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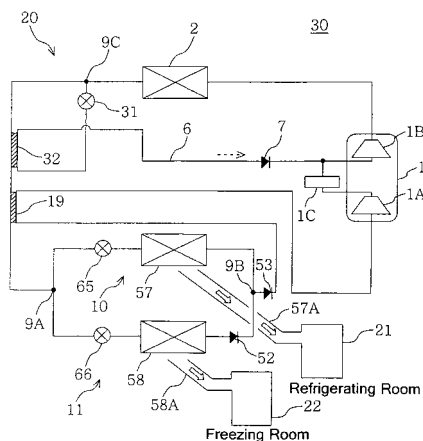
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(57) An object is to provide a refrigerating device capable of realizing a high-efficiency operation and a refrigerator provided with the refrigerating device in a case where a compressor (1) having an intermediate-pressure portion is applied, the refrigerating device comprises a compressor (1) having an intermediate-pressure portion; a radiator (2) connected to the compressor (1) on a discharge side; and a heat absorbing unit (10) connected to the radiator (2) on an outlet side and including a pressure reducing unit (65) and a heat sink (87), the heat absorbing unit (10) on the outlet side is connected to a suction portion having a pressure which is lower than that of the intermediate-pressure portion of the compressor (1), a refrigerant pipe of the radiator on the outlet side is branched, one refrigerant pipe is connected to the heat absorbing unit (10), the other refrigerant pipe (6) is connected to the intermediate-pressure portion of the compressor (1), and provided with a pressure reducing mechanism (31) and a heat exchanger (32), and this heat exchanger (32) is constituted in such a manner that heat is exchangeable between a refrigerant of the one refrigerant pipe and a refrigerant of the other refrigerant pipe.

FIG.1

**EP 1 696 188 A2**

DescriptionBACKGROUND OF THE INVENTION

5 **[0001]** The present invention relates to a refrigerating device provided with a heat exchanger for cooling a refrigerant discharged from a radiator, and a refrigerator provided with this refrigerating device.

[0002] In general, a refrigerating device is known which has a refrigerating cycle provided with a compressor, a radiator, a heat sink and the like and which cools a target to be cooled in the heat sink.

10 **[0003]** As one example of such refrigerating device, for example, in Japanese Patent Application Laid-Open No. 2000-230767, a refrigerator is disclosed in which the compressor and a condenser are combined and in which two heat sinks are connected in parallel to each other and which switches the heat sinks to cool a freezing room and a refrigerating room independently of each other.

[0004] Additionally, in this type of refrigerating device, there is sometimes applied a compressor having an intermediate-pressure portion, for example, a compressor having a multistage compression mechanism.

15 **[0005]** In a case where the compressor having such intermediate-pressure portion is applied to the refrigerating device or the refrigerator as described above, when the refrigerating cycle suitable for use in the intermediate-pressure portion is constructed, it is sometimes possible to realize the refrigerating device which can be operated with a high efficiency.

SUMMARY OF THE INVENTION

20 **[0006]** An object of the present invention is to provide a refrigerating device capable of realizing a high-efficiency operation and a refrigerator provided with this refrigerating device in a case where a compressor having an intermediate-pressure portion is applied.

25 **[0007]** In a first aspect of the present invention, a refrigerating device comprises a compressor having an intermediate-pressure portion; a radiator connected to this compressor on a discharge side; and heat absorbing means connected to the radiator on an outlet side and including pressure reducing means and a heat sink, the heat absorbing means on the outlet side being connected to a suction portion having a pressure which is lower than that of the intermediate-pressure portion of the compressor, wherein a refrigerant pipe of the radiator on the outlet side is branched, one refrigerant pipe is connected to the heat absorbing means, the other refrigerant pipe is connected to the intermediate-pressure portion of the compressor, and provided with a pressure reducing mechanism and a heat exchanger, and this heat exchanger is constituted in such a manner that heat is exchangeable between a refrigerant of the one refrigerant pipe and a refrigerant of the other refrigerant pipe.

30 **[0008]** In a second aspect of the present invention, the refrigerating device of the first aspect of the present invention further comprises a first heat exchanger constituted in such a manner that the refrigerant between the heat absorbing means and the suction portion of the compressor is heat-exchangeable with the refrigerant of the one refrigerant pipe extended from the heat exchanger.

35 **[0009]** In a third aspect of the present invention, in the refrigerating device of the first or second aspect of the present invention, the heat absorbing means comprises first heat absorbing means including first pressure reducing means and a first heat sink; and second heat absorbing means including second pressure reducing means disposed in parallel with the first heat absorbing means and a second heat sink, and the first and second heat absorbing means are combined with each other on the outlet side, and connected to the suction portion of the compressor.

40 **[0010]** In a fourth aspect of the present invention, the refrigerating device of the third aspect of the present invention further comprises a first heat exchanger for exchanging heat between the refrigerant discharged from the first heat sink and the refrigerant of the one refrigerant pipe between the heat exchanger and the first pressure reducing means; and a second heat exchanger for exchanging heat between the refrigerant discharged from the second heat sink and the refrigerant of the one refrigerant pipe between the heat exchanger and the second pressure reducing means.

45 **[0011]** In a fifth aspect of the present invention, the refrigerating device of the third aspect of the present invention further comprises a fourth heat exchanger for exchanging heat between the refrigerant of the one refrigerant pipe extended from the heat exchanger and the refrigerant discharged from the first heat sink, the one refrigerant pipe extended from the fourth heat exchanger being connected to the first and second heat absorbing means; and a fifth heat exchanger for exchanging heat between the refrigerant of the one refrigerant pipe extended from the fourth heat exchanger and that is connected to the second heat absorbing means and the refrigerant discharged from the second heat sink, the refrigerant pipe extended from the first heat sink and the fourth heat exchanger being combined with the refrigerant pipe extended from the second heat sink and the fifth heat exchanger, the combined refrigerant pipe being connected to the suction portion of the compressor.

50 **[0012]** In a sixth aspect of the present invention, in the refrigerating device of the third to fifth aspects of the present invention, the first and second heat absorbing means function in selectively different temperature zones.

55 **[0013]** In a seventh aspect of the present invention, in the refrigerating device of the sixth aspect of the present

invention, the second heat absorbing means functions in a temperature zone which is lower than that of the first heat absorbing means.

[0014] In an eighth aspect of the present invention, a refrigerator comprises the refrigerating device of the first to seventh aspects of the present invention.

