the rotation speed of compressor 10, a circulation amount of the refrigerant is adjusted, and the capability of refrigeration cycle apparatus 1 can be adjusted. As compressor 10, various types of compressors can be adopted, and for example, a compressor of scroll type, rotary type, screw type, or the like can be adopted.

[0017] Condenser 20 condenses the refrigerant discharged from compressor 10 to pipe 80, and delivers the condensed refrigerant to pipe 81. Condenser 20 is configured such that the high-temperature, high-pressure

gas refrigerant discharged from compressor 10 performs heat exchange with outside air (heat dissipation). By this heat exchange, the refrigerant is condensed and transforms into a liquid phase. Fan 22 supplies the outside air with which the refrigerant performs heat exchange in condenser 20, to condenser 20. By adjusting the number of revolutions of fan 22, a refrigerant pressure on a discharge side of compressor 10 (a high pressure-side pressure) can be adjusted.

[0018] It should be noted that, in the present specification, for ease of description, when a device cools the refrigerant in a supercritical state, the device will also be referred to as condenser 20. Further, in the present specification, for ease of description, an amount of decrease from a reference temperature of the refrigerant in the supercritical state will also be referred to as a subcool.

[0019] A flow path from compressor 10 to second expansion valve 40 via condenser 20 and first passage H1 of heat exchanger 30 and a flow path on which first expansion valve 50 and evaporator 60 of load device 3 are disposed form a circulation flow path through which the refrigerant circulates. Hereinafter, this circulation flow path will also be referred to as a "main circuit" of a refrigeration cycle.

[0020] Outdoor unit 2 further includes a first refrigerant flow path (91 to 94) configured to cause the refrigerant to flow from a portion of the circulation flow path between an outlet of first passage H1 and second expansion valve 40 to an inlet of second passage H2, a second refrigerant flow path (96 to 98) configured to cause the refrigerant to flow from an outlet of second passage H2 to suction port G1 or intermediate pressure port G3 of compressor 10, and a flow path switching unit 74 disposed on the second refrigerant flow path and configured to switch, to one of suction port G1 and intermediate pressure port G3, a destination of the refrigerant flowing out from the outlet of second passage H2. Hereinafter, this flow path that branches from the main circuit and delivers the refrigerant to compressor 10 via second passage H2 will be referred to as an "injection flow path".

[0021] Outdoor unit 2 further includes a receiver 73 disposed on the first refrigerant flow path and configured to store the refrigerant, a third expansion valve 71 disposed on a pipe 91 between an inlet of receiver 73 and the portion of the circulation flow path between the outlet of first passage H1 and second expansion valve 40, a degassing passage 93 provided between a pipe 94 at an outlet of receiver 73 and a gas exhaust outlet of receiver 73 and configured to exhaust a refrigerant gas within receiver 73, and a fourth expansion valve 72 disposed on degassing passage 93.

[0022] By providing receiver 73 on the injection flow path as described above, it becomes easy to ensure a subcool in pipes 82 and 83 which are liquid pipes. This is because, since receiver 73 generally includes the gas refrigerant therein and a refrigerant temperature reaches a saturation temperature, it is not possible to ensure a subcool if receiver 73 is disposed on pipe 82.

[0023] Further, if receiver 73 is provided at an intermediate pressure portion, it becomes possible to store intermediate pressure liquid refrigerant within receiver 73 even when a high pressure portion of the main circuit is in the supercritical state. Thus, a design pressure of a container of receiver 73 can be set to be lower than that of the high pressure portion, and cost reduction by thinning the container can also be achieved.

[0024] Outdoor unit 2 further includes pressure sensors 110, 111, and 112, temperature sensors 120, 121, and 122, and controller 100 configured to control flow path switching unit 74.

[0025] Pressure sensor 110 detects a suction pressure PL of compressor 10, and outputs a detection value thereof to controller 100. Pressure sensor 111 detects a discharge pressure PH of compressor 10, and outputs a detection value thereof to controller 100. Pressure sensor 112 detects a pressure P1 in pipe 83 at an outlet of second expansion valve 40, and outputs a detection value thereof to controller 100.

[0026] By providing second expansion valve 40 to the liquid pipe, outdoor unit 2 can decompress the refrigerant pressure to be lower than or equal to a design pressure of load device 3 (for example, 4 MPa), and then deliver the refrigerant to load device 3. Thereby, even if refrigerant utilizing supercriticality such as CO₂ is used, a general-purpose product having the same design pressure as that of a conventional load device can be used as load device 3.

