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(71) Applicant: **SAMSUNG ELECTRONICS CO., LTD.**
Suwon-si,
Gyeonggi-do 442-742 (KR)

(72) Inventors:
• **Kim, Woo Hyun**
Seoul (KR)

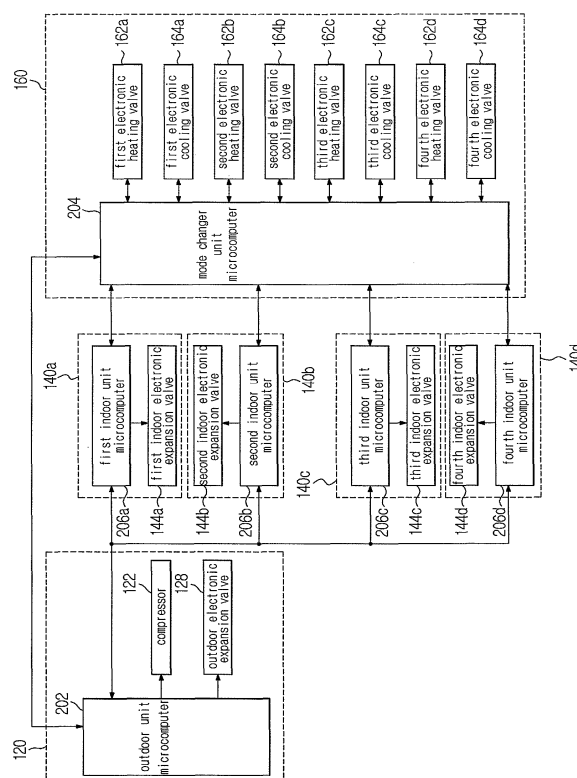
• **Jung, Gyoo Ha**
Gyeonggi-Do (KR)
• **Park, Moon Soo,**
305-903 Satbyeol Hanyang Apt.
Anyang-Si,
Gyeonggi-Do (KR)
• **Song, Myung Seob**
Suwon-si,
Gyeonggi-Do (KR)

(74) Representative: **Grey, Ian Michael et al**
Venner Shipley LLP
20 Little Britain
London EC1A 7DH (GB)

(54) Air Conditioner

(57) Disclosed herein are an air conditioner and a method of controlling the same. In a selective cooling/heating multi-system air conditioner, refrigerant flow noise is minimized when cooling operations are changed to heating operations and vice versa. The method of controlling the air conditioner comprises opening one of cooling (164a-d) and heating (162a-d) valves so as to perform one of cooling and heating operations. The cooling valve is opened when at least one indoor unit is operated at a cooling mode, and the heating valve is opened when the indoor unit is operated at a heating mode. The method of controlling the air conditioner further comprises closing the cooling and heating valves, and, after a predetermined period of time elapses, opening the other of the cooling and heating valves so as to bring about a change between the cooling and heating operations of the indoor unit.

FIG 2.



Description

[0001] The present invention relates to a method of controlling an air conditioning system including an outdoor and an indoor unit switchable between a heating or cooling mode for heating or cooling a space, high and low pressure refrigerant flow paths connecting the outdoor unit to the indoor unit to enable the flow of refrigerant therebetween and first and second valves associated with the indoor unit and located in the high and low pressure flow paths respectively so that, when the first valve of the indoor unit is open and the second valve of said indoor unit is closed, the space occupied by said indoor unit is heated by the indoor unit and, when the first valve of the indoor unit is closed and the second valve of said indoor unit is open, the space occupied by the indoor unit is cooled by the indoor unit.

[0002] The invention also relates to an air conditioning system including an outdoor and an indoor unit switchable between a heating or cooling mode for heating or cooling a space, high and low pressure refrigerant flow paths connecting the outdoor unit to the indoor unit to enable the flow of refrigerant therebetween and first and second valves associated with the indoor unit and located in the high and low pressure flow paths respectively so that, when the first valve of the indoor unit is open and the second valve of said indoor unit is closed, the space occupied by said indoor unit is heated by the indoor unit and, when the first valve of the indoor unit is closed and the second valve of said indoor unit is open, the space occupied by the indoor unit is cooled by the indoor unit and, a mode control unit operable to open and close the first and second valves to switch the indoor unit between heating and cooling modes.