[0015] In a ninth aspect of the present invention, the refrigerator of the eighth aspect of the present invention further comprises a refrigerating room; and a freezing room operated at a temperature which is lower than that of the refrigerating room, the refrigerating room being cooled by the first heat absorbing means, the freezing room being cooled by the second heat absorbing means.

[0016] In a tenth aspect of the present invention, in the refrigerator of the ninth aspect of the present invention, the refrigerant is circulated through the first and second heat absorbing means in a case where the refrigerating room and/or the freezing room is at a temperature which is not less than a predetermined temperature.

[0017] In an eleventh aspect of the present invention, carbon dioxide is used as a refrigerant in the refrigerating device of the first to seventh aspects of the present invention, and the refrigerator of the eighth to tenth aspects of the present invention.

[0018] According to the present invention, there is disposed a heat exchange circuit which super-cools the refrigerant discharged from the radiator to thereby provide the refrigerating device capable of operating with a high efficiency. Furthermore, according to the present invention, there is provided a refrigerator capable of operating with the high efficiency.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

FIG. 1 is a refrigerant circuit diagram showing one embodiment of a refrigerating device in the present invention; FIG. 2 is an enthalpy-pressure chart of a refrigerating cycle in one embodiment of the refrigerating device of the present invention;

FIG. 3 is a schematic constitution diagram showing an application example of the refrigerating device to a refrigerator in one embodiment of the present invention;

FIG. 4 is a refrigerant circuit diagram showing another embodiment of the refrigerating device in the present invention;

FIG. 5 is a refrigerant circuit diagram showing still another embodiment of the refrigerating device in the present invention; and

FIG. 6 is a refrigerant circuit diagram showing a fourth embodiment of the refrigerating device in the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] There will be described hereinafter preferred embodiments of a refrigerating device and a refrigerator provided with the refrigerating device in the present invention in detail with reference to the drawings.

(Embodiment 1)

[0021] One embodiment of the present invention will be described in detail with reference to the drawings. FIG. 1 shows a refrigerant circuit diagram of a refrigerating device as one embodiment of the present invention. A refrigerating device 30 is constituted of a compressor 1; a radiator 2 connected to this compressor 1 on a discharge side; first heat absorbing means 10 connected to the radiator 2 on an outlet side; second heat absorbing means 11 disposed in parallel with the first heat absorbing means 10; and a heat exchange circuit 20. The first heat absorbing means 10 and the second heat absorbing means 11 on the outlet side are connected to the compressor 1 on a suction side, and the heat exchange circuit 20 on the outlet side is connected to an intermediate-pressure portion of the compressor 1 to constitute a refrigerating cycle.

[0022] The first heat absorbing means 10 includes a first expansion valve 65 in which a refrigerant from a branch point 9A circulates; and a refrigerating heat sink 57. The second heat absorbing means 11 is disposed in parallel with the first heat absorbing means 10 as described above, and includes a second expansion valve 66 in which the refrigerant from the branch point 9A circulates; a freezing heat sink 58; and a check valve 52.

[0023] The first heat absorbing means 10 and the second heat absorbing means 11 function in mutually selectively different temperature zones. A refrigerant pipe from the radiator 2 is branched from the branch point 9A into one pipe as the first heat absorbing means 10 and the other pipe as the second heat absorbing means 11. The pipes connected in parallel with each other are again combined at a junction 9B which is disposed before a suction port of the compressor 1.

[0024] Here, the first and second expansion valves 65 and 66 are constituted in such a manner that a throttle degree is variable. This throttle degree is changed to lower a refrigerant pressure to a predetermined pressure before the

refrigerant reaches the heat sinks 57, 58, and it is possible to control an evaporation temperature of the refrigerant in the heat sinks 57, 58. Moreover, one of the first and second expansion valves 65 and 66 is totally closed to thereby selectively circulate the refrigerant in the first heat absorbing means 10 or the second heat absorbing means 11.

[0025] Moreover, in the present embodiment, the refrigerating device 30 is provided with a check valve 53 and a third heat exchanger 19 between the junction 9B of the first and second heat absorbing means 10 and 11 and the suction side of the compressor 1. The third heat exchanger is disposed in such a manner that heat is exchangeable between the refrigerant discharged from the first and second heat sinks 57, 58 and the refrigerant before the branch point 9A.

[0026] Among the refrigerants branched from a branch point 9C on the outlet side of the radiator 2, the refrigerant which does not circulate in the first and second heat absorbing means 10 and 11 circulates in the heat exchange circuit 20. The heat exchange circuit includes a third expansion valve 31 and a cooling heat exchanger 32. The cooling heat exchanger 32 on the outlet side is connected to a refrigerant introducing tube 6 for introducing the refrigerant discharged from the cooling heat exchanger 32 to the intermediate-pressure portion of the compressor 1, and this refrigerant introducing tube 6 is provided with a check valve 7. It is to be noted that the third expansion valve 31 is constituted in such a manner that the throttle degree is variable in the same manner as in the first and second expansion valves 65 and 66. The throttle degree of the third expansion valve 31 is changed to lower the pressure to the predetermined pressure before the refrigerant reaches the cooling heat exchanger 32. The refrigerant discharged from the third expansion valve 31 exchanges heat with the refrigerant reaching the first and second heat absorbing means 10 and 11 from the branch point 9C in the cooling heat exchanger 32, and is warmed to constitute a gas refrigerant. The refrigerant is returned to the intermediate-pressure portion of the compressor 1 via the refrigerant introducing tube 6.

[0027] The compressor 1 is a two-stage compressor including a first-stage compression portion 1A and a second-stage compression portion 1B in a sealed container. An intermediate cooling unit 1C is disposed in a refrigerant pipe constituting the first-stage compression portion 1A to the second-stage compression portion 1B outside the sealed container. The refrigerant introducing tube 6 is connected in such a manner that the gas refrigerant discharged from the cooling heat exchanger 32 can be introduced into the intermediate-pressure portion of the compressor 1, that is, between the intermediate cooling unit 1C and the second-stage compression portion 1B. It is to be noted that the gas refrigerant discharged from the cooling heat exchanger 32 is introduced into the intermediate-pressure portion of the compressor 1 owing to a difference pressure in the refrigerant introducing tube 6 as shown by a broken-line arrow, but the compressor 1 is not limited to the two-stage compressor. For example, when a single-stage compressor is used as the compressor, the refrigerant introducing tube 6 may return to the intermediate-pressure portion of the single-stage compressor. A plurality of compressors may be connected.

