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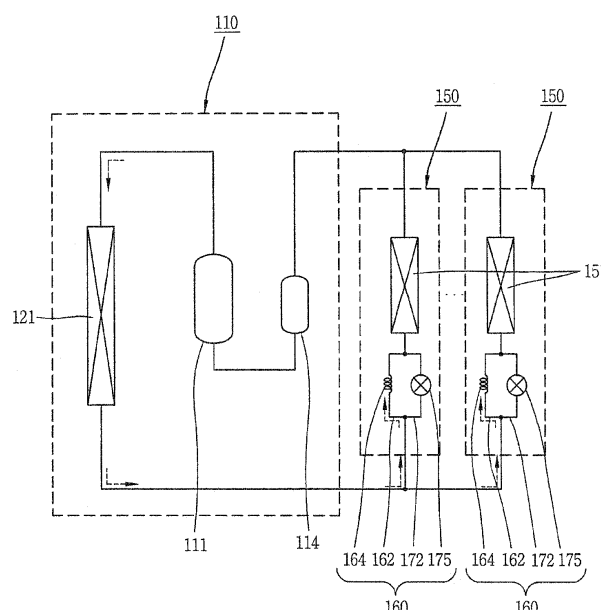
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(54) **Air conditioner and refrigerant control method thereof**

(57) Disclosed are an air conditioner and a refrigerant control method thereof. An air conditioner according to an embodiment of the invention an outdoor unit including a compressor, an outdoor heat exchanger, and a four-way valve that switches a flow passage of refrigerant, an indoor unit including an indoor heat exchanger, an indoor expansion unit disposed at a refrigerant inlet side of the indoor heat exchanger and allowing the refrigerant to be expanded during the cooling operation, an outdoor ex-

pansion unit disposed at a refrigerant inlet side of the outdoor heat exchanger and allowing the refrigerant to be expanded during the heating operation, and a control unit controlling the indoor expansion unit and the outdoor expansion unit such that the refrigerant is expanded in the indoor expansion unit during the cooling operation and the refrigerant is expanded in the outdoor expansion unit during the heating operation. Therefore, the distance between the evaporator and the expansion unit is reduced to thereby raise operating efficiency.

FIG. 2



Description

[0001] The present invention relates to an air conditioner and a refrigerant control method thereof, and more particularly, to an air conditioner and a refrigerant control method that can raise operating efficiency by reducing the distance between an evaporator and an expansion unit.

[0002] FIG. 1 is a structural view of a refrigerating cycle of an air conditioner according to the related art. As shown in FIG. 1, an air conditioner includes compressors 11, each of which compresses refrigerant, an outdoor heat exchanger 21 that is connected at one side of the compressors 11 and performs heat exchange between the refrigerant and outdoor air, and indoor heat exchangers 31 that are disposed to perform heat exchange between the refrigerant and indoor air.

[0003] There are a plurality of compressors 11. An accumulator 12 is provided at a suction side of the compressors 11 so as to provide gaseous refrigerant to each of the compressors 11. A four-way valve 14 is provided at a discharge side of the compressors 11 so as to switch a flow passage of the refrigerant according to a cooling or heating operation mode.

[0004] In a case of the heating operation, an expansion unit 22 is provided at a refrigerant inlet side of the outdoor heat exchanger 21 along a flow direction of the refrigerant such that the refrigerant can be decompressed or expanded.

[0005] However, the air conditioner according to the related art has a problem in that since the expansion unit 22 is disposed at the outdoor heat exchanger 21, when the distance between the expansion unit 22 and the indoor heat exchangers 31, system efficiency is reduced during the cooling operation.

[0006] Further, when the expansion unit 22 is composed of an electronic expansion valve (EEV), the so-called slip of the electronic expansion valve occurs. That is, when a using period passes, since mechanical wear may occur or the spring's modulus of elasticity k may change due to the repeated opening of the valve, the expansion unit operates according to not an opening value, which the system actually recognizes, but a different opening value. Therefore, the life span of the electronic expansion valve is reduced, or the system may shut down, that is, system efficiency is reduced.

[0007] Therefore, an object of the present invention is to provide an air conditioner and a refrigerant control method capable of raising operating efficiency by reducing the distance between an evaporator and an expansion unit.

[0008] Another object of the present invention is to provide an air conditioner and a refrigerant control method capable of extending the life span of an electronic expansion valve by reducing the frequency of using the electronic expansion valve.

[0009] To achieve these and other advantages and in accordance with the purpose of the present invention, as

embodied and broadly described herein, there is provided an air conditioner that includes an outdoor unit including a compressor, an outdoor heat exchanger, and a four-way valve that switches a flow passage of refrigerant, an indoor unit including an indoor heat exchanger, an indoor expansion unit disposed at a refrigerant inlet side of the indoor heat exchanger and allowing the refrigerant to be expanded during the cooling operation, an outdoor expansion unit disposed at a refrigerant inlet side of the outdoor heat exchanger and allowing the refrigerant to be expanded during the heating operation, and a control unit controlling the indoor expansion unit and the outdoor expansion unit such that the refrigerant is expanded in the indoor expansion unit during the cooling operation and the refrigerant is expanded in the outdoor expansion unit during the heating operation.

[0010] To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, there is provided an air conditioner that includes an outdoor unit including a compressor, and an outdoor heat exchanger, and an indoor unit including an indoor heat exchanger, a first branch channel and a second branch channel that are formed in parallel at a refrigerant inlet side of the indoor heat exchanger, an indoor capillary tube that is formed on one of the first branch channel and the second branch channel, and a first switching valve that is formed on the other branch channel so as to switch the corresponding branch channel.