[0027] Temperature sensor 120 detects a discharge temperature TH of compressor 10, and outputs a detection value thereof to controller 100. Temperature sensor 121 detects a refrigerant temperature T1 in pipe 81 at an outlet of condenser 20, and outputs a detection value thereof to controller 100. Temperature sensor 122 detects a refrigerant temperature T2 at the outlet of first passage H1 on a cooled side of heat exchanger 30, and outputs a detection value thereof to controller 100.

[0028] The second refrigerant flow path includes a pipe 96 connecting between the outlet of second passage H2 of heat exchanger 30 and flow path switching unit 74, and flow path switching unit 74. Flow path switching unit 74 includes pipes 97 and 98 branching from pipe 96, and on-off valves 75 and 76 disposed on pipes 97 and 98, respectively. Pipe 97 is connected between pipe 96 and intermediate pressure port G3. Pipe 98 is connected between pipe 96 and suction port G1. By selectively opening one of on-off valves 75 and 76, the destination of the refrigerant flowing through the injection flow path is switched.

[0029] Controller 100 includes a CPU (Central Processing Unit) 102, a memory 104 (a ROM (Read Only Memory) and a RAM (Random Access Memory)), input/output buffers (not shown) for inputting/outputting various signals, and the like. CPU 102 expands programs stored in the ROM onto the RAM or the like and executes the programs. The programs stored in the ROM are programs describing processing procedures of controller

100. According to these programs, controller 100 performs control of the devices in outdoor unit 2. This control can be processed not only by software but also by dedicated hardware (electronic circuitry).

[0030] Fig. 2 is a flowchart for illustrating control of flow path switching unit 74. Referring to Figs. 1 and 2, in step S1, controller 100 determines whether or not on-off valve 75 is opened and on-off valve 76 is closed. When on-off valve 75 is opened and on-off valve 76 is closed (YES in S1), intermediate pressure port G3 is selected as the destination of the refrigerant flowing through the injection flow path. Conversely, when suction port G1 is selected as the destination of the refrigerant flowing through the injection flow path, on-off valve 75 is closed and on-off valve 76 is opened.

[0031] When on-off valve 75 is opened (YES in S1), in step S2, controller 100 determines whether or not refrigerant temperature T2 at the outlet of first passage H1 of heat exchanger 30 is higher than or equal to a first temperature Tth1.

[0032] When refrigerant temperature T2 at the outlet of first passage H1 of heat exchanger 30 is higher than first temperature Tth1 (YES in S2), controller 100 controls flow path switching unit 74 to switch the destination of the refrigerant to suction port G1 in the processing in steps S3 to S7. Also when refrigerant temperature T2 at the outlet of first passage H1 of heat exchanger 30 is equal to first temperature Tth1 (YES in S2), controller 100 controls flow path switching unit 74 to switch the destination of the refrigerant to suction port G1 in the processing in steps S3 to S7.

[0033] Specifically, when a suction air temperature TL of compressor 10 is higher than or equal to a threshold value TLth1 (YES in S3), controller 100 controls flow path switching unit 74 to switch the destination of the refrigerant to suction port G1 by sequentially performing the processing in steps S4 to S7. It should be noted that suction air temperature TL of compressor 10 can be obtained by converting suction pressure PL detected by pressure sensor 110. In step S4, operation of compressor 10 is stopped. In step S5, on-off valve 75 is closed. In step S6, on-off valve 76 is opened. In step S7, operation of compressor 10 is resumed.

[0034] It should be noted that, when refrigerant temperature T2 is lower than first temperature Tth1 (NO in S2), a subcool can be ensured, and when suction air temperature TL of compressor 10 is lower than threshold value TLth1 (NO in S3), an evaporation temperature is low, and thus an intermediate pressure is also low. Accordingly, controller 100 does not perform switching of flow path switching unit 74 in steps S4 to S7.

[0035] On the other hand, when on-off valve 75 is closed (NO in S1), and refrigerant temperature T2 at the outlet of first passage H1 of heat exchanger 30 is lower than a second temperature Tth2 (YES in S8), controller 100 controls flow path switching unit 74 to switch the destination of the refrigerant to intermediate pressure port G3 in the processing in steps S9 to S13. Also when

refrigerant temperature T2 is equal to second temperature Tth2 (YES in S2), controller 100 controls flow path switching unit 74 to switch the destination of the refrigerant to intermediate pressure port G3. It should be noted that Tth1 is higher than Tth2.