[0003] Generally, a multi-system air conditioner for simultaneously performing heating and cooling operations comprises at least one outdoor unit and a plurality of indoor units connected to the outdoor unit in parallel. The plurality of indoor units and the outdoor unit are electrically connected via communication and power cables, and include a plurality of refrigerant pipes and valves, which are used to control the flow and quantity of a refrigerant.

[0004] The simultaneous cooling and heating operation denotes that each of the plural indoor units is capable of selectively performing a cooling or heating operation. A cooling or heating operation is performed by each of the plural indoor units in a plurality of distinct spaces at a user's request or according to indoor environments. An electric cooling valve and an electric heating valve are used to select one of either the cooling and heating operations of each indoor unit. That is, when the cooling electric valve is opened, an indoor unit performs a cooling operation, and when the electric heating valve is opened, the indoor unit performs the heating operation.

[0005] As described above, in order to perform a cooling or heating operation, each of the indoor units requires necessary cooling or heating capacity from the outdoor

unit. When the sum total of the cooling capacities required by the indoor units is higher than the sum total of the heating capacities required by the indoor units, the outdoor unit performs a main net cooling operation, and when the sum total of the heating capacities required by the indoor units is higher than the sum total of the cooling capacities required by the indoor units, the outdoor unit performs a main net heating operation. When the outdoor unit converts from the main cooling operation to the main heating operation or vice versa, the direction of the flow of a refrigerant discharged from a compressor is converted by means of a four-way valve.

[0006] When an electronic cooling valve is closed, and, simultaneously, an electronic heating valve is opened such that the mode of operation of an indoor unit is changed from a cooling mode to a heating mode while the outdoor unit is operated, high pressure refrigerant discharged from the compressor abruptly flows through the opened valve. Similarly, when an electronic heating valve is closed, and, simultaneously, an electronic cooling valve is opened such that the mode of operation of an indoor unit is changed from a heating mode to a cooling mode while the outdoor unit is operated, high pressure refrigerant discharged from the compressor abruptly flows through the opened valve. As a result, noise is generated by the refrigerant flow.

[0007] When the number of indoor units is increased in the multi-system air conditioner described above, changes in the mode of operation occur more frequently.

[0008] Consequently, the refrigerant flow noise is increased, which causes discomfort to a user of the air conditioner.

[0009] It is therefore an object of the present invention to provide an air conditioning system that substantially alleviates or overcomes the problems mentioned above.

[0010] A method of controlling an air conditioning system according to the invention is characterised in that the method of controlling the air conditioning system includes the step of closing both the first and second valves for a predetermined period of time when switching the indoor unit from a heating to a cooling mode and vice-versa.

[0011] Preferably, the method further includes the step of reducing the operating capacity of a compressor after both the first and second valves are closed and increasing the operating capacity of the compressor after one of said valves is opened.

[0012] In one embodiment, the method comprises a hot gas bypass connected between the outlet of the compressor and the inlet, and a hot gas bypass valve to control the flow of refrigerant through the bypass wherein the method may include the step of opening the hot gas bypass valve after the first and second valves are closed and closing the hot gas bypass valve after one of said valves is opened.

[0013] In a preferred embodiment, the method comprises a fan for supplying air to a heat exchanger of the outdoor unit, the method preferably comprising a step of

reducing the speed of the fan when the operating capacity of the compressor is reduced and increasing the speed of the fan once the operating capacity of the compressor is increased.

[0014] In a preferred embodiment, the outdoor unit comprises an expansion valve, the method may further include the step of closing the expansion valve after the first and second valves are closed and opening the expansion valve after one of the first and second valves is opened.

[0015] In one embodiment, the method further includes the step of reducing the operating capacity of the compressor, reducing the speed of the heat exchanger fan, opening the hot bypass valve and closing the expansion valve of a predetermined period of time after the first and second valves are closed.

[0016] Preferably, the method includes the step of increasing the capacity of the compressor, increasing the speed of the fan, closing the hot bypass valve and opening the expansion valve after a predetermined period of time has elapsed following the opening of one of said first or second valves.

[0017] The method may include a plurality of indoor unit each having a first and second valve associated therewith.

[0018] An air conditioning system according to the present invention is characterised in that the control unit is operable to close both the first and second valves for a predetermined period of time when the indoor unit is switched from a heating to a cooling mode and vice-versa.