[0028] Moreover, since the first and second heat absorbing means 10 and 11 are constituted as described above, the refrigerant circulates on the side of the heat sink 57, that is, in the first heat absorbing means 10 only, for example, in a case where the second expansion valve 66 is closed and the first expansion valve 65 is opened. Conversely, when the first expansion valve 65 is closed and the second expansion valve 66 is opened, the refrigerant circulates on the side of the heat sink 58, that is, in the second heat absorbing means 11 only.

[0029] Here, after the refrigerant discharged from the heat sink 57 passes through the check valve 53, the refrigerant passes through the third heat exchanger 19. After exchanging heat with the refrigerant discharged from the cooling heat exchanger 32 in the third heat exchanger 19, the refrigerant is returned to the suction port of the compressor 1. The refrigerant passed through the heat sink 58 passes through the check valves 52, 53 and then the third heat exchanger 19. After exchanging heat with the refrigerant discharged from the cooling heat exchanger 32 in the third heat exchanger 19, the refrigerant is returned to the suction port of the compressor 1.

[0030] Further in the present embodiment, cold air passed through the heat sink 57 is fed to a refrigerating room 21 via a duct 57A, and cold air passed through the heat sink 58 is fed to a freezing room 22 via a duct 58A.

[0031] Here, in the refrigerating device 30 of the present embodiment, as the refrigerant, there is used a carbon dioxide refrigerant (CO_2) which is a natural refrigerant having a small environmental load in consideration of flammability, toxicity and the like. As oil which is a lubricant of the radiator 2, there is used, for example, mineral oil, alkyl benzene oil, ether oil, ester oil, polyalkylene glycol (PAG), polyol ester (POE) or the like.

[0032] There will be described an operation of the refrigerating device 30 of the present embodiment constituted as described above with reference to FIGS. 1 and 2. FIG. 2 is an enthalpy-pressure (ph) chart of a refrigerating cycle in the present embodiment.

[0033] First, a freezing operation (e.g., around -26°C) will be described with reference to the cycle graph shown by a solid line in FIG. 2. It is to be noted that this freezing operation refers to a case where the refrigerant is circulated on the side of the heat sink 58, that is, in the second heat absorbing means 11. In the present embodiment, when the compressor 1 is operated, the refrigerant discharged from the compressor 1 radiates heat in the radiator 2, and is cooled. That is, the refrigerant is circulated in order: (1) suction into the first-stage compression portion 1A; (2) discharge from the first-stage compression portion 1A; (3) suction into the second-stage compression portion 1B; and (4) discharge from the second-stage compression portion 1B. Thereafter, the refrigerant flows from (5) an outlet of the radiator 2 to the branch point 9C. The refrigerant is then branched, a part of the refrigerant circulates in the heat exchange circuit 20, and the

remaining refrigerant circulates in the second heat absorbing means 11.

[0034] The refrigerant circulated from the branch point 9C to the heat exchange circuit 20 reaches (6) an outlet of the third expansion valve 31 to form a two-phase mixture of gas and liquid. Moreover, this refrigerant as the two-phase mixture exchanges heat with the refrigerant circulated from the branch point 9C to the second heat absorbing means 11 in the cooling heat exchanger 32, and is warmed to form the gas refrigerant. The refrigerant is introduced into the intermediate-pressure portion of the compressor 1, that is, between the intermediate cooling unit 1C and the second-stage compression portion 1B. That is, (6) indicates the outlet of the third expansion valve 31, and an inlet to the cooling heat exchanger 32, and (21) indicates the outlet of the cooling heat exchanger 32. The refrigerant discharged from the cooling heat exchanger reaches (3) the suction port to the second-stage compression portion 1B, and is compressed in the second-stage compression portion 1B.

[0035] On the other hand, the refrigerant circulated from the branch point 9C to the second heat absorbing means 11 exchanges heat with the refrigerant circulated on the side of the heat exchange circuit 20 as described above, and is super-cooled. Thereafter, the refrigerant is further cooled, and branched at the branch point 9A to reach the second expansion valve 66. (18) indicates the outlet of the cooling heat exchanger 32 and the inlet to the third heat exchanger 19, (7) indicates the outlet of the third heat exchanger 19 and the inlet to the second expansion valve 66, (8) indicates the outlet of the second expansion valve 66, and (22) indicates the outlet of the heat sink 58. A liquid refrigerant that has entered the heat sink 58 evaporates to absorb heat from the periphery. Thereafter, after exchanging heat with the refrigerant discharged from the cooling heat exchanger 32 in the third heat exchanger 19, the refrigerant returns to the suction port of the compressor 1. That is, (23) indicates the outlet of the third heat exchanger 19, and (1) indicates the suction into the first-stage compression portion 1A.

[0036] On the other hand, during a refrigerating operation (e.g., around -5°C), there is formed a cycle shown by a broken line in FIG. 2. It is to be noted that this refrigerating operation refers to a case where the refrigerant is circulated on the side of the heat sink 57, that is, in the first heat absorbing means 10. Also in this case, when the compressor 1 is operated, the refrigerant discharged from the compressor 1 radiates heat in the radiator 2, and is cooled. That is, first the refrigerant is circulated in order: (9) suction into the first-stage compression portion 1A; (10) discharge from the first-stage compression portion 1A; (11) discharge from the intermediate cooling unit 1C and suction into the second-stage compression portion 1B; and (12) discharge from the second-stage compression portion 1B. Thereafter, the refrigerant flows from (5) the outlet of the radiator 2 to reach the branch point 9C, and is then branched. A part of the refrigerant circulates in the heat exchange circuit 20, and the remaining refrigerant circulates in the first heat absorbing means 10.

[0037] The refrigerant circulated from the branch point 9C to the heat exchange circuit 20 reaches (16) the outlet of the third expansion valve 31 to form a two-phase mixture of gas and liquid. Moreover, this refrigerant as the two-phase mixture exchanges heat with the refrigerant circulated from the branch point 9C to the first heat absorbing means 10 in the cooling heat exchanger 32, and is warmed to constitute a gas refrigerant. The refrigerant is introduced into the intermediate-pressure portion of the compressor 1, that is, between the intermediate cooling unit 1C and the second-stage compression portion 1B. That is, (16) indicates the outlet of the third expansion valve 31 and the inlet to the cooling heat exchanger 32, and (17) indicates the outlet of the cooling heat exchanger 32. The refrigerant discharged from the cooling heat exchanger reaches (12) the suction port of the second-stage compression portion 1B, and is compressed in the second-stage compression portion 1B.