[0036] Specifically, when suction air temperature TL of compressor 10 is lower than or equal to threshold value TLth1 (YES in S9), controller 100 controls flow path switching unit 74 to switch the destination of the refrigerant to intermediate pressure port G3 by sequentially performing the processing in steps S10 to S13. It should be noted that TLth1 is higher than TLth2. In step S10, operation of compressor 10 is stopped. In step S11, on-off valve 76 is closed. In step S12, on-off valve 75 is opened. In step S13, operation of compressor 10 is resumed.

[0037] It should be noted that, when refrigerant temperature T2 is higher than second temperature Tth2 (NO in S8), a subcool cannot be ensured, and when suction air temperature TL of compressor 10 is higher than threshold value TLth2 (NO in S9), the evaporation temperature is high, and thus the intermediate pressure is also high. Accordingly, controller 100 maintains flow path switching unit 74 with the destination of the refrigerant being set to suction port G1, and does not perform flow path switching.

[0038] As described above, when a pressure difference between pipe 82 and pipe 94 is small, controller 100 controls flow path switching unit 74 to increase the pressure difference, to switch the destination of the refrigerant from intermediate pressure port G3 to suction port G1. Accordingly, the amount of decompression in third expansion valve 71 can be ensured, and thus the amount of temperature decrease in third expansion valve 71 increases. Thereby, a temperature difference between a refrigerant temperature in first passage H1 and a refrigerant temperature in second passage H2 of heat exchanger 30 can be ensured. Therefore, the amount of heat exchange in heat exchanger 30 increases, and thus refrigerant temperature T2 can be decreased.

[0039] It should be noted that, although it is more preferable for a stable behavior to perform flow path switching while operation is stopped as in the flowchart of Fig. 2, the flowchart may be modified to perform flow path switching during operation, without performing the processing in steps S4 and S7 of the processing in steps S4 to S7. Similarly, the flowchart may be modified to perform flow path switching during operation, without performing the processing in steps S10 and S13 of the processing in steps S10 to S13.

[0040] Fig. 3 is a flowchart for illustrating control of third expansion valve 71. Referring to Figs. 1 and 3, third expansion valve 71 is feedback-controlled such that discharge temperature TH of compressor 10 matches a target temperature. Specifically, when discharge temperature TH of compressor 10 is higher than the target temperature in step S21 (YES in S21), controller 100 increases a degree of opening of third expansion valve 71 in

step S22. Thereby, the refrigerant flowing into intermediate pressure port G3 or suction port G1 via receiver 73 increases, and thus discharge temperature TH decreases.

[0041] On the other hand, when discharge temperature TH of compressor 10 is lower than the target temperature (NO in S21 and YES in S23), controller 100 decreases the degree of opening of third expansion valve 71 in step S24. Thereby, the refrigerant flowing into intermediate pressure port G3 or suction port G1 via receiver 73 decreases, and thus discharge temperature TH increases.

[0042] When discharge temperature TH is equal to the target temperature (NO in S21 and NO in S23), the degree of opening of third expansion valve 71 is maintained in the present state.

[0043] Thus, controller 100 controls the degree of opening of third expansion valve 71 such that discharge temperature TH of compressor 10 approaches the target temperature.

[0044] It should be noted that the frequency of changing the degree of opening of third expansion valve 71 may be decreased by setting the target temperature in step S21 to be higher than the target temperature in step S23.

[0045] Fig. 4 is a flowchart for illustrating control of fourth expansion valve 72. Referring to Figs. 1 and 4, fourth expansion valve 72 is feedback-controlled such that refrigerant temperature T1 at the outlet of condenser 20 matches a target temperature, to ensure the subcool of the refrigerant at the outlet of condenser 20. Specifically, when a subcool SC determined by refrigerant temperature T1 at the outlet of condenser 20 and a pressure (approximated by PH) of condenser 20 is larger than a target value in step S31 (YES in S31), controller 100 increases a degree of opening of fourth expansion valve 72 in step S32. Thereby, the gas refrigerant flows out of receiver 73 and the amount of the liquid refrigerant increases, and thus the amount of the refrigerant circulating through the main circuit decreases. Accordingly, the refrigerant temperature increases on the whole and refrigerant temperature T1 increases, and thus subcool SC decreases.