[0019] Preferably, an air conditioning system further comprises valves, wherein the mode of operation is determined by either a first or second valve being open and control means to control the closing of one valve and the opening of a second valve a predetermined period of time after closing the first valve.

[0020] Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a refrigerating cycle circuit diagram of an air conditioner according to an embodiment of the present invention;

Figure 2 is a block diagram showing a control system of the air conditioner shown in Figure 1; and

Figure 3 is a timing chart showing a method of controlling an air conditioner according to an embodiment of the present invention.

[0021] Referring to the drawings, there is shown in Figure 1 a circuit diagram of an air conditioner comprising an outdoor unit 120, first to fourth indoor units 140a, 140b, 140c and 140d and a mode changing unit 160.

[0022] In the outdoor unit 120, the flow direction of refrigerant discharged from a compressor 122 is changed by means of a four-way valve 124. In a main cooling operation, the flow direction of the refrigerant is changed

by means of the four-way valve 124 such that the refrigerant, for example, high-temperature, high pressure refrigerant discharged from the compressor 122, is guided to a main electronic cooling valve 186a and an outdoor heat exchanger 126. In a main heating operation, on the other hand, the flow direction of the refrigerant is changed by means of the four-way valve 124 such that the refrigerant discharged is supplied to the first to fourth indoor units 140a, 140b, 140c and 140d via a check valve 188 and the mode changing unit 160. Heat exchange between the refrigerant and external air, which flows into the outdoor unit 120 through an outdoor unit fan 102, is performed by means of the outdoor heat exchanger 126. In the outdoor unit 120 are also disposed an outdoor electronic expansion valve 128 to expand the refrigerant, a liquid receiver 130 to separate liquid refrigerant from gaseous refrigerant, and an accumulator 132. Flow of the refrigerant between the first to fourth indoor units 140a, 140b, 140c and 140d, and the outdoor unit 120 is accomplished through a high pressure gas pipe 134 and a low-pressure gas pipe 136.

[0023] The low-pressure gas pipe 136 is connected to the inlet of the compressor 122 via the accumulator 132 and a high pressure liquid pipe 138 is connected to the outdoor electronic expansion valve 128 via the liquid receiver 130. To the outdoor electronic expansion valve 128 are connected, in parallel, a bypass valve 182a and a check valve 182b, which are opened, when a cooling operation is performed, such that liquid refrigerant discharged from the outdoor heat exchanger 126 passes through the bypass valve 182a and the check valve 182b, not through the outdoor electronic expansion valve 128. When a heating operation is performed, the bypass valve 182a and the check valve 182b are closed such that the refrigerant passes through the outdoor electronic expansion valve 128.

[0024] Between the four-way valve 124 and the inlet of the outdoor heat exchanger 126 is connected a high pressure branch pipe 184, which branches off from the high pressure gas pipe 134. On the high pressure branch pipe 184 are disposed a main electronic cooling valve 186a and a check valve 186b that prevents a refrigerant from flowing backward from the high pressure gas pipe 134. Between the four-way valve 124 and the high pressure liquid pipe 138 is disposed another check valve 188 that prevents refrigerant from flowing backward.

[0025] The first to fourth indoor units 140a, 140b, 140c and 140d are connected, in parallel, to the outdoor unit 120. The first to fourth indoor units 140a, 140b, 140c and 140d have first to fourth indoor heat exchangers 142a, 142b, 142c and 142d and first to fourth indoor electronic expansion valves 144a, 144b, 144c and 144d.

[0026] The mode changing unit 160 is provided to change cooling operations of the first to fourth indoor units 140a, 140b, 140c and 140d to heating operations of the first to fourth indoor units 140a, 140b, 140c and 140d and vice versa. In the mode changing unit 160 has first to fourth high pressure gas branch pipe 166a, 166b, 166c

