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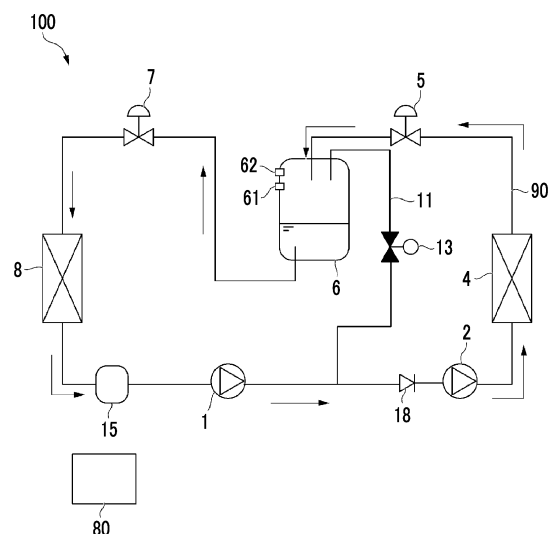
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(54) **FREEZING APPARATUS**

(57) A refrigerating apparatus comprising: a main circuit through which a refrigerant flows; a plurality of compressors; a non-return valve; a condenser; a receiver; a first expansion valve; an evaporator; an injection flow-path; an solenoid valve disposed upon the injection flow-path; a fluid level detection unit that detects the amount of refrigerant stored inside the receiver; and a control unit. The control unit closes the first expansion valve prior to stopping the compressors and closes the solenoid valve at the point that the fluid level detection unit has detected that the amount of fluid component inside the receiver has reached a predetermined upper value.

FIG. 1



Description

Technical Field

[0001] The present disclosure relates to a refrigerating apparatus.

[0002] This application claims priority to Japanese Patent Application No. 2021-170169, filed in Japan on October 18, 2021, the content of which is incorporated herein by reference.

Background Art

[0003] A general refrigerating apparatus includes a compressor, a condenser, an expansion valve, a receiver (gas-liquid separator), and an evaporator. A high-temperature high-pressure gaseous refrigerant generated by the compressor is first sent to the condenser. In the condenser, heat exchange between the refrigerant and air is performed, and the refrigerant becomes a high-temperature high-pressure liquid refrigerant. Thereafter, the refrigerant passes through the expansion valve, so that the temperature and the pressure of the refrigerant decrease, and the refrigerant becomes a low-temperature low-pressure liquid refrigerant. Further, by performing heat exchange with air in the evaporator, the refrigerant becomes a low-temperature low-pressure gaseous refrigerant. In this process, a temperature of a space in which the condenser or the evaporator is installed is adjusted. In particular, in recent years, in order to improve an output of the refrigerating apparatus, a configuration in which a plurality of compressors are disposed in series may be adopted (see PTL 1 described below). That is, a low pressure-side compressor and a high pressure-side compressor are disposed in series.

Citation List

Patent Literature

[0004] [PTL 1] Japanese Unexamined Patent Application Publication No. 2020-204454

Summary of Invention

Technical Problem

[0005] In the refrigerating apparatus as described above, heretofore, in general, in a case where an operation is stopped, the refrigerant is present uniformly on a pipe path. Therefore, it is necessary to secure pressure resistance performance of the pipe and various devices to a certain level or higher. As a result, in particular, it is necessary to make pressure resistance performance of the low pressure-side compressor substantially the same as pressure resistance performance of the high pressure-side compressor, which causes an increase in cost.

[0006] The present disclosure has been made to solve

the above problem, and an object thereof is to provide a refrigerating apparatus capable of being manufactured at a lower cost.

Solution to Problem

[0007] In order to solve the above problem, a refrigerating apparatus according to the present disclosure includes a main circuit as a circulation flow path through which a refrigerant circulates; a plurality of compressors that are disposed in series on the main circuit; a check valve that is disposed between the plurality of compressors; a condenser that is disposed on a downstream side of the plurality of compressors; a receiver that is disposed on a downstream side of the condenser; a first expansion valve that is disposed on a downstream side of the receiver; an evaporator that is disposed on a downstream side of the expansion valve; an injection flow path that connects the receiver and an upstream side of the check valve between the plurality of compressors; an solenoid valve that is disposed on the injection flow path; a liquid level detection unit that detects an amount of a liquid component of the refrigerant stored in the receiver; and a control unit, in which the control unit closes the first expansion valve before stopping the compressor and closes the solenoid valve at a point in time when the liquid level detection unit detects that the amount of the liquid component in the receiver has reached a predetermined upper limit value.

Advantageous Effects of Invention

[0008] According to the present disclosure, it is possible to provide a refrigerating apparatus that can be manufactured at a lower cost.

Brief Description of Drawings

[0009]

Fig. 1 is a circuit diagram showing a configuration of a refrigerating apparatus according to a first embodiment of the present disclosure.

Fig. 2 is a circuit diagram showing a configuration of a refrigerating apparatus according to the first embodiment of the present disclosure, which shows a state before an operation is stopped.

Fig. 3 is a circuit diagram showing a configuration of a refrigerating apparatus according to the first embodiment of the present disclosure, which shows a state after the operation is stopped.

Fig. 4 is a circuit diagram showing a configuration of a refrigerating apparatus according to a second embodiment of the present disclosure, which shows a state before the operation is stopped.

Fig. 5 is a circuit diagram showing a configuration of a refrigerating apparatus according to the second embodiment of the present disclosure, which shows

a state after the operation is stopped.

Fig. 6 is a circuit diagram showing a configuration of a refrigerating apparatus according to the second embodiment of the present disclosure, which shows a state in which a refrigerant in a receiver is transferred to another receiver during stoppage.

Description of Embodiments

[First Embodiment]

(Configuration of Refrigerating Apparatus)

[0010] Hereinafter, a refrigerating apparatus 100 according to a first embodiment of the present disclosure will be described with reference to Figs. 1 to 3. The refrigerating apparatus 100 is a heat pump-type apparatus that performs heat exchange between a refrigerant and air by being operated by a refrigerating cycle.

[0011] As shown in Fig. 1, the refrigerating apparatus 100 comprises a main circuit 90 formed as a circulation flow path, a first compressor 1 (compressor), a second compressor 2 (compressor), a condenser 4, a first expansion valve 7, a receiver 6, a liquid level detection unit 61, a pressure detection unit 62, a second expansion valve 5, an evaporator 8, an injection flow path 11, an solenoid valve 13, an accumulator 15, a check valve 18, and a control unit 80.