[0046] On the other hand, when subcool SC determined by refrigerant temperature T1 at the outlet of condenser 20 and the pressure (approximated by PH) of condenser 20 is smaller than the target value (YES in S33), controller 100 decreases the degree of opening of fourth expansion valve 72 in step S34. Thereby, the amount of the gas refrigerant increases and the amount of the liquid refrigerant decreases in receiver 73, and thus the amount of the refrigerant circulating through the main circuit increases. Accordingly, the refrigerant temperature decreases on the whole and refrigerant temperature T1 decreases, and thus subcool SC increases.

[0047] When subcool SC is equal to the target value (NO in S31 and NO in S33), the degree of opening of fourth expansion valve 72 is maintained in the present

state.

[0048] Thus, controller 100 controls the degree of opening of fourth expansion valve 72 such that refrigerant temperature T1 at the outlet of condenser 20 approaches the target temperature.

[0049] It should be noted that the frequency of changing the degree of opening of fourth expansion valve 72 may be decreased by setting the target value in step S31 to be larger than the target value in step S33.

[0050] Controller 100 performs control of compressor 10 and second expansion valve 40 to use a supercritical region of the refrigerant. For example, when an outside air temperature is higher than a supercritical temperature of the refrigerant as in summer, controller 100 increases the rotation speed of compressor 10 to be higher than that for spring or autumn, to increase the pressure of the high pressure portion. In this case, the pressure of the high pressure portion of the main circuit increases. In order to allow load device 3 to be used in common with a device used with an ordinary refrigerant, decompression is performed in second expansion valve 40. On this occasion, second expansion valve 40 is controlled as described below.

[0051] Fig. 5 is a flowchart for illustrating control of second expansion valve 40. Referring to Figs. 1 and 5, second expansion valve 40 is feedback-controlled such that pressure PI matches a target pressure. Specifically, when pressure PI is higher than the target pressure in step S41 (YES in S41), controller 100 decreases a degree of opening of second expansion valve 40 in step S42. Thereby, the amount of decompression by second expansion valve 40 increases, and thus pressure PI decreases.

[0052] On the other hand, when pressure P1 is lower than the target pressure (NO in S41 and YES in S43), controller 100 increases the degree of opening of second expansion valve 40 in step S44. Thereby, the amount of decompression by second expansion valve 40 decreases, and thus pressure P1 increases.

[0053] When pressure PI is equal to the target pressure (NO in S41 and NO in S43), the degree of opening of second expansion valve 40 is maintained in the present state.

[0054] Since pressure PI is controlled as described above, the pressure within load device 3 can be set to be lower than or equal to a design pressure of the device used with an ordinary refrigerant, and load device 3 can be used in common with a load device for a conventional machine which uses refrigerant such as R410A.

[0055] Although the present embodiment has described a refrigerating machine including refrigeration cycle apparatus 1 as an example, refrigeration cycle apparatus 1 may be utilized in an air conditioner or the like.

[0056] It should be understood that the embodiment disclosed herein is illustrative and non-restrictive in every respect. The scope of the present disclosure is defined by the scope of the claims, rather than the description of the embodiment described above, and is intended to in-

clude any modifications within the scope and meaning equivalent to the scope of the claims.

REFERENCE SIGNS LIST

[0057] 1: refrigeration cycle apparatus; 2: outdoor unit; 3: load device; 10: compressor; 20: condenser; 22: fan; 30: heat exchanger; 40: second expansion valve; 50: first expansion valve; 60: evaporator; 71: third expansion valve; 72: fourth expansion valve; 73: receiver; 74: flow path switching unit; 75, 76: on-off valve; 80, 81, 82, 83, 85, 89, 91, 94, 96, 97, 98: pipe; 84, 88: extension pipe; 93: degassing passage; 100: controller; 102: CPU; 104: memory; 110, 111, 112: pressure sensor; 120, 121, 122: temperature sensor; G1: suction port; G2: discharge port; G3: intermediate pressure port; H1: first passage; H2: second passage.