and 166d which branch off from the high pressure gas pipe 134. On the first to fourth high pressure gas branch pipe 166a, 166b, 166c and 166d are disposed first to fourth electronic heating valves 162a, 162b, 162c and 162d respectively. On first to fourth low pressure gas branch pipe 168a, 168b, 168c and 168d which branch off from the low pressure gas pipe 136, are disposed first to fourth electronic cooling valves 164a, 164b, 164c and 164d respectively. The first electronic heating valve 162a and the first electronic cooling valve 164a are connected to a first refrigerant pipe 170a, which is connected to the first indoor heat exchanger 142a. Similarly, the second to fourth electronic heating valves 162b, 162c and 162d and the second to fourth electronic cooling valves 164b, 164c and 164d are connected to second to fourth refrigerant pipes 170b, 170c and 170d respectively. On the refrigerant pipe, between the first to fourth indoor electronic expansion valves 144a, 144b, 144c and 144d and the liquid receiver 130 of the outdoor unit 120 is disposed an electronic mode changing unit valve 104. The electronic mode changing unit valve 104 is opened, when the number of indoor units performing cooling operations is greater than that of indoor unit performing heating operation, such that refrigerant discharged from the indoor units performing cooling operations are not excessively supplied to the indoor units performing heating operations.

[0027] Figure 2 is a block diagram showing a control system of the air conditioner shown in Figure 1. As is shown in Figure 2, the outdoor unit 120 of the air conditioner according to the present invention further comprises an outdoor unit microcomputer 202 that controls the components of the outdoor unit 120. The first to fourth indoor units 140a, 140b, 140c and 140d further comprises first to fourth indoor microcomputers 206a, 206b, 206c and 206d which controls the components of the first to fourth indoor units 140a, 140b, 140c and 140d respectively. The mode changing unit 160 further comprises a mode changer unit microcomputer 204 that controls the first to fourth electronic cooling valves 164a, 164b, 164c and 164d and the first to fourth electronic heating valves 162a, 162b, 162c and 162d.

[0028] Figure 3 is a timing chart showing a method of controlling an air conditioner according to an embodiment of the present invention. (A) to (F) of Figure 3 show a change between cooling and heating operations, (G) and (H) show opening and closing control of the electronic heating valves 162a, 162b, 162c and 162d and the electronic cooling valves 164a, 164b, 164c and 164d when heating operations are changed to cooling operations and (I) and (J) show opening and closing control of the electronic heating valves 162a, 162b, 162c and 162d and the electronic cooling valves 164a, 164b, 164c and 164d when cooling operations are changed to heating operations. (K) of Figure 3 shows opening and closing control of the electronic heating valves 162a, 162b, 162c and 162d when the stopped indoor units start to perform heating operations, and (L) shows opening and closing con-

trol of the electronic cooling valves 164a, 164b, 164c and 164d when the stopped indoor units start to perform cooling operations.

[0029] When a heating operation is changed to a cooling operation in at least one of the indoor units, the corresponding one of the electronic heating valves 162a, 162b, 162c and 162d is closed (t1 of Figure 3(G)) while the compressor 122, the outdoor unit fan 102, the four-way valve 124, the outdoor electronic expansion valve 128, the electronic mode changing unit valve 104, and a hot gas bypass valve 106 are maintained in the current operation states, i.e. the states before change between cooling and heating operations, as is shown in (A) to (F) of Figure 3. At this time, the corresponding one of the electronic cooling valves 164a, 164b, 164c and 164d is closed. In this way, the electronic heating valves 162a, 162b, 162c and 162d and the electronic cooling valves 164a, 164b, 164c and 164d are closed for a predetermined period of time (for example, approximately 30 seconds), and then the cooling operation is performed while the capacity of the compressor 122 is reduced. Preferably, the cooling operation is performed with the minimum capacity of the compressor (t2 of Figure 3(A)). At the same time, the rotating speed of the outdoor unit fan 102 is reduced corresponding to the operating capacity of the compressor 122, the outdoor electronic expansion valve 128 and the electronic mode changing unit valve 104 are closed, and the hot gas bypass valve 106 is opened (t2 of Figure 3(B), 3(D), 3(E) and 3(F)). The four-way valve 124 is maintained at the previous operating state (Figure 3(C)). The hot gas bypass valve 106, which is connected between the outlet side (high pressure side) of the compressor 122 and the inlet side of the compressor 122, is controlled such that hot gas flows to the inlet of the compressor. When hot gas bypass valve 106 is opened while the electronic heating valves 162a, 162b, 162c and 162d and the electronic cooling valves 164a, 164b, 164c and 164d are closed, the difference in pressure between the high pressure gas pipe 134 and the low pressure gas pipe 136 is considerably reduced. Consequently, the refrigerant flow noise is minimized when the electronic cooling valves 164a, 164b, 164c and 164d are opened.