[0038] On the other hand, the refrigerant circulated from the branch point 9C to the first heat absorbing means 10 exchanges heat with the refrigerant circulated on the side of the heat exchange circuit 20 in the cooling heat exchanger 32 as described above, and is super-cooled. Thereafter, the refrigerant is further cooled in the third heat exchanger 19, and branched at the branch point 9A to reach the first expansion valve 65. (13) indicates the outlet of the cooling heat exchanger 32 and the inlet to the third heat exchanger 19, (14) indicates the outlet of the third heat exchanger 19 and the inlet to the first expansion valve 65, (15) indicates the outlet of the first expansion valve 65, and (24) indicates the outlet of the heat sink 57. After the liquid refrigerant which has entered the heat sink 57 evaporates to absorb heat from the periphery, the refrigerant exchanges heat with the refrigerant discharged from the cooling heat exchanger 32 in the third heat exchanger 19, and the refrigerant returns to the suction port of the compressor 1. That is, (25) indicates the outlet of the third heat exchanger 19, and (9) indicates the suction into the first-stage compression portion 1A. The refrigerant circulates and changes its state to form the refrigerating cycle as described above during both the freezing operation and the refrigerating operation.

[0039] Moreover, in the present embodiment, since the carbon dioxide refrigerant is introduced into the refrigerant circuit, a dry degree of the refrigerant entering the expansion valves 65, 66 is excessively high in the refrigerant circuit for use in a conventional chlorofluorocarbon-based refrigerant or HC-based refrigerant, that is, the refrigerant circuit in which the expansion valves 65, 66 are disposed immediately after the radiator 2 even in a case where the atmospheric temperature around the radiator 2, that is, the temperature in (5) the outlet of the radiator 2 in FIG. 2 is about +22°C as in the present embodiment. Therefore, a ratio of the gas refrigerant in the refrigerant is high, and it is difficult to obtain a sufficient cooling performance.

[0040] To solve the problem, in the present embodiment, the refrigerant pipe on the side of the outlet of the radiator

2 is branched, and one pipe is provided with the heat exchange circuit 20 to super-cool the refrigerant which has entered the first and second heat absorbing means 10 and 11 in the cooling heat exchanger 32 of the heat exchange circuit 20. The refrigerant is further cooled in the third heat exchanger 19. According to such constitution, a high cooling effect can be obtained even in a case where the carbon dioxide refrigerant having the above-described characteristics is used. In this case, the refrigerant on the side of the heat exchange circuit 20 is introduced as the gas refrigerant into the intermediate-pressure portion of the compressor 1. Therefore, a compression efficiency in the compressor 1 can be improved, and an efficiency of the refrigerating device 30 can further be improved.

[0041] Moreover, during the freezing operation, the refrigerant entering the second heat absorbing means 11 needs to be super-cooled as compared with the refrigerating operation. However, in the present embodiment, the degree of throttle of the third expansion valve 31 is variable in the heat exchange circuit 20 as described above. Therefore, during the freezing operation, more super-cooling can be achieved as compared with the refrigerating operation. Furthermore, during the freezing operation, there is used the heat sink 58 which functions in a temperature zone lower than that of the refrigerating heat sink 57. In consequence a higher-efficiency freezing operation can be performed.

[0042] As described above in detail, in the present embodiment, the heat exchange circuit 20 is disposed, and the heat sinks 57, 58 are selectively used based on the use temperature zone. According to this constitution, the heat sink suitable at the temperature is usable during the freezing operation and the refrigerating operation which are different from each other in temperature zone, and improvement of each operation efficiency can be expected.

[0043] Next, there will be described an example in which the refrigerating device 30 of the present embodiment is applied to a refrigerator with reference to FIG. 3.

[0044] FIG. 3 shows a schematic constitution diagram of the refrigerator provided with the refrigerating device 30 of the present embodiment. This refrigerator 40 is constituted of a refrigerating room 41 disposed in an upper stage; and a freezing room 42 disposed in a lower stage. Moreover, refrigerator partition walls 61, 62 are disposed in inner parts of the respective rooms 41, 42, and the heat sinks 57, 58 and fans 63, 64 are disposed in air paths 44 defined by the refrigerator partition walls 61, 62. In the present constitution, the first heat absorbing means 10 and the second heat absorbing means 11 are switched as described above when a thermostat turns on and off during the refrigerating operation and the freezing operation. Accordingly, the refrigerant is passed through one of the heat sinks 57, 58, and the corresponding fan 63 or 64 is driven. When the refrigerant flows through the heat sink 57, cold air is supplied to the refrigerating room 41. When the refrigerant flows through the heat sink 58, cold air is supplied to the freezing room 42.

[0045] As described above, in the present embodiment, since the refrigerator 40 is provided with the refrigerating device 30, it is possible to obtain a high cooling performance and a high-efficiency operation even in a case where carbon dioxide is used as the refrigerant.

[0046] It is to be noted that as described above, in the present embodiment, in the refrigerating device 30, the first expansion valve 65 is closed and the second expansion valve 66 is opened to circulate the refrigerant in the second heat absorbing means 11 during the freezing operation. During the refrigerating operation, the second expansion valve 66 is closed, and the first expansion valve 65 is opened to circulate the refrigerant in the first heat absorbing means 10. However, the present invention is not limited to this embodiment. For example, in the refrigerator 40, in a case where the refrigerating room 41 and the freezing room 42 need to be cooled rapidly at normal temperature, during so-called pull-down, in a case where the compressor 1 brought in an operation stopped state is started to operate, at a high-load time, or in a case where the refrigerating room 41 and the freezing room 42 are at a temperature which is not less than a predetermined temperature, both of the first expansion valve 65 and the second expansion valve 66 are opened at required open degrees. Accordingly, the refrigerant can be circulated in both of the first heat absorbing means 10 and the second heat absorbing means 11 to rapidly cool the insides of the respective rooms 41, 42.

(Embodiment 2)

[0047] Next, another embodiment of the present invention will be described with reference to FIG. 4. FIG. 4 shows a refrigerant circuit diagram of a refrigerating device 50 in this case. The present embodiment is different from Embodiment 1 in that first and second heat exchangers 17, 18 are disposed instead of a third heat exchanger 19. That is, in the present embodiment, refrigerants discharged from the heat sinks 57, 58 exchange heat with refrigerants that are to enter first and second expansion valves 65, 66 before the refrigerants are combined at a junction 9B. Needless to say, the refrigerating device 50 of the present embodiment can be applied to a refrigerator in the same manner as in the refrigerating device 30 of Embodiment 1 described above.