Claims

1. An outdoor unit of a refrigeration cycle apparatus, the outdoor unit being connectable to a load device including a first expansion valve and an evaporator, the outdoor unit comprising:

a compressor having a suction port, a discharge port, and an intermediate pressure port;

a condenser;

a heat exchanger having a first passage and a second passage and configured to exchange heat between refrigerant flowing in the first passage and the refrigerant flowing in the second passage; and

a second expansion valve, wherein the load device and a flow path from the compressor to the second expansion valve via the condenser and the first passage of the heat exchanger form a circulation flow path through which the refrigerant circulates, the outdoor unit further comprising:

a first refrigerant flow path configured to cause the refrigerant to flow from a portion of the circulation flow path between an outlet of the first passage and the second expansion valve to an inlet of the second passage; a third expansion valve disposed on the first refrigerant flow path;

a second refrigerant flow path configured to cause the refrigerant to flow from an outlet of the second passage to the suction port or the intermediate pressure port of the compressor; and

a flow path switching unit disposed on the second refrigerant flow path and configured to switch, to one of the suction port and the intermediate pressure port, a destination of

- the refrigerant flowing out from the outlet of the second passage.
2. The outdoor unit according to claim 1, further comprising: 5
- a receiver disposed on the first refrigerant flow path and configured to store the refrigerant; a degassing passage provided between an outlet of the receiver and the receiver and configured to exhaust a refrigerant gas within the receiver; and 10
- a fourth expansion valve disposed on the degassing passage, wherein 15
- the third expansion valve is disposed between an inlet of the receiver and the portion of the circulation flow path between the outlet of the first passage and the second expansion valve.
3. The outdoor unit according to claim 2, further comprising a controller configured to control the flow path switching unit, wherein 20
- when a temperature at the outlet of the first passage of the heat exchanger is higher than a first temperature, the controller controls the flow path switching unit to switch the destination of the refrigerant to the suction port. 25
4. The outdoor unit according to claim 3, wherein, when the temperature at the outlet of the first passage of the heat exchanger is lower than a second temperature, the controller controls the flow path switching unit to switch the destination of the refrigerant to the intermediate pressure port. 30
- 35
5. The outdoor unit according to claim 3, wherein the controller controls a degree of opening of the third expansion valve such that a refrigerant temperature at the discharge port of the compressor approaches a target temperature. 40
6. The outdoor unit according to claim 3, wherein the controller controls a degree of opening of the fourth expansion valve such that a refrigerant temperature at an outlet of the condenser approaches a target temperature. 45
7. The outdoor unit according to any one of claims 3 to 6, wherein the controller performs control of the compressor and the second expansion valve to use a supercritical region of the refrigerant. 50
8. A refrigeration cycle apparatus comprising:
- the outdoor unit according to any one of claims 1 to 7; and 55
- the load device.
9. A refrigerating machine comprising the refrigeration cycle apparatus according to claim 8.