(Configurations of First Compressor and Second Compressor)

[0012] The main circuit 90 is filled with a refrigerant in a liquid or gaseous state. The first compressor 1 and the second compressor 2 are disposed in series on the main circuit 90. That is, a discharge side of the first compressor 1 faces a suction side of the second compressor 2. As the first compressor 1 and the second compressor 2, for example, a scroll compressor, a rotary compressor, or a scrotary compressor can be used. In the following description, on the main circuit 90, a side on which the second compressor 2 is located when viewed from the first compressor 1 is referred to as a downstream side, and an opposite side thereof is referred to as an upstream side. The check valve 18 is provided between the first compressor 1 and the second compressor 2. The check valve 18 is configured to allow the refrigerant to circulate only in a direction from the upstream side toward the downstream side.

(Configuration of Condenser)

[0013] The condenser 4 is disposed on the downstream side of the second compressor 2. The condenser 4 is a heat exchanger for exchanging heat between external air and the refrigerant. A fan (not shown) is provided in the vicinity of the condenser 4, so that it is possible to forcibly perform heat exchange between the air and

the refrigerant. A high-temperature high-pressure gaseous refrigerant generated by the second compressor 2 is condensed by passing through the condenser 4 to become a high-temperature high-pressure liquid refrigerant.

[0014] The second expansion valve 5 is provided on the downstream side of the condenser 4. The high-temperature high-pressure liquid refrigerant supplied from the condenser 4 passes through the second expansion valve 5, and thus the pressure and the temperature of the liquid refrigerant decrease, and the liquid refrigerant becomes a low-temperature low-pressure liquid refrigerant.

(Configuration of Receiver)

[0015] The receiver 6 is connected to the downstream side of the second expansion valve 5. The receiver 6 is a container for storing at least a part of the liquid refrigerant that has passed through the second expansion valve 5. An amount of the liquid refrigerant that can be present in the main circuit 90 varies depending on an operation condition of the refrigerating apparatus 100. The receiver 6 is provided to cope with this variation. The liquid level detection unit 61 and the pressure detection unit 62 are attached to the receiver 6. The liquid level detection unit 61 detects an amount of the liquid refrigerant in the receiver 6 and transmits the detected amount to the control unit 80 as an electrical signal. The pressure detection unit 62 detects the pressure in the receiver 6 and transmits the detected pressure to the control unit 80 as an electrical signal.

[0016] The first expansion valve 7 is disposed further downstream of the receiver 6. The first expansion valve 7 is provided to further reduce the temperature and the pressure of the low-temperature low-pressure liquid refrigerant that has passed through the receiver 6. The second expansion valve 5 and the first expansion valve 7 are electromagnetic expansion valves capable of switching between open and closed states by an electrical signal from the outside.

(Configuration of Evaporator)

[0017] The evaporator 8 is provided on the downstream side of the first expansion valve 7. The evaporator 8 is a heat exchanger for exchanging heat between the external air and the refrigerant. A fan (not shown) is provided in the vicinity of the evaporator 8, so that it is possible to forcibly perform heat exchange between the air and the refrigerant. The low-temperature low-pressure liquid refrigerant that has passed through the first expansion valve 7 evaporates by being heat-exchanged with the external air when passing through the evaporator 8, and thus becomes a low-temperature low-pressure gaseous refrigerant.

[0018] The accumulator 15 is provided on the downstream side of the evaporator 8. The accumulator 15 is

a container for storing the liquid refrigerant that has not been evaporated in the evaporator 8. After a liquid component is removed in the accumulator 15, the gaseous refrigerant is sent to the first compressor 1 again to be compressed. The refrigerating apparatus 100 is operated by continuously repeating such a cycle (refrigerating cycle).

(Configuration of Injection Flow Path)

[0019] The injection flow path 11 connects the receiver 6 and a portion between the check valve 18 and the first compressor 1 (that is, the low pressure-side compressor) described above. The solenoid valve 13 is provided on the injection flow path 11. The solenoid valve 13 can switch between open and closed states thereof by an electrical signal from the outside.

(Configuration of Control Unit)

[0020] The control unit 80 is provided to switch the open and closed states of the respective valve devices described above and operation states of the first compressor 1 and the second compressor 2 by electrical signals. Specifically, the control unit 80 can switch the open and closed states of the first expansion valve 7, the second expansion valve 5, and the solenoid valve 13. In addition, the control unit 80 can switch driving and stopping of the first compressor 1 and the second compressor 2.

(Operations and Effects)

[0021] Next, an example of an operation of the refrigerating apparatus 100 will be described. As shown in Fig. 1, in a normal operation of the refrigerating apparatus 100, the control unit 80 closes the solenoid valve 13. As a result, the injection flow path 11 is closed, and the refrigerant circulates only in the main circuit 90. The refrigerant circulates in the main circuit 90, and thus the above-described refrigerating cycle continuously occurs.

[0022] Next, an operation when stopping the refrigerating apparatus 100 will be described with reference to Figs. 2 and 3. In the refrigerating apparatus 100 as described above, heretofore, in general, in a case where an operation is stopped, the refrigerant is present uniformly on a pipe path. Therefore, it is necessary to secure pressure resistance performance of the pipe and various devices to a certain level or higher. As a result, in particular, it is necessary to make pressure resistance performance of the low pressure-side first compressor 1 substantially the same as pressure resistance performance of the high pressure-side second compressor 2, which causes an increase in cost.

[0023] Therefore, the refrigerating apparatus 100 according to the present embodiment is configured to perform an operation described below to recover the refrigerant in the receiver 6. As shown in Fig. 2, first, the control

unit 80 closes the first expansion valve 7. Thus, the downstream side of the receiver 6 in the main circuit 90 is blocked. As a result, the refrigerant in the main circuit 90 and the injection flow path 11 is sequentially stored in the receiver 6.

[0024] Thereafter, as shown in Fig. 3, in a case where the liquid level detection unit 61 detects that the receiver 6 is filled with the liquid refrigerant (the amount of the refrigerant reaches an upper limit value), the control unit 80 closes the second expansion valve 5 and the solenoid valve 13. Thus, the receiver 6 is disconnected from the main circuit 90. Subsequently, the control unit 80 stops the driving of the first compressor 1 and the second compressor 2. As a result, the refrigerating apparatus 100 is stopped.