(Embodiment 3)

[0048] Next, still another embodiment of the present invention will be described with reference to FIG. 5. FIG. 5 shows a refrigerant circuit diagram of a refrigerating device 70 in this case. The present embodiment is different from Embodiment 1 in that a third heat exchanger 19 is not disposed, first a refrigerant discharged from a cooling heat exchanger 32

exchanges heat with a refrigerant discharged from a heat sink 57 in a fourth heat exchanger 15 before reaching a branch point 9A, and an only refrigerant entering second heat absorbing means 11 exchanges heat with a refrigerant discharged from a heat sink 58 in a fifth heat exchanger 16.

[0049] It is to be noted that, needless to say, even the refrigerating device 70 of the present embodiment can be applied to a refrigerator in the same manner as in the refrigerating device of each of the above-described embodiments.

(Embodiment 4)

[0050] Next, a fourth embodiment of the present invention will be described with reference to FIG. 6. FIG. 6 shows a refrigerant circuit diagram of a refrigerating device 90 in this case. The present embodiment is different from Embodiment 1 in that a three-way valve 91 is disposed in place of a branch point 9A, and third and fourth heat absorbing means 10B, 11B are disposed instead of first and second heat absorbing means 10, 11.

[0051] The third heat absorbing means 10B includes a first capillary tube 92 and a heat sink 57, and the fourth heat absorbing means 11B includes a second capillary tube 93 and a heat sink 58.

[0052] In the present embodiment, the refrigerating device 90 selects, via the three-way valve 91, whether to circulate a refrigerant in the third heat absorbing means 10B or the fourth heat absorbing means 11B so that a refrigerating operation or a freezing operation can be selected. As described above, since the capillary tubes 92, 93 are used instead of expansion valves 65, 66 in the respective heat absorbing means in the refrigerating device 90 of the present embodiment, it is possible to realize the refrigerating device of the present invention at a lower cost.

[0053] It is to be noted that even in the refrigerating devices 50, 70 of Embodiments 2, 3, it is possible to apply the third and fourth heat absorbing means 10B, 11B as in the present embodiment. Needless to say, even the refrigerating device 90 of the present embodiment can be applied to a refrigerator in the same manner as in the refrigerating device of each of the above-described embodiments.

[0054] The present invention has been described above in accordance with the respective embodiments, but the present invention is not limited to the embodiments, and can variously be modified or embodied. For example, in the above-described embodiments, the carbon dioxide refrigerant is introduced in the refrigerant circuit, but the present invention is not limited to this embodiments, and can be applied to a refrigerant circuit into which another refrigerant such as a chlorofluorocarbon-based refrigerant is introduced.

[0055] Moreover, the third expansion valve 31 in each of the above-described embodiments and the expansion valves 65, 66 of Embodiments 1, 2, and 3 may be replaced with capillary tubes.

Claims

1. A refrigerating device comprising: a compressor having an intermediate-pressure portion; a radiator connected to the compressor on a discharge side; and heat absorbing means connected to the radiator on an outlet side and including pressure reducing means and a heat sink, the heat absorbing means on the outlet side being connected to a suction portion having a pressure which is lower than that of the intermediate-pressure portion of the compressor, wherein a refrigerant pipe of the radiator on the outlet side is branched, one refrigerant pipe is connected to the heat absorbing means, the other refrigerant pipe is connected to the intermediate-pressure portion of the compressor, and provided with a pressure reducing mechanism and a heat exchanger, and this heat exchanger is constituted in such a manner that heat is exchangeable between a refrigerant of the one refrigerant pipe and a refrigerant of the other refrigerant pipe.

2. The refrigerating device according to claim 1, further comprising:

a first heat exchanger constituted in such a manner that the refrigerant between the heat absorbing means and the suction portion of the compressor is heat-exchangeable with the refrigerant of the one refrigerant pipe extended from the heat exchanger.

3. The refrigerating device according to claim 1 or 2, wherein the heat absorbing means comprises: first heat absorbing means including first pressure reducing means and a first heat sink; and second heat absorbing means including second pressure reducing means disposed in parallel with the first heat absorbing means and a second heat sink, and the first and second heat absorbing means are combined with each other on the outlet side, and connected to the suction portion of the compressor.

4. The refrigerating device according to claim 3, further comprising:

a first heat exchanger for exchanging heat between the refrigerant discharged from the first heat sink and the refrigerant of the one refrigerant pipe between the heat exchanger and the first pressure reducing means; and a second heat exchanger for exchanging heat between the refrigerant discharged from the second heat sink and the refrigerant of the one refrigerant pipe between the heat exchanger and the second pressure reducing means.

5. The refrigerating device according to claim 3, further comprising:

a fourth heat exchanger for exchanging heat between the refrigerant of the one refrigerant pipe extended from the heat exchanger and the refrigerant discharged from the first heat sink, the one refrigerant pipe extended from the fourth heat exchanger being connected to the first and second heat absorbing means; and a fifth heat exchanger for exchanging heat between the refrigerant of the one refrigerant pipe extended from the fourth heat exchanger and that is connected to the second heat absorbing means and the refrigerant discharged from the second heat sink, the refrigerant pipe extended from the first heat sink and the fourth heat exchanger being combined with the refrigerant pipe extended from the second heat sink and the fifth heat exchanger, the combined refrigerant pipe being connected to the suction portion of the compressor.

6. The refrigerating device according to claims 3 to 5, wherein the first and second heat absorbing means function in selectively different temperature zones.

7. The refrigerating device according to claim 6, wherein the second heat absorbing means functions in a temperature zone which is lower than that of the first heat absorbing means.

8. A refrigerator comprising:

the refrigerating device according to claims 1 to 7.

9. The refrigerator according to claim 8, further comprising: a refrigerating room; and a freezing room operated at a temperature which is lower than that of the refrigerating room, the refrigerating room being cooled by the first heat absorbing means, the freezing room being cooled by the second heat absorbing means.

10. The refrigerator according to claim 9, wherein the refrigerant is circulated in the first and second heat absorbing means in a case where the refrigerating room and/or the freezing room is at a temperature which is not less than a predetermined temperature.

11. The refrigerating device according to claims 1 to 7 and the refrigerator according to claims 8 to 10, wherein carbon dioxide is used as a refrigerant.