[0011] To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, there is provided a refrigerant control method of an air conditioner which has an outdoor unit including a compressor, an outdoor heat exchanger, and a four-way valve that switches a flow passage of refrigerant; an indoor unit including an indoor heat exchanger; an indoor expansion unit disposed at a refrigerant inlet side of the indoor heat exchanger and allowing the refrigerant to be expanded during the cooling operation; and an outdoor expansion unit disposed at a refrigerant inlet side of the outdoor heat exchanger and allowing the refrigerant to be expanded during the heating operation, the method including switching the flow passage of the refrigerant according to a selected operating mode, and controlling the indoor expansion unit and the outdoor expansion unit such that the refrigerant is expanded in the indoor expansion unit during the cooling operation and the refrigerant is expanded in the outdoor expansion unit during the heating operation.

[0012] The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

[0013] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specifi-

cation, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

[0014] In the drawings:

FIG. 1 is a structural view of a refrigerating cycle of an air conditioner according to the related art;
 FIG. 2 is a structural view of a refrigerating cycle of an air conditioner according to a first embodiment of the present invention;
 FIG. 3 is a control block diagram of an air conditioner of FIG. 2;
 FIG. 4 is a structural view of a refrigerating cycle of an air conditioner according to a second embodiment of the present invention;
 FIG. 5 is a control block diagram of an air conditioner of FIG. 4;
 FIG. 6 is a flow chart illustrating a refrigerant control method of an air conditioner of FIG. 4;
 FIG. 7 is a structural view of a refrigerating cycle of an air conditioner according to a third embodiment of the present invention;
 FIG. 8 is a view illustrating the operation of an air conditioner of FIG. 7 during the heating operation;
 FIG. 9 is control block diagram of an air conditioner of FIG. 7; and
 FIG. 10 is a flow chart illustrating a refrigerant control method of an air conditioner of FIG. 7.

[0015] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

[0016] As shown in FIG. 2, an air conditioner according to a first embodiment of the present invention includes an outdoor unit 110 that includes a compressor 111 compressing refrigerant and an outdoor heat exchanger 121 disposed to perform heat exchange with outdoor air, indoor units 150, each of which includes indoor heat exchangers 151 disposed to perform heat exchange with indoor air, and indoor expansion units 160, each of which is disposed at a refrigerant inlet side of the indoor heat exchangers 151 and allows the refrigerant to be expanded during the cooling operation.

[0017] An accumulator 114 is connected at a suction side of the compressor 111 so as to suck gaseous refrigerant, and the outdoor heat exchanger 121 is connected at a discharge side of the compressor 111.

[0018] Each of the indoor expansion units 160 includes a first branch channel 162 and a second branch channel 172 that are connected in parallel with each other, such that the refrigerant is branched and flows at the refrigerant inlet side of each of the indoor heat exchangers 151, an indoor capillary tube 164 that is formed in the first branch channel 162, and an indoor electronic expansion valve 175 that is formed in the second branch channel 172. Here, the indoor capillary tube 164 is formed to correspond to part of a load amount of each of the indoor heat exchangers 15. The indoor electronic expansion

valve 175 is formed such that the opening thereof can be controlled when the load amount of each of the indoor heat exchangers 151 increases.

[0019] As shown in FIG. 3, a control unit 181 is implemented in the form of a microprocessor that includes a control program capable of controlling the expansion of the refrigerant according to a load amount of the indoor units 150, and the control unit 181 is connected to each of the indoor electronic expansion valves 175 so as to transmit electric signals.

[0020] According to the above-described structure, when the indoor units 150 start to operate, the control unit 181 controls each of the indoor electronic expansion valves 175 according to the load amount of the indoor units 150. That is, when the load amount of the indoor units 150 is less than a set value, the control unit 181 controls each of the indoor electronic expansion valves 175 to block the second branch channel 172 such that the expansion of the refrigerant is only performed by the indoor capillary tube 164. When the load amount of the indoor units 150 is equal to or more than the set value, the control unit 181 controls the opening of each of the indoor electronic expansion valves 175 according to an increase of the load amount.

[0021] FIG. 4 is a structural view of a refrigerating cycle according to a second embodiment of the present invention. FIG. 5 is a control block diagram of an air conditioner of FIG. 4. FIG. 6 is a flow chart illustrating a refrigerant control method of an air conditioner of FIG. 4. Like reference numerals designate like or corresponding parts to those of the above-described or illustrated structure. As shown in FIG. 4, an air conditioner according to a second embodiment of the present invention includes an outdoor unit 110 that includes a compressor 111 compressing refrigerant, an outdoor heat exchanger 121 disposed to perform heat exchange with outdoor air, and a four-way valve 115 switching a flow passage of the refrigerant according to an operating mode, an indoor unit 150 that includes an indoor heat exchanger 151 disposed to perform heat exchange with indoor air, an indoor expansion unit 160 that is disposed at a refrigerant inlet side of the indoor heat exchanger 151 and allows refrigerant to be expanded during the cooling operation, and an outdoor expansion unit 130 that is disposed at a refrigerant inlet side of the outdoor heat exchanger 121 and allows the refrigerant to be expanded during the heating operation.

[0022] An accumulator 114 that sucks gaseous refrigerant is connected at a suction side of the compressor 111. The four-way valve 115 that switches the flow passage of the refrigerant is connected at a discharge side of the compressor 111.

[0023] The outdoor heat exchanger 121, the accumulator 114, and the indoor unit 150 are connected to the four-way valve 115, such that the refrigerant can appropriately flow according to the operating mode.

[0024] The indoor expansion unit 160 includes a first branch channel 162 and a second branch channel 172

that branch off at the refrigerant inlet side of the indoor heat exchanger 151 and formed in parallel with each other, an indoor capillary tube 164 that is formed in the first branch channel 162, and a first switching valve 174 that is formed in the second branch channel 172.