FIG. 1

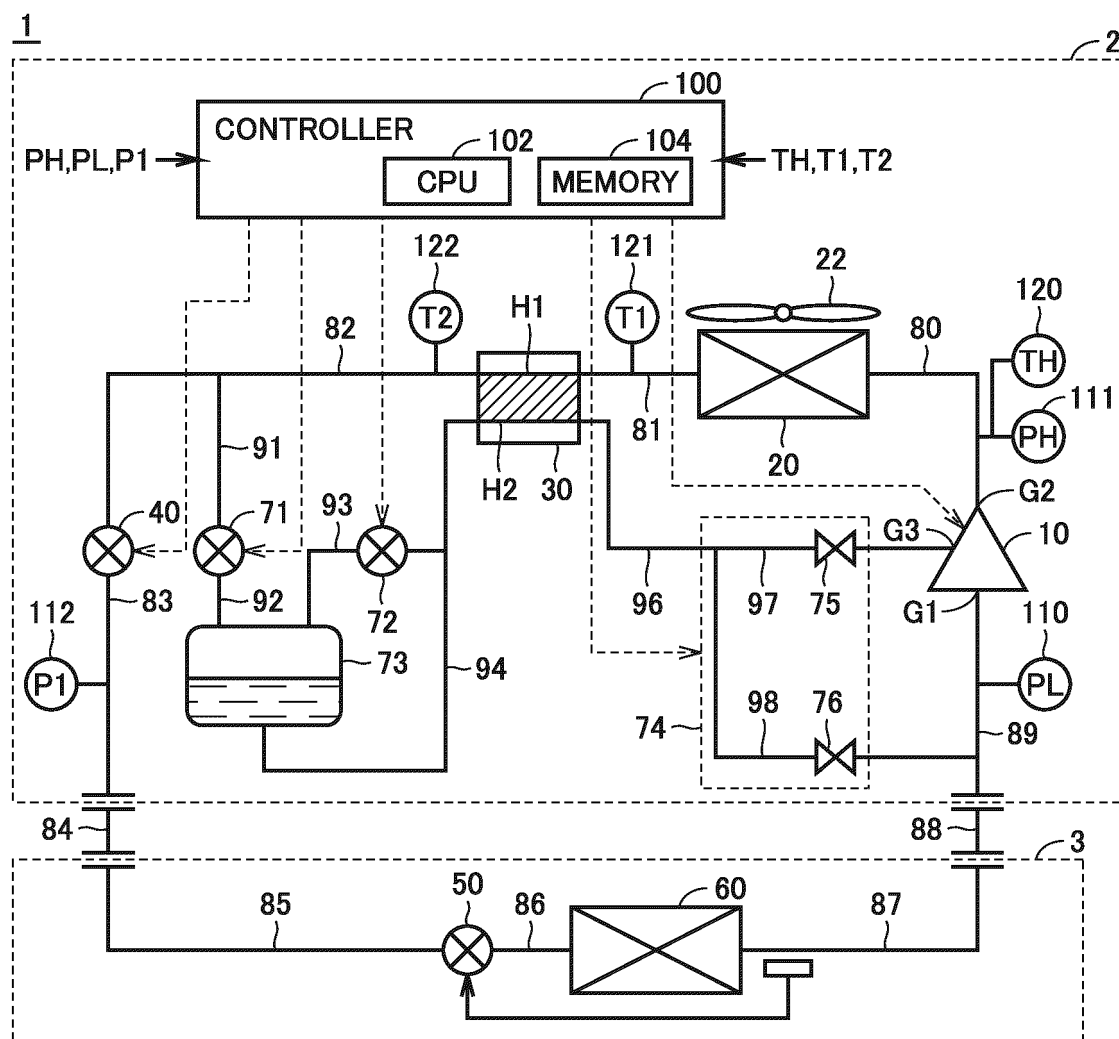


FIG.2

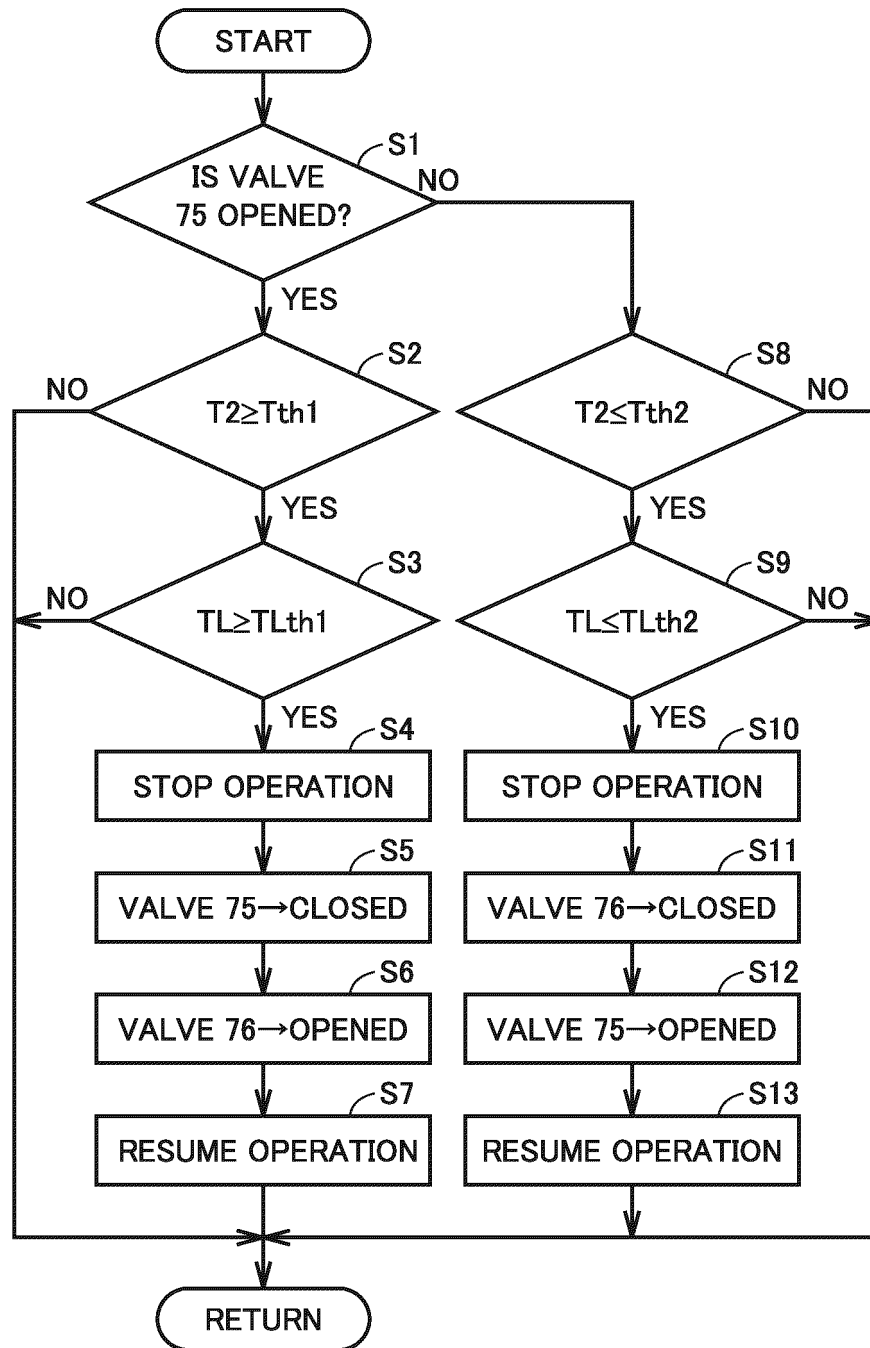


FIG.3

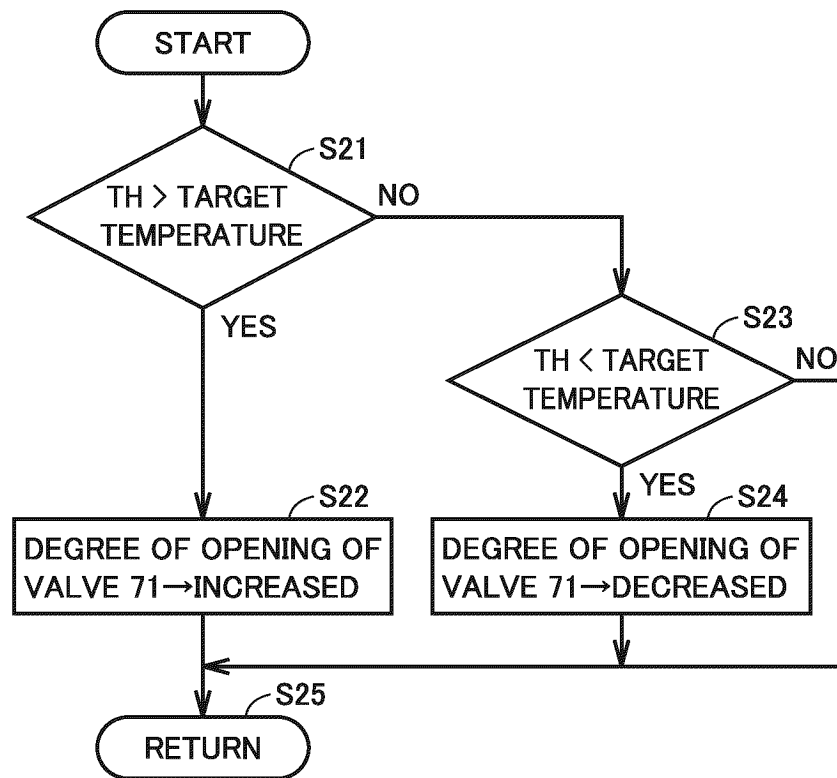


FIG.4

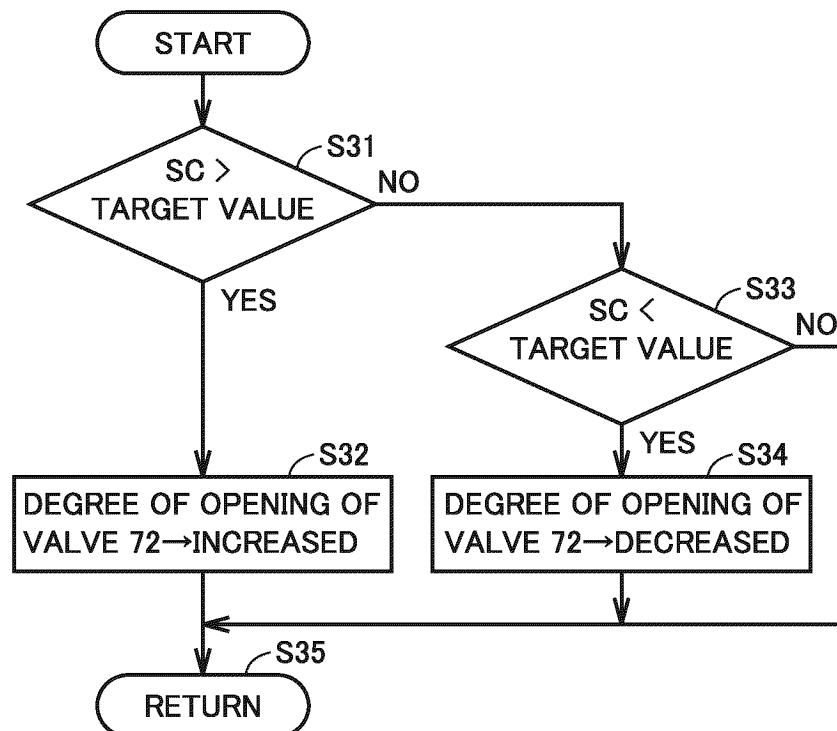
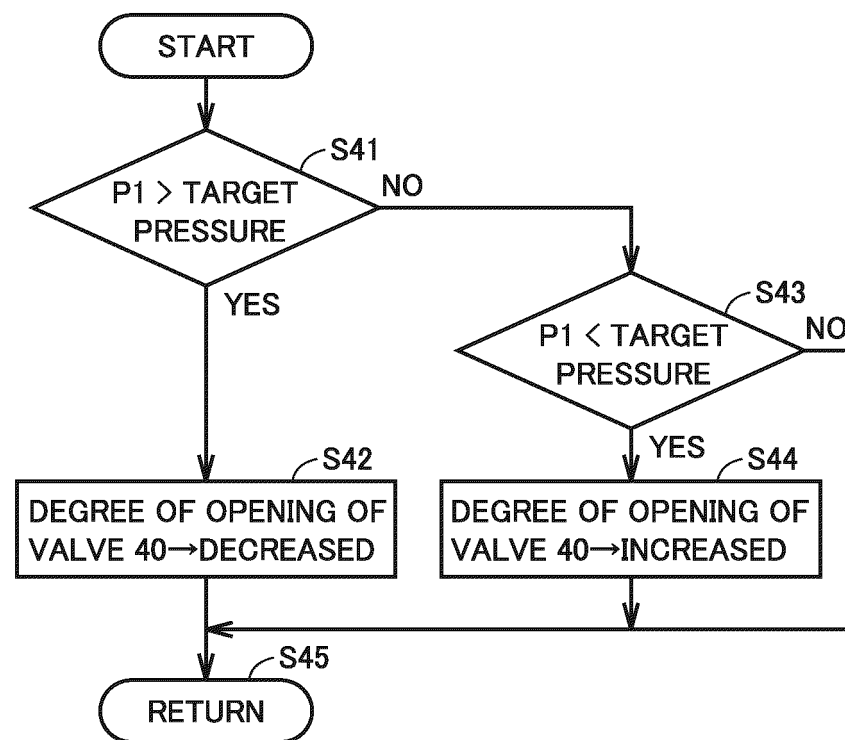


FIG.5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2019/015681

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. F25B1/00 (2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int. Cl. F25B1/00

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

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2019
Registered utility model specifications of Japan	1996-2019
Published registered utility model applications of Japan	1994-2019

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2015/063838 A1 (MITSUBISHI ELECTRIC CORP.) 07 May 2015, paragraph [0037], fig. 7 & GB 2534510 A, paragraph [0037], fig. 7 & CN 105683681 A	1-9
A	US 2011/0094248 A1 (CARRIER CORPORATION) 28 April 2011, fig. 2 & WO 2009/082367 A1	1-9

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Patent documents cited in the description

- JP 2017187189 A [0002] [0003]