FIG.1

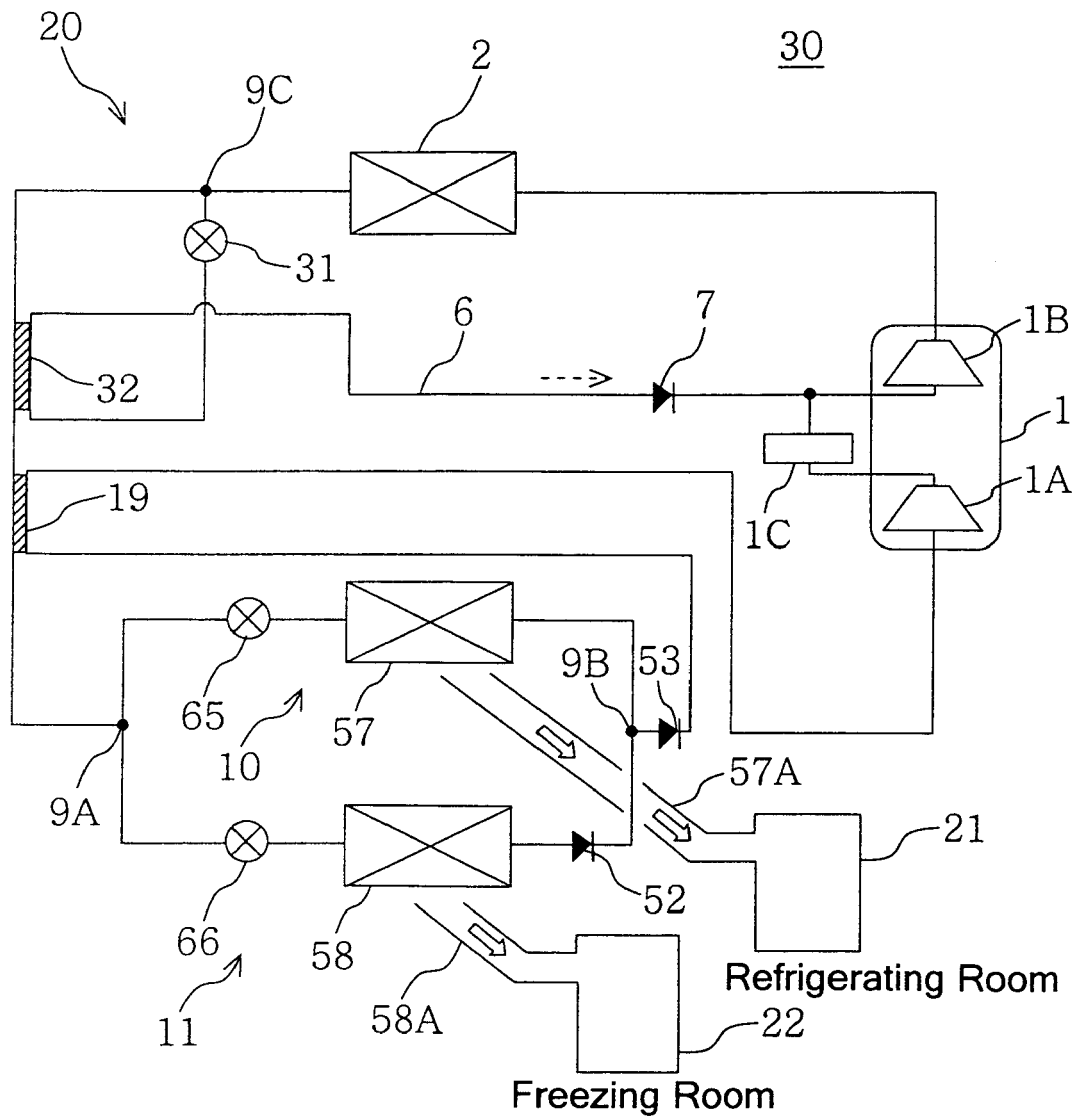


FIG.2

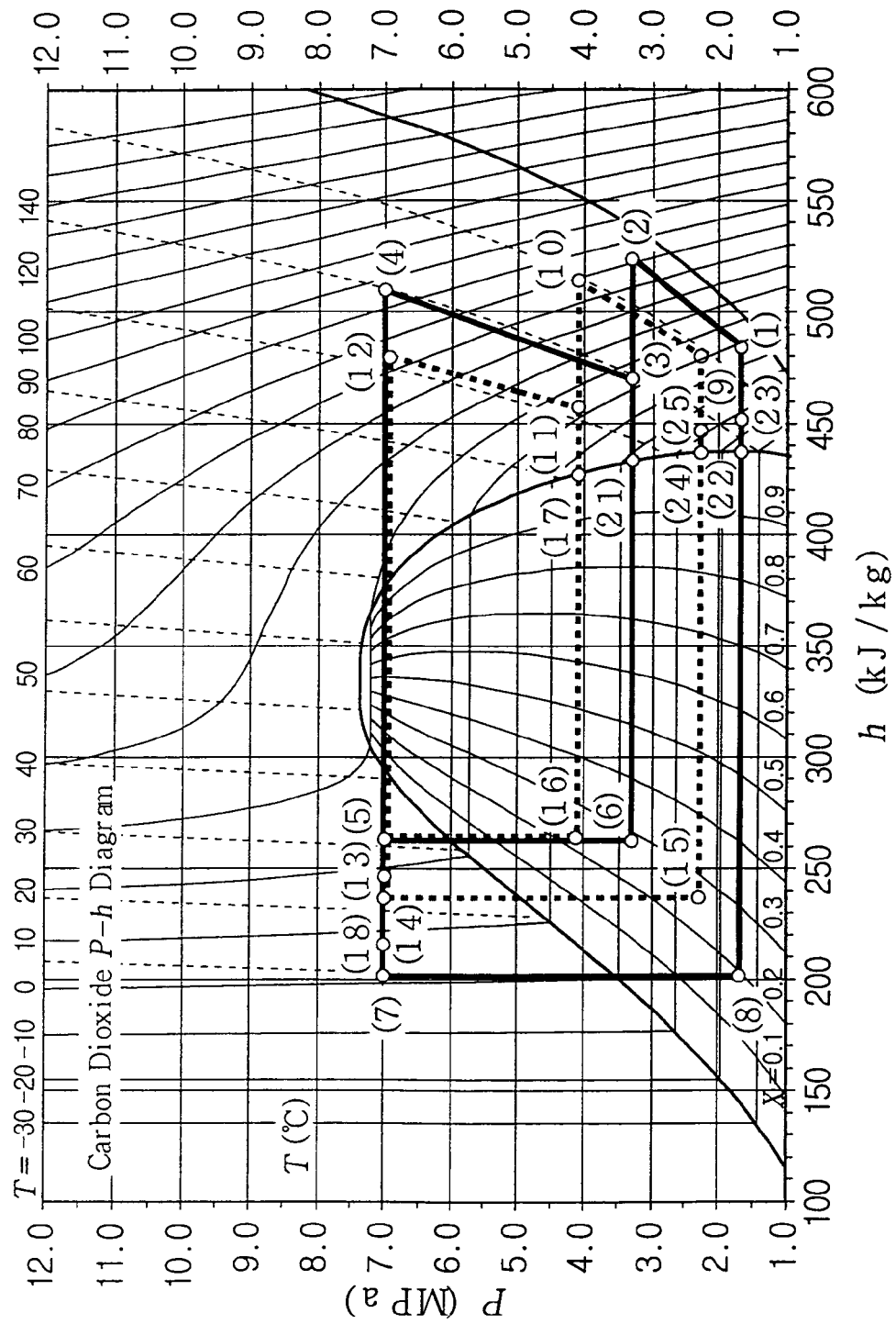