[0025] The outdoor expansion unit 130 includes a third branch channel 132 and a fourth branch channel 142 that branch off at the refrigerant inlet side of the outdoor heat exchanger 121 and connected in parallel with each other, an outdoor capillary tube 134 that is formed on the third branch channel 132, and a second switching valve 144 that is formed on the fourth branch channel 142.

[0026] As shown in FIG. 5, the control unit 181 is implemented in the form of a microprocessor that includes a control program capable of controlling the four-way valve 115, the first switching valve 174, and the second switching valve 144, such that the flow passage of the refrigerant is switched according to the operating mode of the indoor unit 150, and the expansion of the refrigerant is performed at an inlet side of an evaporator where the refrigerant evaporates. The control unit 181 is connected to an operating mode selecting unit 183, which selects the operating mode of the indoor unit 150, the four-way valve 115, the first switching valve 174, and the second switching valve 144 so as to transmit electrical signals.

[0027] Hereinafter, a refrigerant control method of an air conditioner according to an embodiment of the present invention will be described with reference to FIG. 6.

[0028] When the operating mode selecting unit 183 selects the operating mode of the indoor unit 150 (S10), the control unit 181 determines the operating mode (S20), and controls the four-way valve 115 according to the operating mode so as to switch the flow passage of the refrigerant (S30 and S50). That is, the control unit 181 controls the four-way valve 115 such that during the cooling operation of the indoor unit 150, the refrigerant discharged from the compressor 111 flows into the outdoor heat exchanger 121 (S30). Further, the control unit 181 controls the four-way valve 115 such that the refrigerant discharged from the compressor 111 flows into the indoor heat exchanger 151 during the heating operation (S50).

[0029] When the indoor unit 150 performs the cooling operation, the control unit 181 controls to open the second switching valve 144 such that the refrigerant passing through the outdoor heat exchanger 121 flows through the fourth branch channel 142, and at the same time, controls to block the first switching valve 174 such that the expansion of the refrigerant is performed in the indoor capillary tube 164 (S40).

[0030] When the indoor unit 150 performs the heating operation, the control unit 181 controls to open the first switching valve 174 such that the refrigerant passing through the indoor heat exchangers 151 flows through the second branch channel 172, and at the same time, controls to block the second switching valve 144 such that the expansion of the refrigerant is performed in the

outdoor capillary tube 134 (S60). Meanwhile, the control unit 181 stops the operation of the outdoor unit 110 and the indoor unit 150 (S80) when an operation terminating signal of the indoor unit 150 is input (S70).

[0031] FIG. 7 is a structural view of a refrigerating cycle of an air conditioner according to a third embodiment of the present invention. FIG. 8 is a view illustrating the operation of an air conditioner of FIG. 7 during the heating operation. FIG. 9 is a view illustrating a refrigerant control method of an air conditioner of FIG. 7. FIG. 10 is a flow chart illustrating a refrigerant control method of an air conditioner of FIG. 7. As shown in FIGS. 7 to 9, an air conditioner according to a third embodiment of the present invention includes an outdoor unit 110 that includes a compressor 111 compressing refrigerant, an outdoor heat exchanger 121 disposed to perform heat exchange with outdoor air, and a four-way valve 115 switching a flow passage of the refrigerant according to an operating mode, indoor units 150, each of which includes an indoor heat exchanger 151 that is disposed to perform heat exchange with indoor air, an indoor expansion unit 160 that is disposed at a refrigerant inlet side of each of the indoor heat exchangers 151, and allows refrigerant to be expanded during the cooling operation, an outdoor expansion unit 130 that is disposed at a refrigerant inlet side of the outdoor heat exchanger 121 and allows the refrigerant to be expanded during the heating operation, and a control unit 181 that controls the indoor expansion units 160 and the outdoor expansion unit 130 such that the refrigerant is expanded in each of the indoor expansion units 160 during the cooling operation and the refrigerant is expanded in the outdoor expansion unit 130 during the heating operation.

[0032] An accumulator 114 that sucks gaseous refrigerant is connected at a suction side of the compressor 111. A four-way valve 115 that switches the flow passage of the refrigerant is connected at a discharge side of the compressor 111 such that the refrigerant can appropriately flow according to the operating mode.

[0033] The outdoor heat exchanger 121, each of the indoor heat exchangers 151, and the accumulator 114 are connected to the four-way valve 115, such that the refrigerant can appropriately flow according to the operating mode.

[0034] The compressor 111 includes a fixed velocity type compressor 112a that rotates at a fixed velocity and an inverter compressor 112b that changes rotation speed so as to vary compression capacity.

[0035] Each of the indoor expansion units 160 includes a first branch channel 162 and a second branch channel 172 that are connected in parallel with each other such that the refrigerant branches off and flows at the refrigerant inlet side of the indoor heat exchangers 151, an indoor capillary tube 164 that is connected to the first branch channel 162, and an indoor electronic expansion valve 175 that is formed in the second branch channel 172.

[0036] The outdoor expansion unit 130 includes a third

branch channel 132 and a fourth branch channel 142 that are connected in parallel with each other such that the refrigerant branches off and flows at the refrigerant inlet side of the outdoor heat exchanger 121, an outdoor capillary tube 134 that is formed in the third branch channel 132, and an outdoor electronic expansion valve 145 is formed in the fourth branch channel 142.

[0037] As shown in FIG. 9, the control unit 181 is implemented in the form of a microprocessor that includes a control program capable of controlling a flow direction of the refrigerant according to the operating mode of the indoor units 150, and controlling such that the expansion of the refrigerant is performed before the refrigerant flows into the evaporator. The control unit 181 is connected to an operating mode selecting unit 183 that selects the operating mode of the indoor unit 150, the four-way valve 115, the indoor electronic expansion valve 175, and the outdoor electronic expansion valve 145 so as to transmit electrical signals.

[0038] Hereinafter, a refrigerant control method of an air conditioner according to another embodiment of the present invention will be described with reference to FIG. 10.