[0025] As described above, in the refrigerating apparatus 100 according to the present embodiment, the refrigerant present in the main circuit 90 and each device can be recovered in the receiver 6 by operating the first compressor 1 and the second compressor 2 in a state in which the first expansion valve 7 is closed before the operation is stopped. Therefore, in a state in which the operation of the refrigerating apparatus 100 is stopped, the refrigerant is less likely to remain in the main circuit 90 or each device, and the pressure resistance performance of the low pressure-side first compressor 1 can be particularly reduced. As a result, it is possible to reduce manufacturing costs or maintenance costs of the refrigerating apparatus 100.

[0026] In addition, according to the above configuration, the receiver 6 is in a state of being disconnected from the main circuit by closing the second expansion valve 5 in addition to the solenoid valve 13. Thus, the refrigerant can be stably sealed in the receiver 6.

[0027] The first embodiment of the present disclosure has been described above. Various changes or improvements can be made to the above configuration without departing from the concept of the present disclosure.

[Second Embodiment]

[0028] Next, a refrigerating apparatus 200 according to a second embodiment of the present disclosure will be described with reference to Figs. 4 to 6. The same configurations as in the first embodiment described above are denoted by the same reference signs, and detailed descriptions thereof will not be repeated.

[0029] As shown in Fig. 4, in the present embodiment, the number of compressors is different from that in the first embodiment. Specifically, two high pressure-side second compressors 2a and 2b are provided on the main circuit 90 in addition to a lowest pressure-side first compressor 1. One check valve 18 (18a, 18b) is provided on the upstream side of each of the second compressors 2a and 2b.

[0030] Further, in the present embodiment, the receiver 6, the first expansion valve 7, the injection flow path 11, and the solenoid valve 13 described in the first em-

bodiment are provided in a plurality of sets (two sets), respectively. In the following description, the receiver 6, the first expansion valve 7, the injection flow path 11, and the solenoid valve 13 which are located on a relatively downstream side on the main circuit 90 are referred to as a downstream receiver 6a, a downstream first expansion valve 7a, a downstream injection flow path 11a, and a downstream solenoid valve 13a, respectively. In addition, devices that are located on a relatively upstream side are referred to as an upstream receiver 6b, an upstream first expansion valve 7b, an upstream injection flow path 11b, and an upstream solenoid valve 13b, respectively.

[0031] The downstream injection flow path 11a connects the downstream receiver 6a and a portion between the first compressor 1 and the check valve 18a. The upstream injection flow path 11b connects the upstream receiver 6b and a portion between the second compressor 2a and the check valve 18b.

[0032] Subsequently, an operation when stopping the refrigerating apparatus 200 will be described. As shown in Fig. 4, before the stopping, the control unit 80 first closes the downstream first expansion valve 7a. As a result, the refrigerant downstream of the downstream first expansion valve 7a on the main circuit 90 is sequentially recovered in the downstream receiver 6a.

[0033] Thereafter, when it is detected that the downstream receiver 6a is filled with the refrigerant, the control unit 80 closes the upstream first expansion valve 7b and the downstream solenoid valve 13a as shown in Fig. 5. As a result, the downstream receiver 6a is disconnected from the main circuit 90. Thereafter, the refrigerant that still remains on the main circuit 90 is stored in the upstream receiver 6b. Finally, when it is detected that the upstream receiver 6b is also filled with the refrigerant, the control unit 80 closes the second expansion valve 5 and the upstream solenoid valve 13b. Thus, the upstream receiver 6b is also disconnected from the main circuit 90. Thereafter, the control unit 80 stops the first compressor 1 and the second compressors 2a and 2b. As a result, the refrigerating apparatus 200 is stopped.

[0034] In this way, the refrigerant is sequentially stored in a plurality of the receivers 6 from the downstream receiver 6 to the upstream receiver 6, so that the refrigerant in the main circuit 90 and each device is recovered.

[0035] Meanwhile, in a case where the refrigerating apparatus 200 is stopped as described above, the pressure in the receiver 6 may increase due to an influence of an outside air temperature. For example, a case where the pressure detection unit 62 detects that the pressure in the downstream receiver 6a is equal to or greater than a predetermined upper limit pressure is considered. In this case, as shown in Fig. 6, the control unit 80 opens only the downstream solenoid valve 13a and the second expansion valve 5. In this state, the control unit 80 drives the first compressor 1 and the second compressors 2a and 2b. Then, the refrigerant in the downstream receiver 6a flows toward the upstream receiver 6b through the

downstream injection flow path 11a and the main circuit 90. The control unit 80 continues this operation until the pressure in the downstream receiver 6a becomes less than the upper limit pressure.

[0036] As described above, according to the above configuration, in the refrigerating apparatus 200 including the plurality of receivers 6, the receivers 6 can be sequentially filled with the refrigerant from the downstream side to the upstream side. As a result, it is possible to store a larger amount of refrigerant in the plurality of receivers 6.

[0037] In addition, according to the above configuration, in a case where the pressure in the receiver 6 is increased during the stop of the refrigerating apparatus 200, the refrigerant in the receiver 6 located on the downstream side can be transferred to the other receiver 6 located on the upstream side by driving the compressor in a state in which the injection flow path 11 connected to the receiver 6 located on the downstream side is opened. Accordingly, the pressure in each receiver 6 can be maintained to be equal to or less than the upper limit pressure.

[0038] The embodiments of the present disclosure have been described above. Various changes or improvements can be made to the above configuration without departing from the concept of the present disclosure. For example, in each of the above-described embodiments, the refrigerating apparatus 100 for two-stage compression including the first compressor 1 and the second compressor 2, and the refrigerating apparatus 200 for three-stage compression including the first compressor 1 and the second compressors 2a and 2b have been described. However, the number of compressors is not limited to the embodiments, and a configuration in which compression is performed in four or more stages can be adopted. Specific examples of the refrigerating apparatus for four-stage compression include a configuration in which two scroll compressors are used. With such a configuration, it is possible to realize the operations described in the second embodiment.

[Appendix]

[0039] The refrigerating apparatus 100 and the refrigerating apparatus 200 described in the embodiments are understood as follows, for example.