FIG. 3

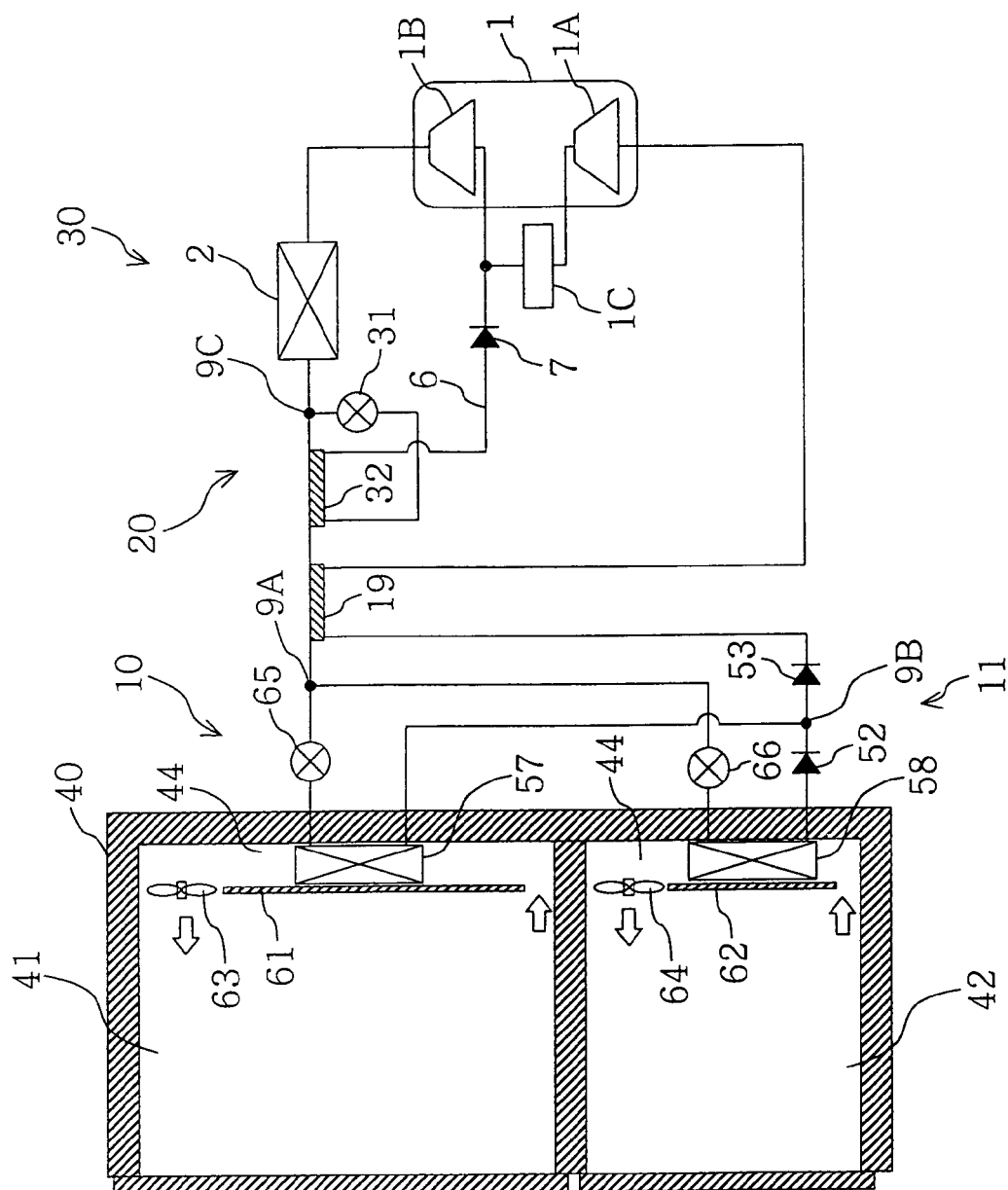


FIG.4