[0039] When the operating mode selecting unit 183 selects the operating mode of the indoor unit 150 (S10), the control unit 181 determines the selected operating mode (S20), controls the four-way valve 115 according to the selected operating mode, and switches the flow passage such that the refrigerant compressed in the compressor 111 can appropriately flow (S30 and S50).

[0040] That is, when each of the indoor units 150 performs the cooling operation, the control unit 181 completely opens the outdoor electronic expansion valve 145 such that the refrigerant passing through the outdoor heat exchanger 121 can smoothly flow, and at the same time, the control unit 181 controls such that each of the indoor electronic expansion valves 175 has an appropriate opening value according to a load amount each of the indoor units 150 (S45). Accordingly, as shown in FIG. 7, the refrigerant compressed in the compressor 111 passes through the four-way valve 115 and flows into the outdoor heat exchanger 121. The refrigerant passing through the outdoor heat exchanger 121 flows toward the indoor units 150 through the second branch channels 172, respectively. According to a load amount of each of the indoor units 150, when each of the indoor electronic expansion valves 175 is blocked, the refrigerant flowing into each of the indoor units 150 is decompressed and expanded while passing through each of the indoor capillary tubes 164 of each of the first branch channels 162. According to the load amount of each of the indoor units 150, when the indoor electronic expansion valve 175 is opened, the refrigerant flowing into each of the indoor units 150 is decompressed and expanded while passing through each of the indoor capillary tubes 164 and each of the indoor electronic expansion valves 175. The refrigerant having performed heat exchange with each of the indoor units 150 passes through the four-way valve

115 and flows into the accumulator 114. The gaseous refrigerant inside the accumulator 114 is sucked into the compressor 111, compressed, and then discharged. These processes are repeated.

[0041] Further, when the indoor unit 150 performs the heating operation, the control unit 181 completely opens the indoor electronic expansion valve 175 such that the refrigerant passing through each of the indoor heat exchangers 151 can smoothly flow, and at the same time, controls such that the outdoor electronic expansion valve 145 has an appropriate opening value according to the load amount of each of the indoor units 150 (S65). Here, when the fixed velocity type compressor 112a is only driven from the compressor 111, the structure may be formed such that the expansion of the refrigerant is only performed by using the outdoor capillary tube 134. That is, when the fixed velocity type compressor 112a is only driven, the outdoor electronic expansion valve 145 blocks the fourth branch channel 142. When the inverter compressor 112b is additionally added, the expansion of the refrigerant is also performed by the outdoor electronic expansion valve 145. Therefore, the refrigerant may be expanded by the outdoor capillary tube 134 and the outdoor electronic expansion valve 145 at the same time.

[0042] As shown in FIG. 8, the refrigerant compressed by the compressor 111 passes through the four-way valve 115 and flows into each of the indoor units 150. The refrigerant flowing into each of the indoor units 150 performs heat exchange in the indoor heat exchangers 151 so as to execute the heating function, and flows toward the outdoor unit 110 through each of the second branch channels 172. When the outdoor electronic expansion valve 145 is blocked according to the load amount of each of the indoor units 150, the refrigerant flowing into the outdoor unit 110 is decompressed and expanded while passing through the outdoor capillary tube 134. When the outdoor electronic expansion valve 145 is opened, the refrigerant is decompressed and expanded while passing through the outdoor capillary tube 134 and the outdoor electronic expansion valve 145. Then, the expanded refrigerant is evaporated while passing the outdoor heat exchanger 121, passes through the four-way valve 115, and flows into the accumulator 114. The gaseous refrigerant inside the accumulator 114 is sucked into the compressor 111, compressed, and then discharged. These processes are repeated. Meanwhile, the control unit 181 stops the operation of the indoor units 150 and the outdoor unit 110 (80) when an operation terminating signal is input from each of the indoor units 150 (S70).

[0043] Hereinafter, the operational effect of the air conditioner and the refrigerant control method according to the embodiments of the present invention will be described.

[0044] The air conditioner according to the embodiment of the present invention forms during the cooling operation, the first and second branch channels at the inlet side of the indoor heat exchanger and the indoor

capillary tube and the first switching valve, which are formed on the first and second branch channels, respectively, such that the expansion of the refrigerant is performed before the refrigerant flows into the indoor heat exchanger, which is the evaporator, so as to raise system efficiency.

[0045] Further, during the cooling operation, the first switching valve is composed of the indoor electronic expansion valve, and the refrigerant is decompressed and expanded by the indoor capillary tube and/or the indoor electronic expansion valve according to the load amount of the indoor unit, such that the expansion of the refrigerant is performed before the refrigerant flows into the indoor heat exchanger, the evaporator. Therefore, system efficiency can be raised, and the life span of the indoor electronic expansion valve may be extended because the use of the indoor electronic expansion valve can be prevented.

[0046] Further, the air conditioner according to the embodiment of the present invention forms the four-way valve that switches the flow passage of the compressed refrigerant according to the cooling operation or the heating operation mode, forms the branch channels at the inlet side of the indoor heat exchanger during the cooling operation so as to form the capillary tube and the indoor electronic expansion valve, respectively, in the branch channels, and forms, during the heating operation, the branch channels at the inlet side of the outdoor heat exchanger so as to form the outdoor capillary tube in one of the branch channels and outdoor electronic expansion valve on the other branch channel. During both the cooling and heating operations, the refrigerant is expanded before the refrigerant flows into the heat exchanger that serves as the evaporator. Therefore, during both the cooling and heating operations, the distance between the expansion unit and the evaporator can be reduced to thereby raise system efficiency. Further, since the use of the electronic expansion valve can be prevented to thereby extend the life span of the electronic expansion valve.