[0030] When the first electronic cooling valve 164a is opened and the first electronic heating valve 162a is closed to perform a cooling operation of the first indoor unit 140a, for example, high pressure and low pressure sections are formed at both ends of the first electronic heating valve 162a. Specifically, the high pressure gas pipe 134 on the left of the first electronic heating valve 162a becomes the high pressure section and the first refrigerant pipe 170a on the right of the first electronic heating valve 162a becomes the low pressure section. When the first electronic heating valve 162a is suddenly opened, the refrigerant in the high pressure section abruptly flows to the low pressure section. As a result, refrigerant flow noise is generated.

[0031] In the case that the compressor 122 is operated with the minimum capacity while the first electronic cool-

ing valve 164a is closed according to the present invention, however, the pressure of refrigerant in the high pressure section is lowered, and thus the difference in pressure between the high pressure section and the low pressure section is reduced. When the first electronic heating valve 162a is opened while the difference in pressure between the high pressure section and the low pressure section is reduced, the refrigerant does not abruptly flow, and therefore the refrigerant flow noise is considerably reduced.

[0032] If the first to fourth electronic heating valves 162a, 162b, 162c and 162d and the first to fourth electronic cooling valves 164a, 164b, 164c and 164d are all closed while change between cooling and heating operations is brought about, a vacuum is created at the inlet side of the compressor although the compressor 122 is operated with the minimum capacity, which may affect the air conditioner. For this reason, the hot gas bypass valve 106 is opened while the compressor 122 is operated with the minimum capacity such that the compressor 122 is normally operated. In this case, the amount of refrigerant is also controlled.

[0033] As a predetermined period of time (for example, approximately 30 seconds) elapses after t₂, which means that pressure equilibrium of refrigerant between the refrigerant pipes is achieved, the electronic cooling valves 164a, 164b, 164c and 164d corresponding to the indoor units to be changed to cooling operations are opened (t₃ of Figure 3(H)). When a predetermined period of time (for example, approximately 10 seconds) elapses after t₃, the compressor 122, the outdoor unit fan 102, the outdoor electronic expansion valve 128, the electronic mode changing unit valve 104, and the hot gas bypass valve 106 are controlled such that the required cooling operations are performed. Specifically, the compressor 122 is operated according to the cooling and heating capacities required by the respective indoor units at the time of t₄, the rotating speed of the outdoor unit fan 102 is increased corresponding to increase of operating capacity of the compressor 122, the opening degree of the outdoor electronic expansion valve 128 is decided on the basis of the operation mode of the outdoor unit, the opening degree of the electronic mode changing unit valve 104 is decided on the basis of the corresponding operation mode, and the hot gas bypass valve 106 is closed (t₄ of Figures 3(B), 3(D), 3(E) and 3(F)).

[0034] When a predetermined period of time elapses after the electronic heating valves 162a, 162b, 162c and 162d corresponding to the indoor units performing heating operations are closed, the compressor 122, the outdoor unit fan 102, the outdoor electronic expansion valve 128, the electronic mode changing unit valve 104, and the hot gas bypass valve 106 are operated. Consequently, refrigerant flow noise due to abrupt opening and closing of the valves is reduced. Also, the compressor 122, the outdoor unit fan 102, the outdoor electronic expansion valve 128, the electronic mode changing unit valve 104, and the hot gas bypass valve 106 are maintained

at their previous operating states for a predetermined period of time (t₁ to t₂) after the electronic heating valves 162a, 162b, 162c and 162d are closed. Consequently, the refrigerant is prevented from stagnating in the corresponding indoor units.

[0035] Also, the compressor 122 is operated with the minimum capacity before the electronic cooling valves 164a, 164b, 164c and 164d are opened to change the cooling operations, by which refrigerant flow noise generated due to the high pressure refrigerant abruptly flowing when the electronic cooling valves 164a, 164b, 164c and 164d are opened is minimized.