[0040]

(1) A refrigerating apparatus 100 according to a first aspect includes a main circuit 90 as a circulation flow path through which a refrigerant circulates; a plurality of compressors (a first compressor 1 and a second compressor 2) that are disposed in series on the main circuit 90; a check valve 18 that is disposed between the plurality of compressors; a condenser 4 that is disposed on a downstream side of the plurality of compressors; a receiver 6 that is disposed on a downstream side of the condenser 4; a first

expansion valve 7 that is disposed on a downstream side of the receiver 6; an evaporator 8 that is disposed on a downstream side of the first expansion valve 7; an injection flow path 11 that connects the receiver 6 and an upstream side of the check valve 18 between the plurality of compressors; an solenoid valve 13 that is disposed on the injection flow path 11; a liquid level detection unit 61 that detects an amount of a liquid component of the refrigerant stored in the receiver 6; and a control unit 80, in which the control unit 80 closes the first expansion valve 7 before stopping the compressor and closes the solenoid valve 13 at a point in time when the liquid level detection unit 61 detects that the amount of the liquid component in the receiver 6 has reached a predetermined upper limit value.

According to the above configuration, the refrigerant present in the main circuit 90 and each device can be recovered in the receiver 6 by operating the compressors in a state in which the first expansion valve 7 is closed before stopping the operation of the refrigerating apparatus 100. Therefore, in a state in which the operation of the refrigerating apparatus 100 is stopped, the refrigerant is less likely to remain in the main circuit 90 or each device, and the pressure resistance performance of the low pressure-side compressor can be particularly reduced.

(2) A refrigerating apparatus 200 according to a second aspect includes a plurality of sets of the receivers 6, the first expansion valves 7, the injection flow paths 11, and the solenoid valves 13 that are disposed in series on the main circuit 90, in which the control unit 80 performs control of closing the first expansion valve 7 before stopping the compressor and closing the solenoid valve 13 at a point in time when the liquid level detection unit 61 detects that the amount of the liquid component in the receiver 6 has reached the upper limit value in a sequence from the first expansion valve 7 and the solenoid valve 13 that are located on a most downstream side to the first expansion valve 7 and the solenoid valve 13 that are located on a most upstream side among the plurality of sets of the first expansion valves 7 and the solenoid valves 13.

According to the above configuration, in the refrigerating apparatus 200 including the plurality of receivers 6, the receivers 6 can be sequentially filled with the refrigerant from the downstream side to the upstream side. As a result, it is possible to store a larger amount of refrigerant in the plurality of receivers 6.

(3) The refrigerating apparatus 200 according to a third aspect further includes a pressure detection unit 62 that detects a pressure in the receiver 6, in which in a case where the pressure detection unit 62 detects that the pressure in the receiver 6 located on a relatively upstream side among the plurality of receivers 6 is equal to or greater than a predetermined

upper limit pressure while the compressor is stopped, the control unit 80 closes the solenoid valve 13 on the injection flow path 11 connected to the receiver 6 located on the relatively upstream side, opens the solenoid valve 13 on the injection flow path 11 connected to the receiver 6 located on a relatively downstream side, and drives the compressor.

Here, during the stop of the refrigerating apparatus 200, the pressure in the receiver 6 may increase due to the influence of the outside air temperature. According to the above configuration, in such a case, the refrigerant in the receiver 6 located on the downstream side can be transferred to the other receiver 6 located on the upstream side by driving the compressor in a state in which the injection flow path 11 connected to the receiver 6 located on the downstream side is opened. Accordingly, the pressure in each receiver 6 can be maintained to be equal to or less than the upper limit pressure.

(4) The refrigerating apparatus 100 according to a fourth aspect further includes a second expansion valve 5 that is disposed between the condenser 4 and the receiver 6, in which the control unit 80 closes the solenoid valve 13 and the second expansion valve 5 at a point in time when the liquid level detection unit 61 detects that an amount of the refrigerant in the receiver 6 has reached a predetermined upper limit value.

[0041] According to the above configuration, the receiver 6 is in a state of being disconnected from the main circuit by closing the second expansion valve 5 in addition to the solenoid valve 13. Thus, the refrigerant can be stably sealed in the receiver 6.

Industrial Applicability

[0042] According to the present disclosure, it is possible to provide a refrigerating apparatus that can be manufactured at a lower cost.

Reference Signs List

[0043]

100, 200: refrigerating apparatus
 90: main circuit
 80: control unit
 1: first compressor
 2, 2a, 2b: second compressor
 4: condenser
 5: second expansion valve
 6: receiver
 6a: downstream receiver
 6b: upstream receiver
 7: first expansion valve
 7a: downstream first expansion valve

7b: upstream first expansion valve
 8: evaporator
 11: injection flow path
 11a: downstream injection flow path
 11b: upstream injection flow path
 13: solenoid valve
 13a: downstream solenoid valve
 13b: upstream solenoid valve
 15: accumulator
 18, 18a, 18b: check valve

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Claims

1. A refrigerating apparatus comprising:

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a main circuit as a circulation flow path through which a refrigerant circulates;
 a plurality of compressors that are disposed in series on the main circuit;
 a check valve that is disposed between the plurality of compressors;
 a condenser that is disposed on a downstream side of the plurality of compressors;
 a receiver that is disposed on a downstream side of the condenser;
 a first expansion valve that is disposed on a downstream side of the receiver;
 an evaporator that is disposed on a downstream side of the first expansion valve;
 an injection flow path that connects the receiver and an upstream side of the check valve between the plurality of compressors;
 an solenoid valve that is disposed on the injection flow path;
 a liquid level detection unit that detects an amount of a liquid component of the refrigerant stored in the receiver; and
 a control unit,
 wherein the control unit closes the first expansion valve before stopping the compressor and closes the solenoid valve at a point in time when the liquid level detection unit detects that the amount of the liquid component in the receiver has reached a predetermined upper limit value.

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2. The refrigerating apparatus according to Claim 1,

wherein a plurality of sets of the receivers, the first expansion valves, the injection flow paths, and the solenoid valves that are disposed in series on the main circuit are provided, and the control unit performs control of closing the first expansion valve before stopping the compressor and closing the solenoid valve at a point in time when the liquid level detection unit detects that the amount of the liquid component in the receiver has reached the upper limit value

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in a sequence from the first expansion valve and the solenoid valve that are located on a most downstream side to the first expansion valve and the solenoid valve that are located on a most upstream side among the plurality of sets of the first expansion valves and the solenoid valves.