[0047] Further, the refrigerant control method according to the embodiment of the present invention can raise operating efficiency of the air conditioner by allowing the refrigerant to be expanded before the refrigerant flows into the evaporator where the refrigerant is evaporated during the cooling or heating operation.

Claims

1. An air conditioner comprising:

an outdoor unit including a compressor, an outdoor heat exchanger, and a four-way valve that switches a flow passage of refrigerant;
an indoor unit including an indoor heat exchanger;
an indoor expansion unit disposed at a refriger-

ant inlet side of the indoor heat exchanger and allowing the refrigerant to be expanded during the cooling operation;

an outdoor expansion unit disposed at a refrigerant inlet side of the outdoor heat exchanger and allowing the refrigerant to be expanded during the heating operation; and

a control unit controlling the indoor expansion unit and the outdoor expansion unit such that the refrigerant is expanded in the indoor expansion unit during the cooling operation and the refrigerant is expanded in the outdoor expansion unit during the heating operation.

2. The air conditioner of claim 1, wherein the indoor expansion unit includes a first branch channel and a second branch channel that are connected in parallel with the indoor heat exchanger, an indoor capillary tube that is formed in one of the first branch channel and the second branch channel, and a first switching valve that is formed on the other branch channel, and the control unit controls such that the first switching valve is blocked during the cooling operation and the first switching valve is opened during the heating operation.

3. The air conditioner of claim 2, wherein the compressor includes an inverter compressor, the first switching valve includes an indoor electronic expansion valve, and the control unit controls such that the opening of the indoor electronic expansion valve is controlled according to a load amount of the indoor unit during the cooling operation, and the indoor electronic expansion valve is completely opened during the heating operation.

4. The air conditioner of claim 2 or 3, wherein the outdoor expansion unit includes a third branch channel and a fourth branch channel that are connected in parallel with the outdoor heat exchanger, an outdoor capillary tube that is formed in one of the third branch channel and the fourth branch channel, and a second switching valve that is formed on the other branch channel, and the control unit controls such that the second switching valve is blocked during the cooling operation and the second switching valve is opened during the heating operation.

5. The air conditioner of claim 4, wherein the compressor includes an inverter compressor, the second switching valve includes an indoor electronic expansion valve, and the control unit controls such that the indoor electronic expansion valve is completely opened during the cooling operation, and the opening of the indoor electronic expansion valve is controlled according to a load amount of the indoor unit.

6. An air conditioner comprising:

an outdoor unit including a compressor, and an outdoor heat exchanger; and
 an indoor unit including an indoor heat exchanger, a first branch channel and a second branch channel that are formed in parallel at a refrigerant inlet side of the indoor heat exchanger, an indoor capillary tube that is formed on one of the first branch channel and the second branch channel, and a first switching valve that is formed on the other branch channel so as to switch the corresponding branch channel.

7. The air conditioner of claim 6,
 wherein the compressor includes an inverter compressor, and the first switching valve includes an indoor electronic expansion valve.

8. The air conditioner of claim 7, further comprising:

a four-way valve disposed at a discharge side of the compressor and switching a flow passage of the refrigerant;
 a third branch channel and a fourth branch channel formed in parallel at an inlet side of the outdoor heat exchanger during the heating operation;
 an outdoor capillary tube disposed in one of the third branch channel and the fourth branch channel; and
 an outdoor electronic expansion valve switching the other branch channel.

9. The air conditioner of claim 8, further comprising:

a control unit controlling the four-way valve to switch the flow passage of the refrigerant according to an operating mode, controlling the indoor electronic expansion valve to allow the refrigerant to be expanded at the refrigerant inlet side of the indoor heat exchanger, and at the same time, controlling the outdoor electronic expansion valve to be completely opened during the cooling operation, and controlling the outdoor electronic expansion valve to allow the refrigerant to be expanded at the refrigerant inlet side of the outdoor heat exchanger, and at the same time, controlling the indoor electronic expansion valve to be completely opened during the heating operation.

10. The air conditioner of any of claims 7 to 9, further comprising:

a control unit controlling the indoor electronic expansion valve according to a load amount of the indoor unit during the cooling operation.

11. The air conditioner of any of claims 6 to 10, further comprising:

a control unit controlling such that the first switching valve is blocked during the cooling operation.