[0036] When the cooling operations are changed to the heating operations as is shown in (I) and (J) of Figure 3, the electronic cooling valves 164a, 164b, 164c and 164d corresponding to the indoor units to be changed to the heating operations are closed at the time of t₁, and then the compressor 122, the outdoor unit fan 102, the outdoor electronic expansion valve 128, the electronic mode changing unit valve 104, and the hot gas bypass valve 106 are controlled after a predetermined period of time so as to minimize the refrigerant flow noise (t₂ of Figures 3(B), 3(D), 3(E) and 3(F)). At the time of t₃, the electronic heating valves 162a, 162b, 162c and 162d corresponding to the indoor units to be changed to the heating operations are opened (t₃ of Figure 3(J)). After a predetermined period of time has elapsed, the compressor 122, the outdoor unit fan 102, the outdoor electronic expansion valve 128, the electronic mode changing unit valve 104, and the hot gas bypass valve 106 are controlled such that heating operations are performed (t₄ of Figures 3(B), 3(D), 3(E) and 3(F)).

[0037] In order to operate the stopped indoor units at heating or cooling mode, the compressor 122, the outdoor unit fan 102, the outdoor electronic expansion valve 128, the electronic mode changing unit valve 104, and the hot gas bypass valve 106 are controlled to minimize the refrigerant flow noise (t₂ of Figures 3(B), 3(D), 3(E) and 3(F)), and then, at the time of t₃, the electronic heating valves 162a, 162b, 162c and 162d or the electronic cooling valves 164a, 164b, 164c and 164d corresponding to the indoor units to be changed to the corresponding operations are opened (t₃ of Figures 3(K) and 3(L)). After a predetermined period of time (for example, approximately 10 seconds) has elapsed, the compressor 122, the outdoor unit fan 102, the outdoor electronic expansion valve 128, the electronic mode changing unit valve 104, and the hot gas bypass valve 106 are controlled such that cooling operations or heating operations are performed (t₄ of Figures 3(B), 3(D), 3(E) and 3(F)).

[0038] As apparent from the above description, the present invention provides a selective cooling/heating multi-system air conditioner wherein a predetermined period of time is given at the time of opening and closing electronic cooling and heating valves when change is made between cooling and heating operations. Consequently, the present invention has the effect of minimizing refrigerant flow noise.

[0039] Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles of the invention, the scope of which is defined in the claims and their equivalents and the foregoing description should be regarded as a description of a preferred embodiment only.

Claims

1. A method of controlling an air conditioning system including an outdoor and an indoor unit switchable between a heating or cooling mode for heating or cooling a space, high and low pressure refrigerant flow paths connecting the outdoor unit to the indoor unit to enable the flow of refrigerant therebetween and first and second valves associated with the indoor unit and located in the high and low pressure flow paths respectively so that, when the first valve of the indoor unit is open and the second valve of said indoor unit is closed, the space occupied by said indoor unit is heated by the indoor unit and, when the first valve of the indoor unit is closed and the second valve of said indoor unit is open, the space occupied by the indoor unit is cooled by the indoor unit **characterised in that** the method of controlling the air conditioning system includes the step of closing both the first and second valves for a predetermined period of time when switching the indoor unit from a heating to a cooling mode and vice-versa.
2. A method of controlling an air conditioning system according to claim 1 further comprising a compressor, the method further including the step of reducing the operating capacity of the compressor after both the first and second valves are closed and increasing the operating capacity of the compressor after one of said valves is opened.
3. A method of controlling an air conditioning system according to claim 2 comprising a hot gas bypass connected between the outlet of the compressor and the inlet, and a hot gas bypass valve to control the flow of refrigerant through the bypass wherein the method includes the step of opening the hot gas bypass valve after the first and second valves are closed and closing the hot gas bypass valve after one of said valves is opened.
4. A method of controlling an air conditioning system according to claim 2 or claim 3 comprising a fan for supplying air to a heat exchanger of the outdoor unit, the method comprising a step of reducing the speed of the fan when the operating capacity of the compressor is reduced and increasing the speed of the fan once the operating capacity of the compressor

is increased.