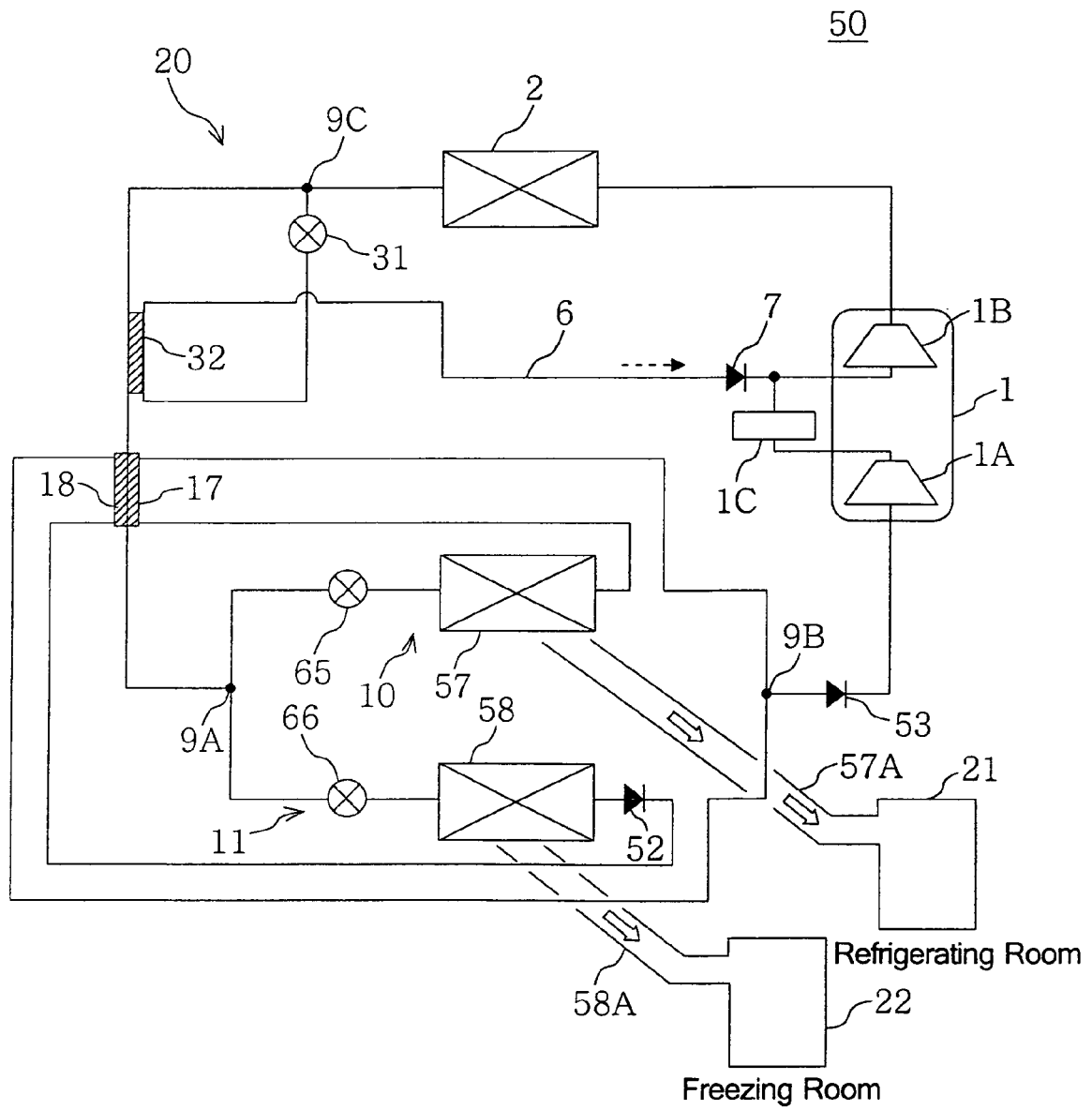


FIG.5

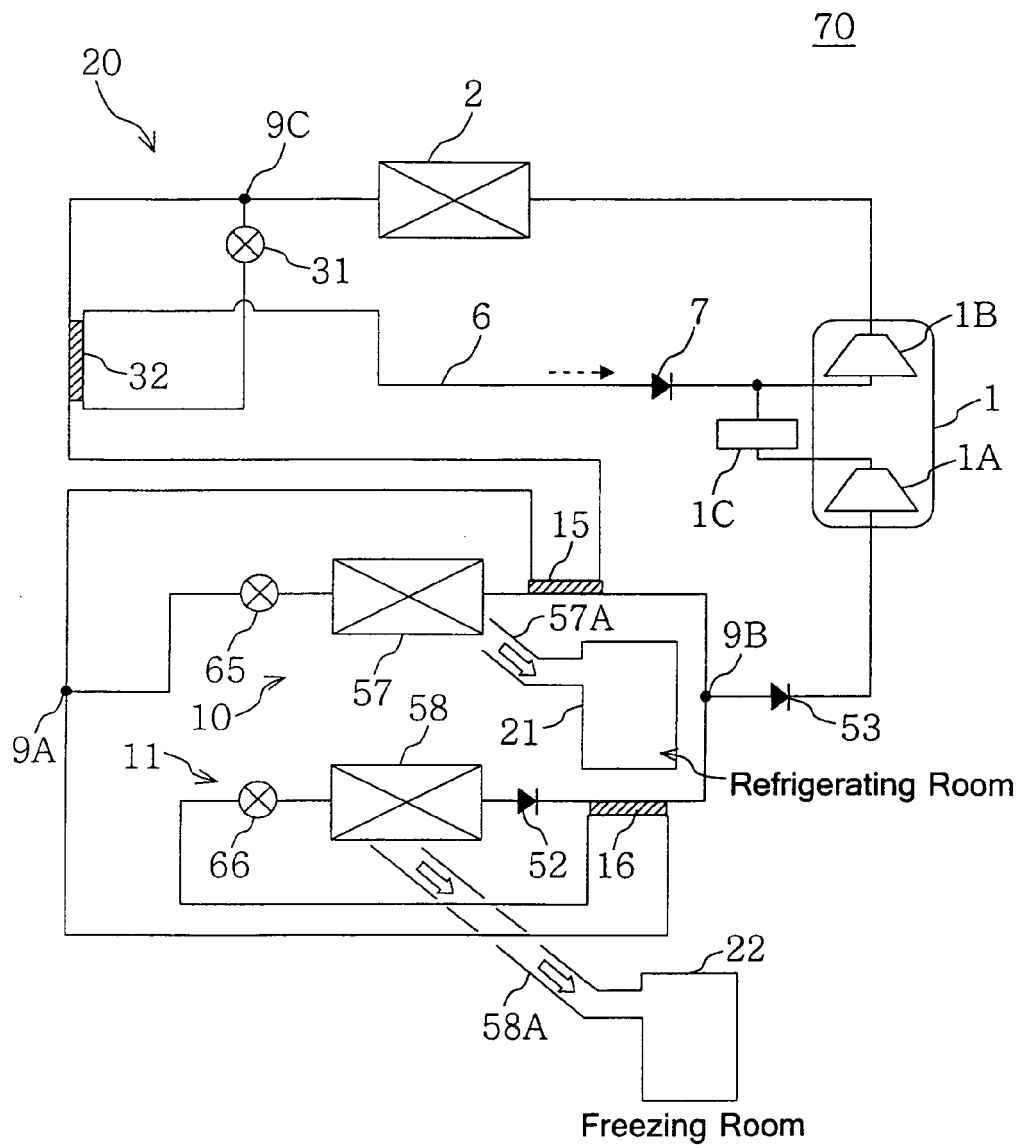


FIG.6