FIG. 1

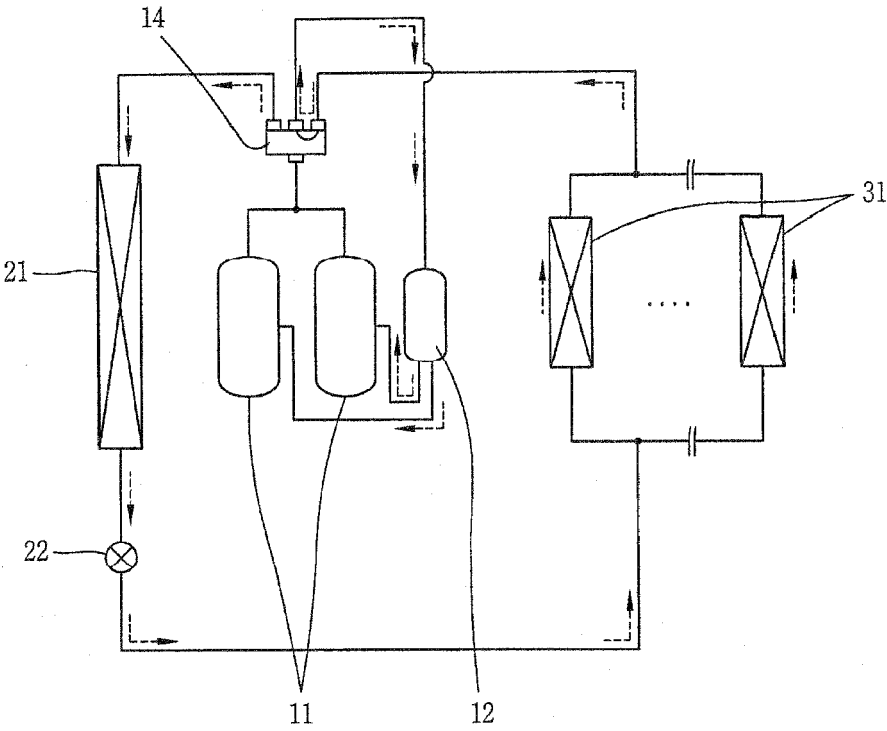


FIG. 2

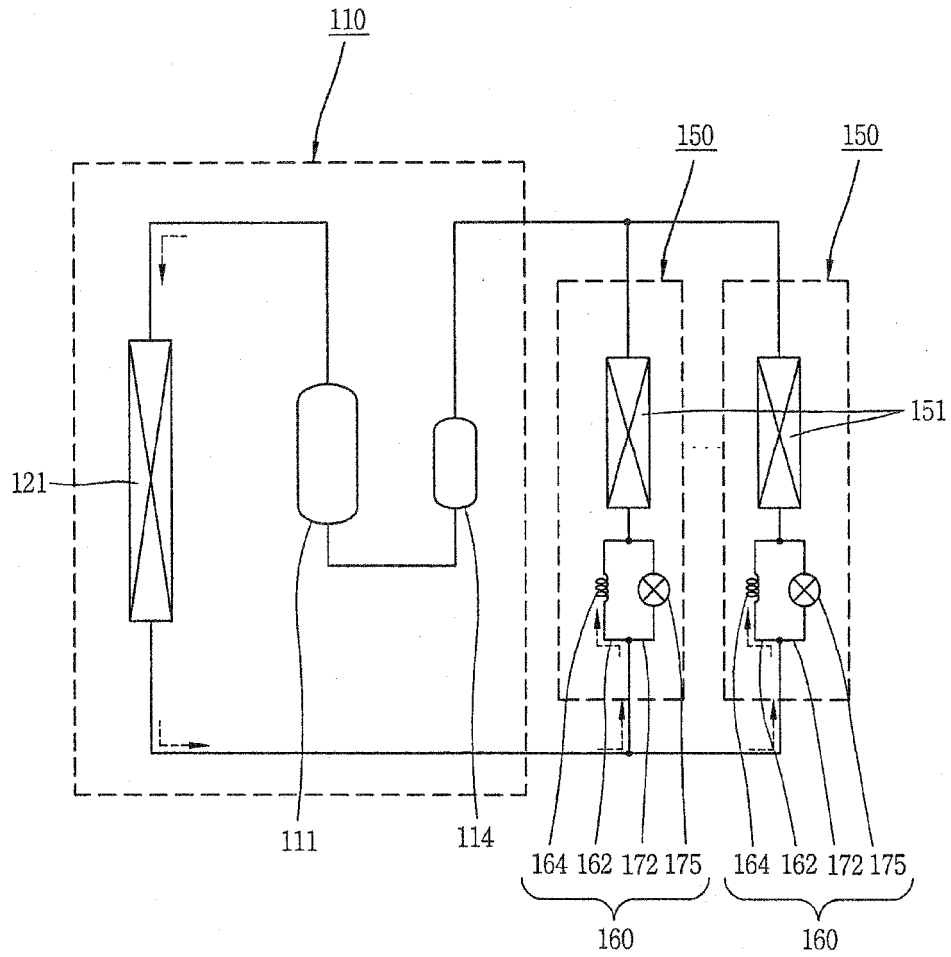


FIG. 3

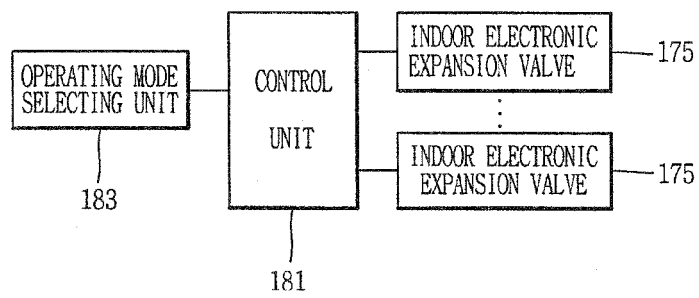