5. A method of controlling an air conditioning system according to any of claims 2 to 4 wherein the outdoor unit comprises an expansion valve, the method further including the step of closing the expansion valve after the first and second valves are closed and opening the expansion valve after one of the first and second valves is opened.
6. A method of controlling an air conditioning system according to any of claims 2 to 5 wherein the method further includes the step of reducing the operating capacity of the compressor, reducing the speed of the heat exchanger fan, opening the hot bypass valve and closing the expansion valve for a predetermined period of time after the first and second valves are closed.
7. A method of controlling an air conditioning system according to claim 6 wherein the method includes the step of increasing the capacity of the compressor, increasing the speed of the fan, closing the hot bypass valve and opening the expansion valve after a predetermined period of time has elapsed following the opening of one or said first or second valves.
8. A method of controlling an air conditioning system according to any preceding claim including a plurality of indoor units each having a first and second valve associated therewith.
9. An air conditioning system including an outdoor and an indoor unit switchable between a heating or cooling mode for heating or cooling a space, high and low pressure refrigerant flow paths connecting the outdoor unit to the indoor unit to enable the flow of refrigerant therebetween and first and second valves associated with the indoor unit and located in the high and low pressure flow paths respectively so that, when the first valve of the indoor unit is open and the second valve of said indoor unit is closed, the space occupied by said indoor unit is heated by the indoor unit and, when the first valve of the indoor unit is closed and the second valve of said indoor unit is open, the space occupied by the indoor unit is cooled by the indoor unit and, a mode control unit operable to open and close the first and second valves to switch the indoor unit between heating and cooling modes **characterised in that** the control unit is operable to close both the first and second valves for a predetermined period of time when the indoor unit is switched from a heating to a cooling mode and vice-versa.
10. An air conditioning system according to claim 9, further comprising valves, wherein the mode of operation is determined by either a first or second valve

being open and control means to control the closing of one valve and the opening of a second valve a predetermined period of time after closing the first valve.

11. A method of controlling an air conditioner comprising opening one of cooling and heating valves so as to perform one of cooling and heating operations, the cooling valve being opened when at least one indoor unit is operated at a cooling mode, the heating valve being opened when the indoor unit is operated at a heating mode and closing the cooling and heating valves and after a predetermined period of time elapses, opening the other of the cooling and heating valves so as to bring about a change between the cooling and heating operations of the indoor unit.
12. The method according to claim 11 further comprising controlling the pressure of a refrigerant so as to reduce the difference in pressure between high pressure and low pressure sections of a refrigerating cycle after the cooling and heating valves are closed.
13. The method according to claim 12 further comprising operating a compressor with the minimum capacity so as to control the pressure of the refrigerant while the cooling and heating valves are closed.
14. The method according to claim 13 further comprising reducing the number of rotations of an outdoor unit fan while the compressor is operated with the minimum capacity.
15. The method according to claim 12 further comprising opening a hot gas bypass valve connected between the outlet side and the inlet side of the compressor so as to control the pressure of the refrigerant while the cooling and heating valves are closed.
16. The method according to claim 11 further comprising interrupting the control of the pressure of the refrigerant after the change between the cooling and heating operations of the indoor unit is brought about, and operating an outdoor unit with a cooling or heating capacity required by the indoor unit.
17. A method of controlling an air conditioner comprising opening one of cooling and heating valves so as to perform one of cooling and heating operations, the cooling valve being opened when at least one indoor unit is operated at a cooling mode, the heating valve being opened when the indoor unit is operated at a heating mode, closing the cooling and heating valves so as bring about a change between the cooling and heating operations of the indoor unit, controlling the pressure of a refrigerant so as to reduce the difference in pressure between high pressure and low pressure sections of a refrigerating cycle, opening

the other of the cooling and heating valves so as to bring about a change between the cooling and heating operations of the indoor unit and interrupting the control of the pressure of the refrigerant after the change between the cooling and heating operations of the indoor unit is brought about, and operating an outdoor unit with a cooling or heating capacity required by the indoor unit.

18. The method according to claim 17 further comprising operating a compressor with the minimum capacity so as to control the pressure of the refrigerant while the cooling and heating valves are closed.
19. The method according to claim 18 further comprising reducing the number of rotations of the outdoor unit fan while the compressor is operated with the minimum capacity.
20. The method according to claim 17 further comprising opening a hot gas bypass valve connected between the outlet side and the inlet side of the compressor so as to control the pressure of the refrigerant while the cooling and heating valves are closed.
21. An air conditioner comprising an outdoor unit, at least one indoor unit, a mode changing unit to bring about a change between cooling and heating operations of the indoor unit and a control unit to control the mode changing unit such that one of the cooling and heating operations is performed, and to open the other of cooling and heating valves after a predetermined period of time elapses while the flow of a refrigerant is interrupted in the indoor unit such that the change between cooling and heating operations of the indoor unit is brought about.
22. The air conditioner according to claim 21 wherein the mode changing unit comprises a cooling valve opened when the indoor unit is operated at a cooling mode and a heating valve opened when the indoor unit is operated at a heating mode.