3. The refrigerating apparatus according to Claim 2, further comprising a pressure detection unit that detects a pressure in the receiver, wherein in a case where the pressure detection unit detects that the pressure in the receiver located on a relatively upstream side among the plurality of receivers is equal to or greater than a predetermined upper limit pressure while the compressor is stopped, the control unit closes the solenoid valve on the injection flow path connected to the receiver located on the relatively upstream side, opens the solenoid valve on the injection flow path connected to the receiver located on a relatively downstream side, and drives the compressor.

4. The refrigerating apparatus according to any one of Claims 1 to 3, further comprising a second expansion valve that is disposed between the condenser and the receiver, wherein the control unit closes the solenoid valve and the second expansion valve at a point in time when the liquid level detection unit detects that an amount of the refrigerant in the receiver has reached a predetermined upper limit value.

FIG. 1

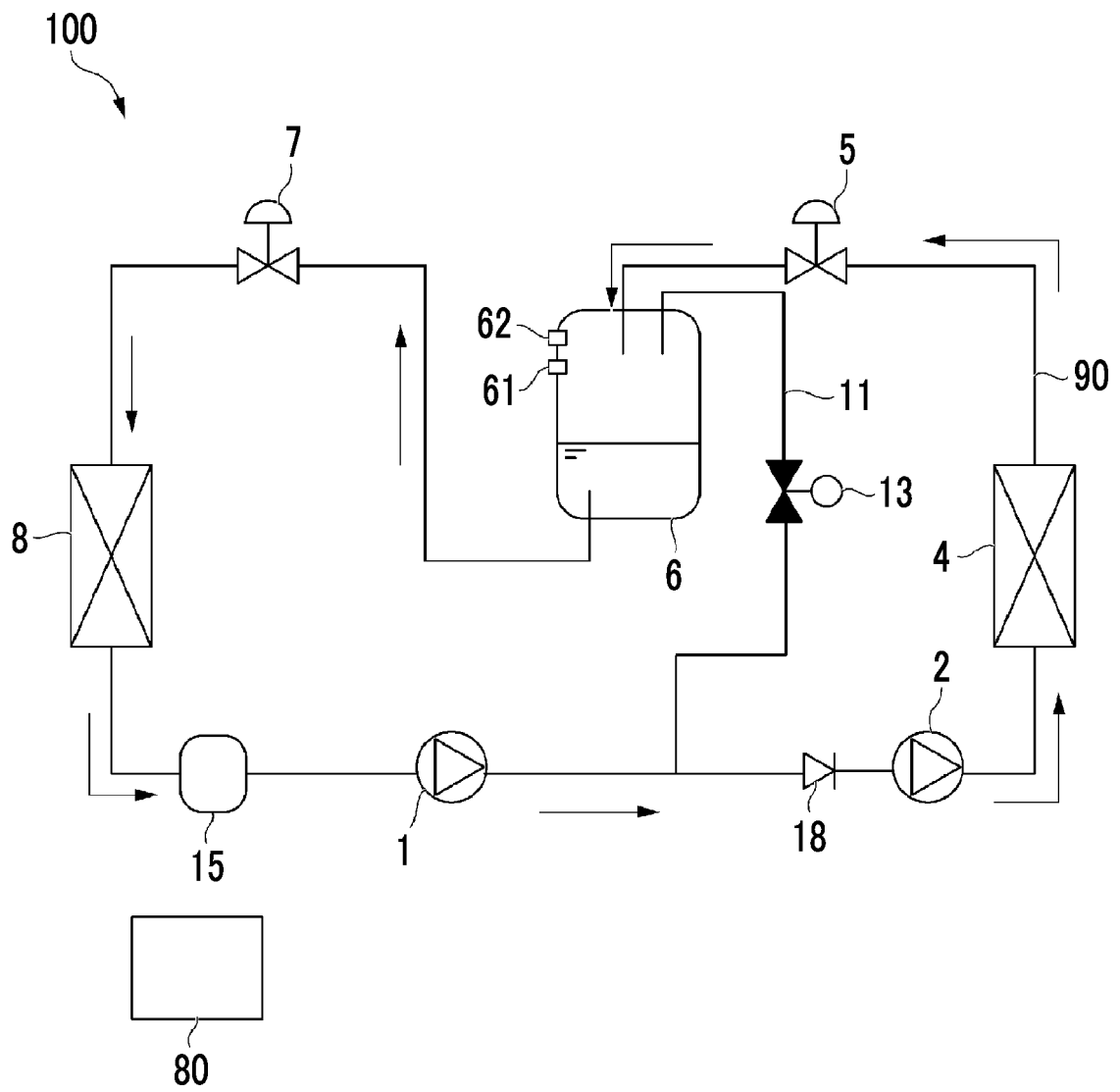


FIG. 2

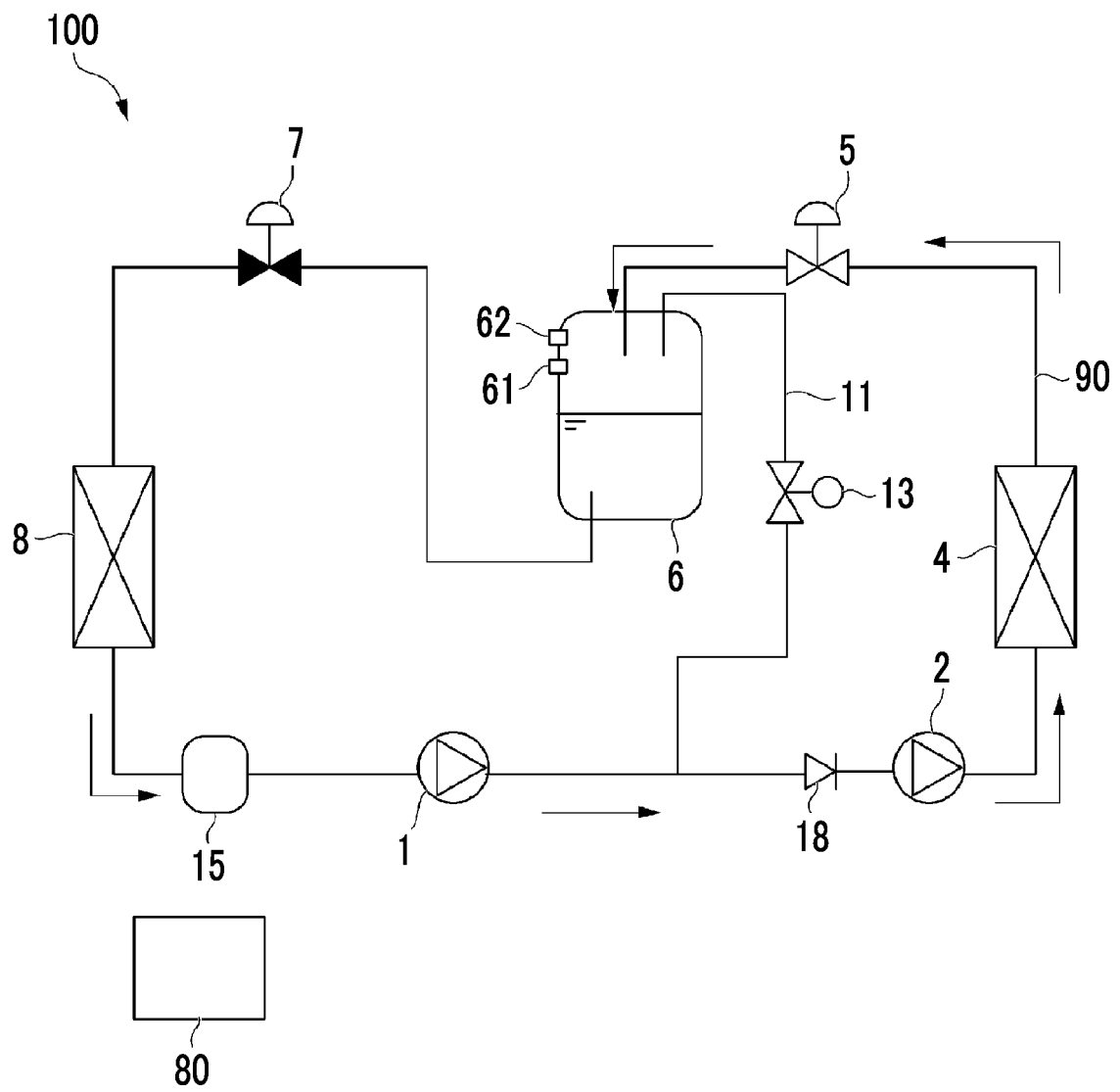


FIG. 3

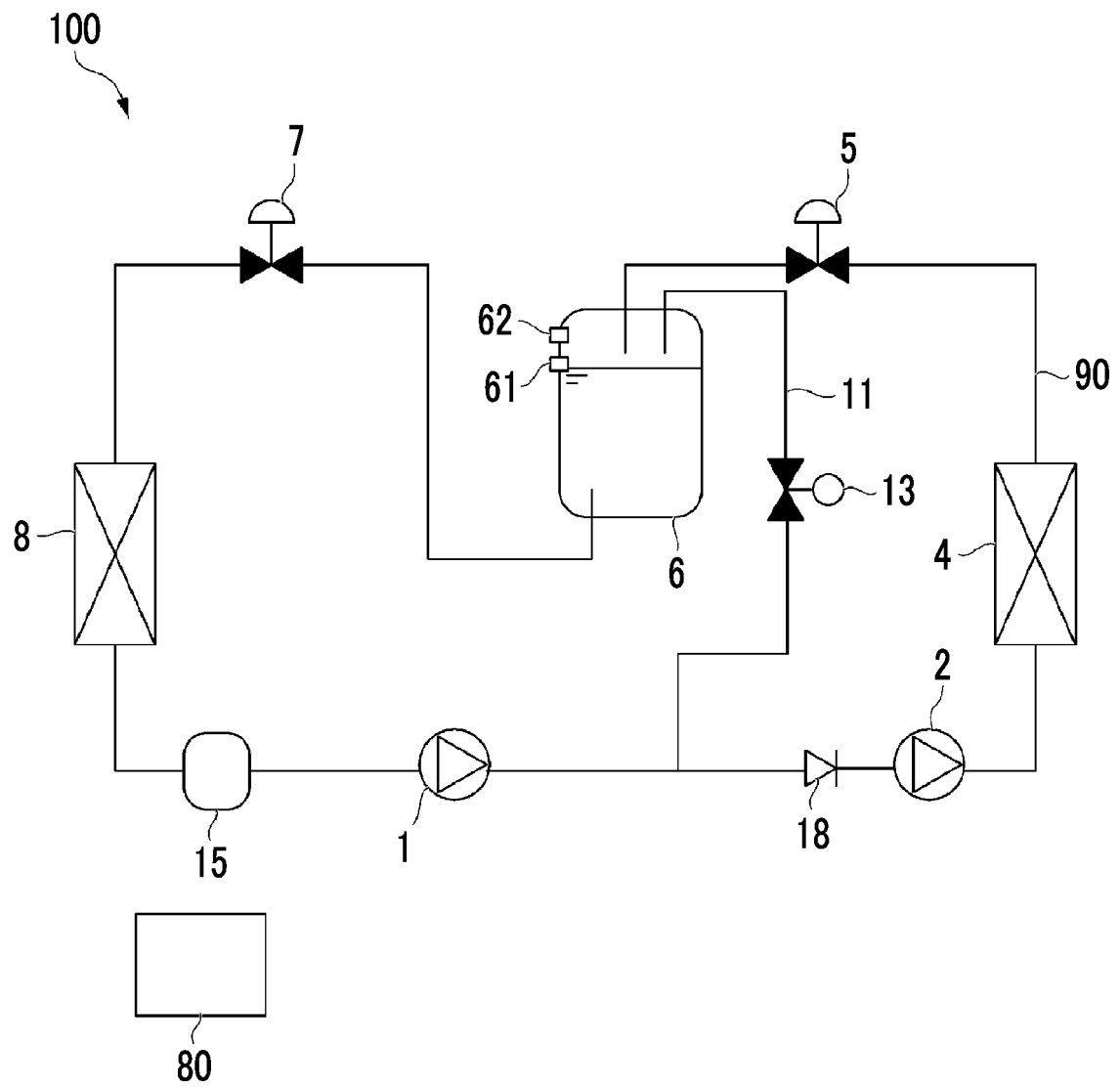


FIG. 4

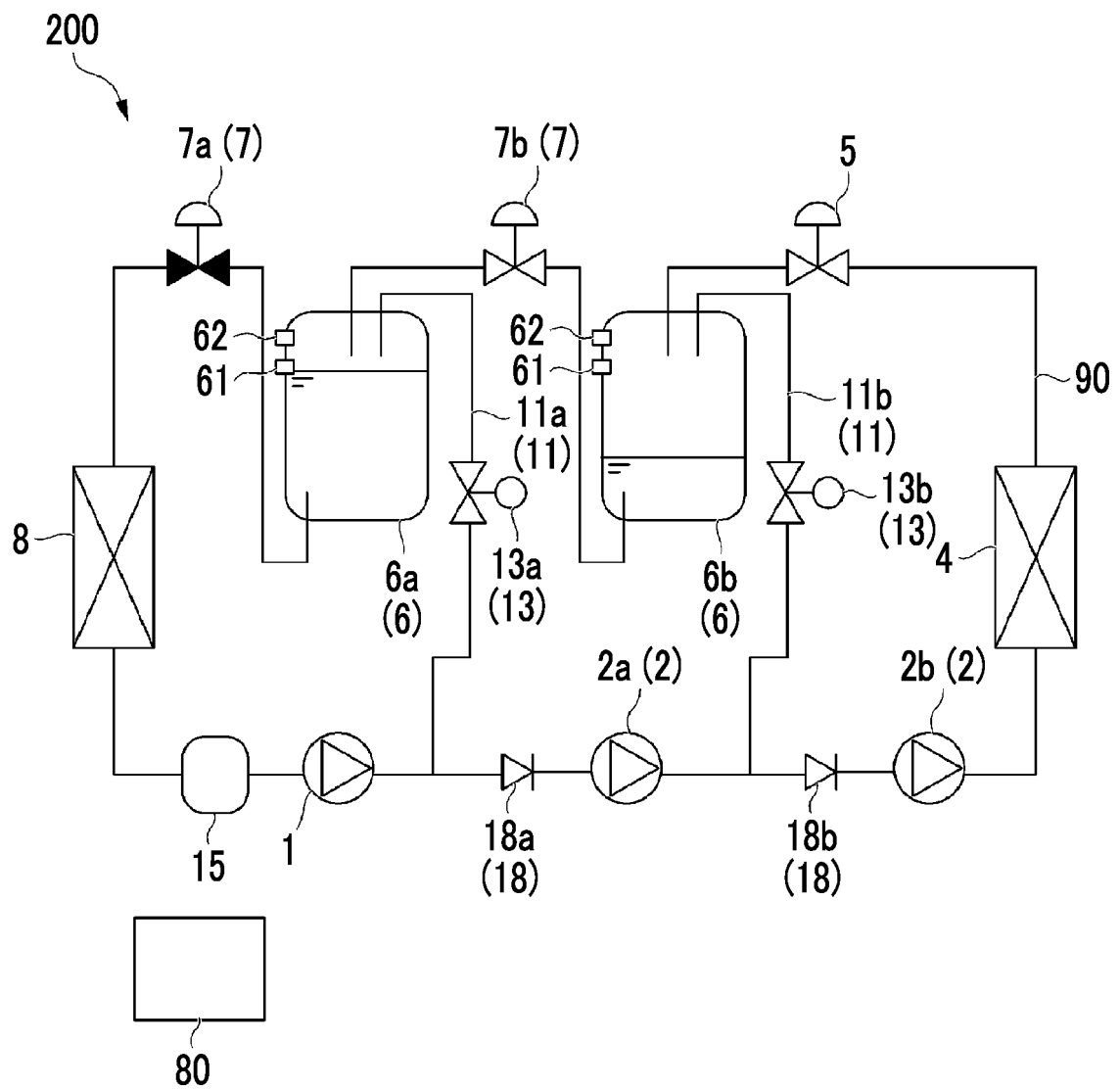


FIG. 5

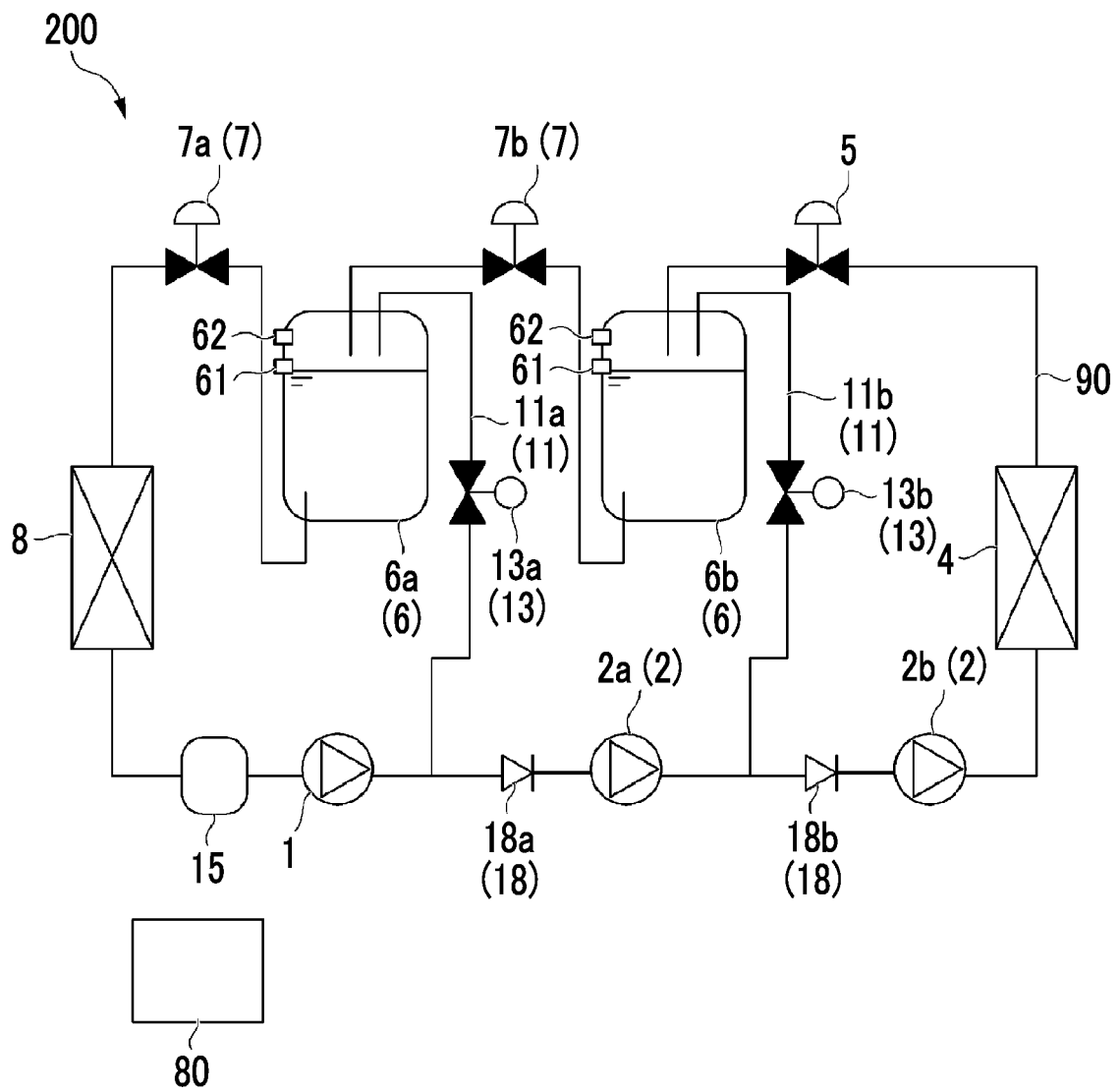
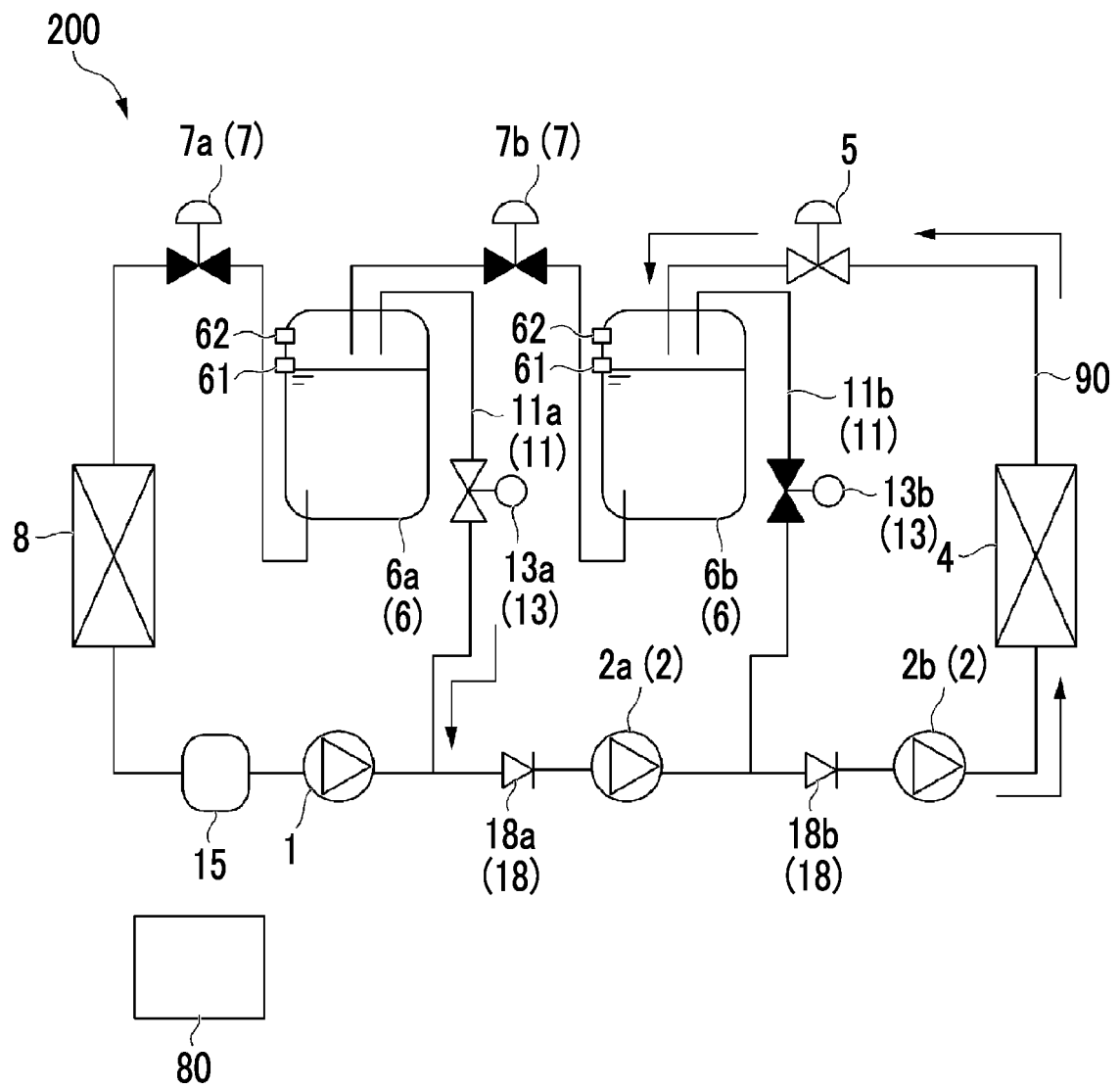


FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/038399

A. CLASSIFICATION OF SUBJECT MATTER**F25B 1/00**(2006.01)i; **F25B 1/10**(2006.01)i; **F25B 43/00**(2006.01)i

FI: F25B1/00 391; F25B1/00 311B; F25B43/00 R; F25B1/10 C; F25B1/10 Q; F25B1/00 341V

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)

F25B1/00; F25B1/10; F25B43/00

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 1971-2022

Registered utility model specifications of Japan 1996-2022

Published registered utility model applications of Japan 1994-2022

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.
A	JP 2018-9767 A (DAIKIN IND LTD) 18 January 2018 (2018-01-18) entire text, all drawings	1-4
A	JP 2001-133056 A (MITSUBISHI ELECTRIC CORP) 18 May 2001 (2001-05-18) entire text, all drawings	1-4
A	JP 2013-139938 A (DAIKIN IND LTD) 18 July 2013 (2013-07-18) entire text, all drawings	1-4
A	WO 2018/167820 A1 (MITSUBISHI ELECTRIC CORP) 20 September 2018 (2018-09-20) entire text, all drawings	1-4
A	CN 113503653 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI) 15 October 2021 (2021-10-15) entire text, all drawings	1-4

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

* Special categories of cited documents:

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Information on patent family members

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