FIG. 4

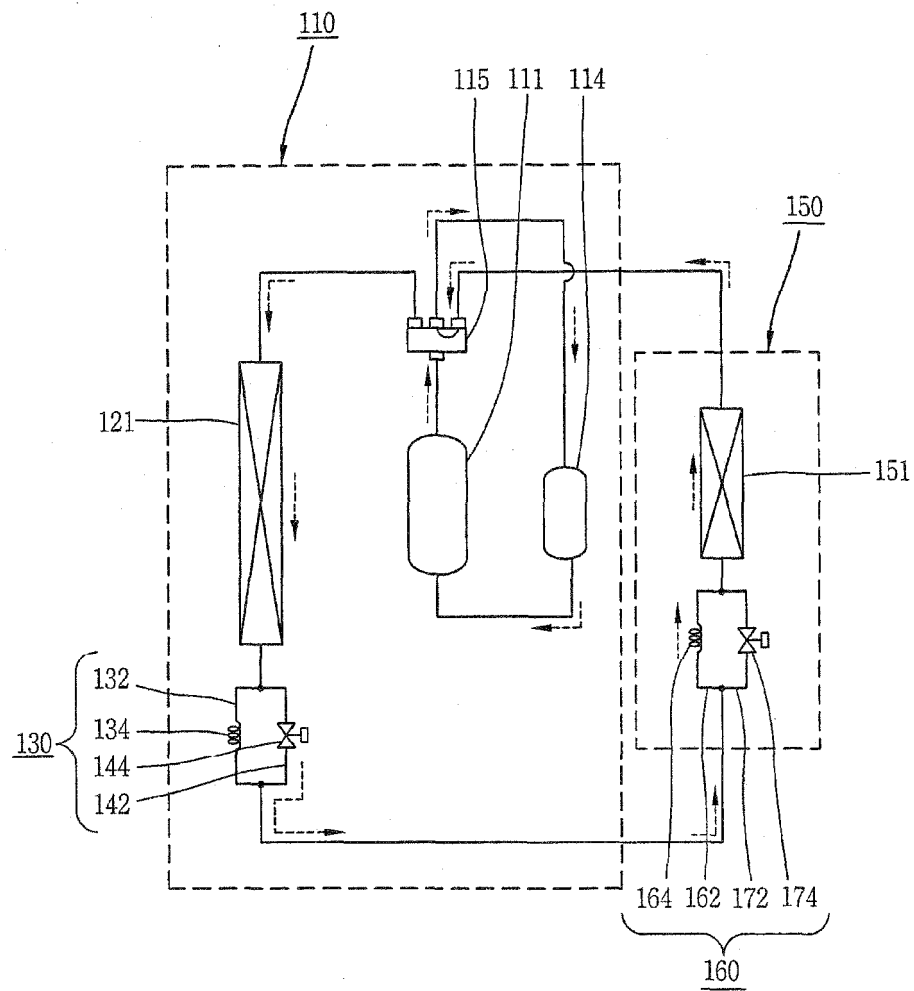


FIG. 5

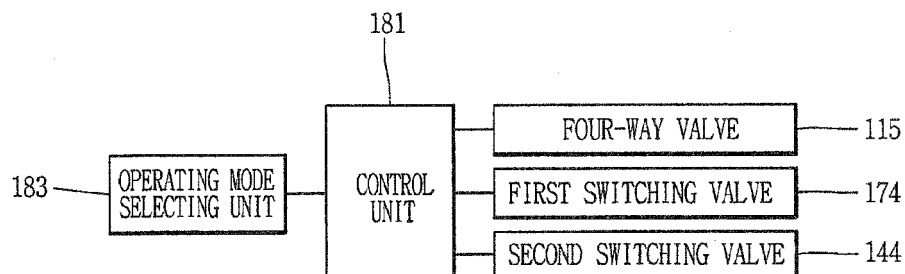


FIG. 6

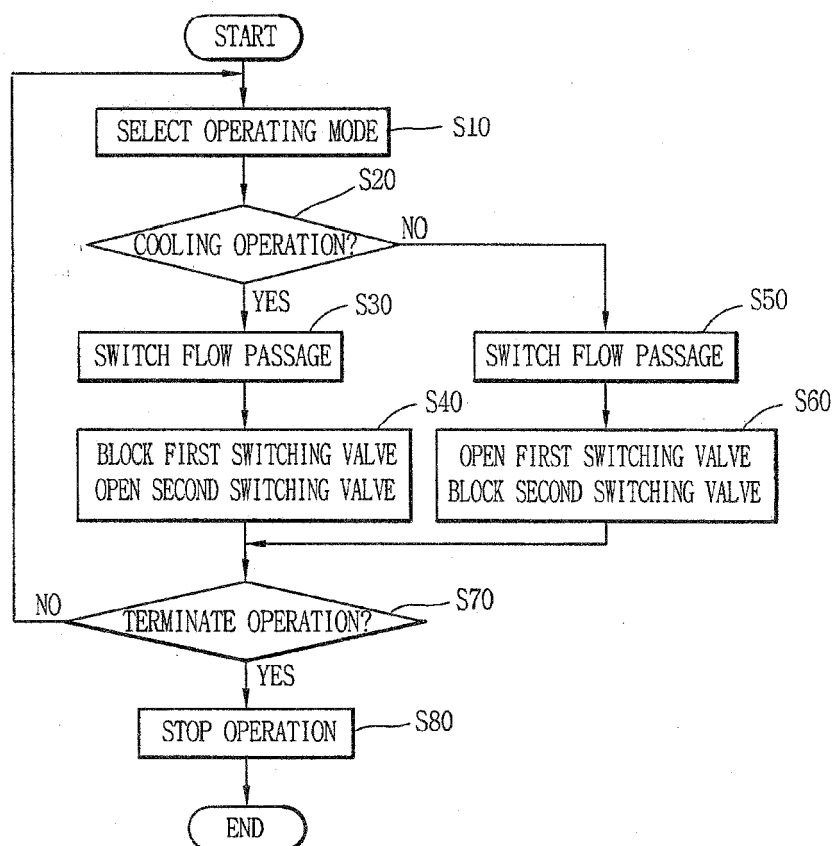


FIG. 7

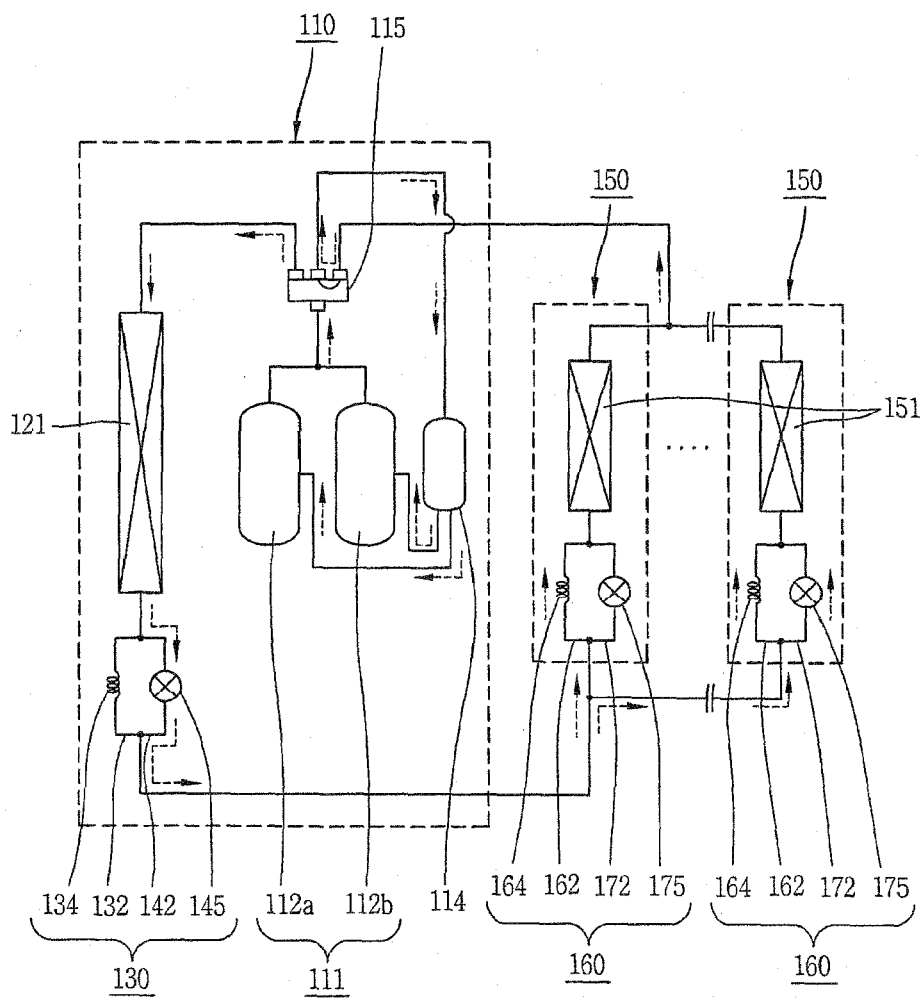


FIG. 8

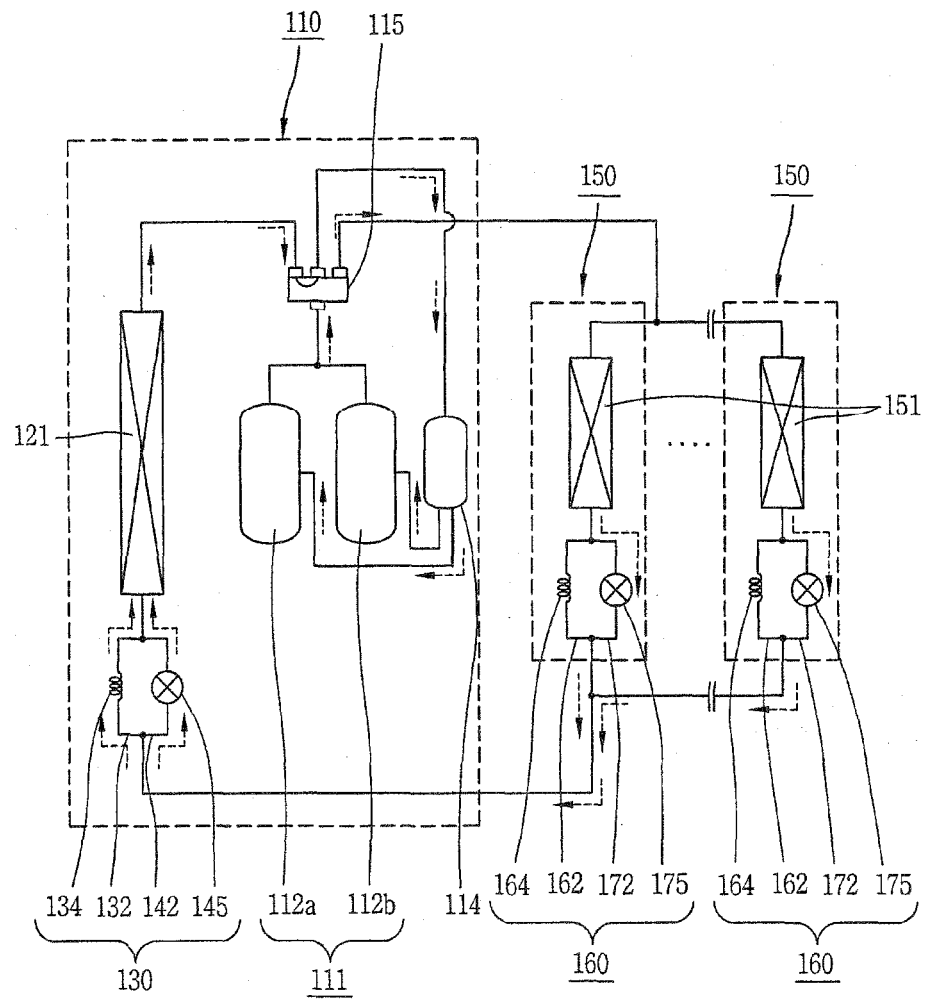


FIG. 9

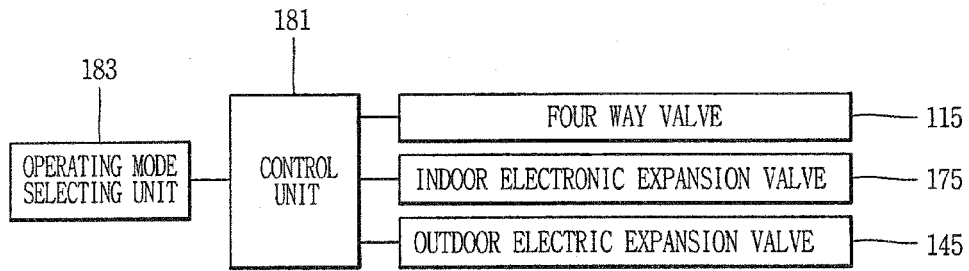


FIG. 10