FIG 1.

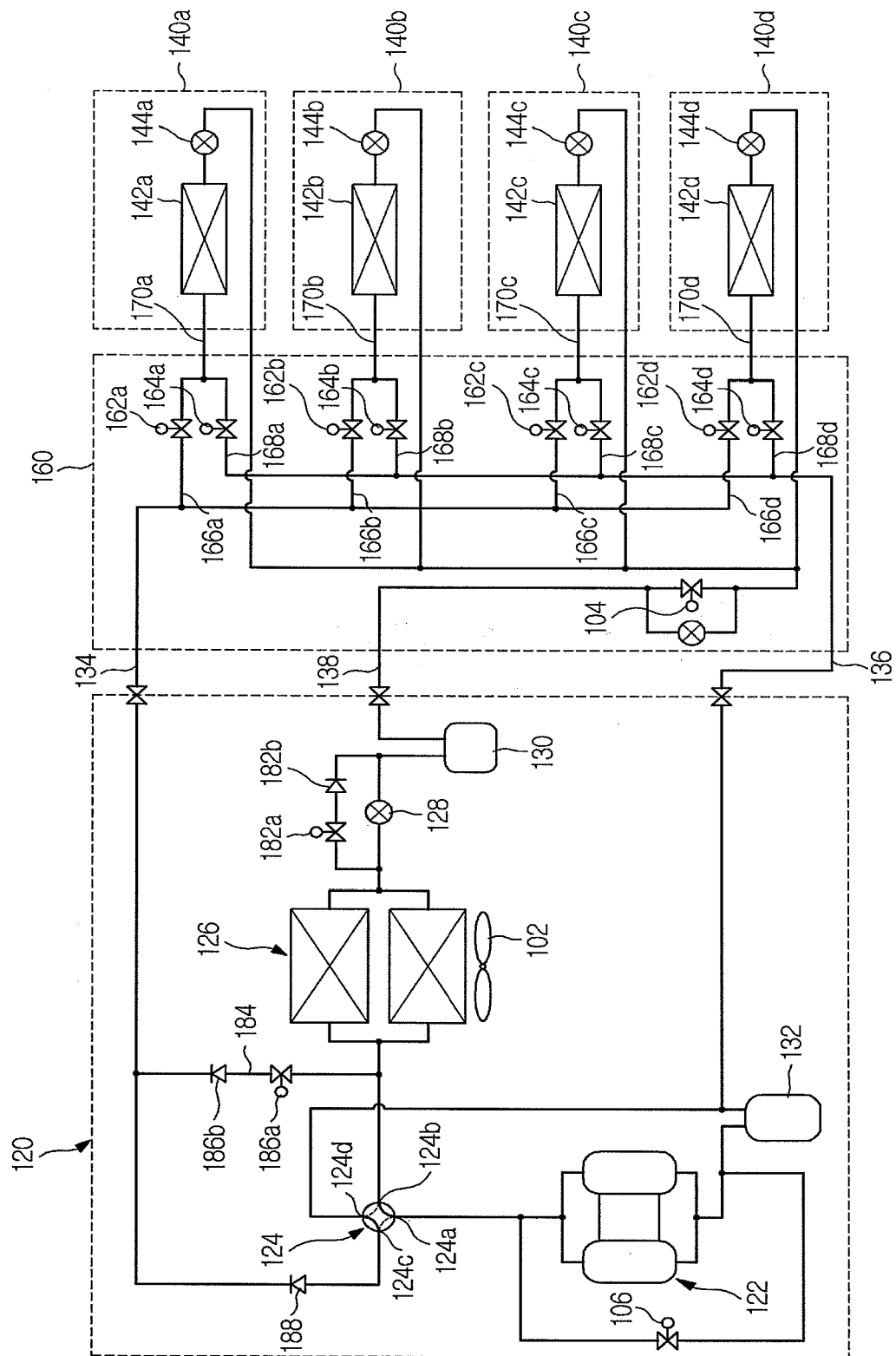


FIG 2.

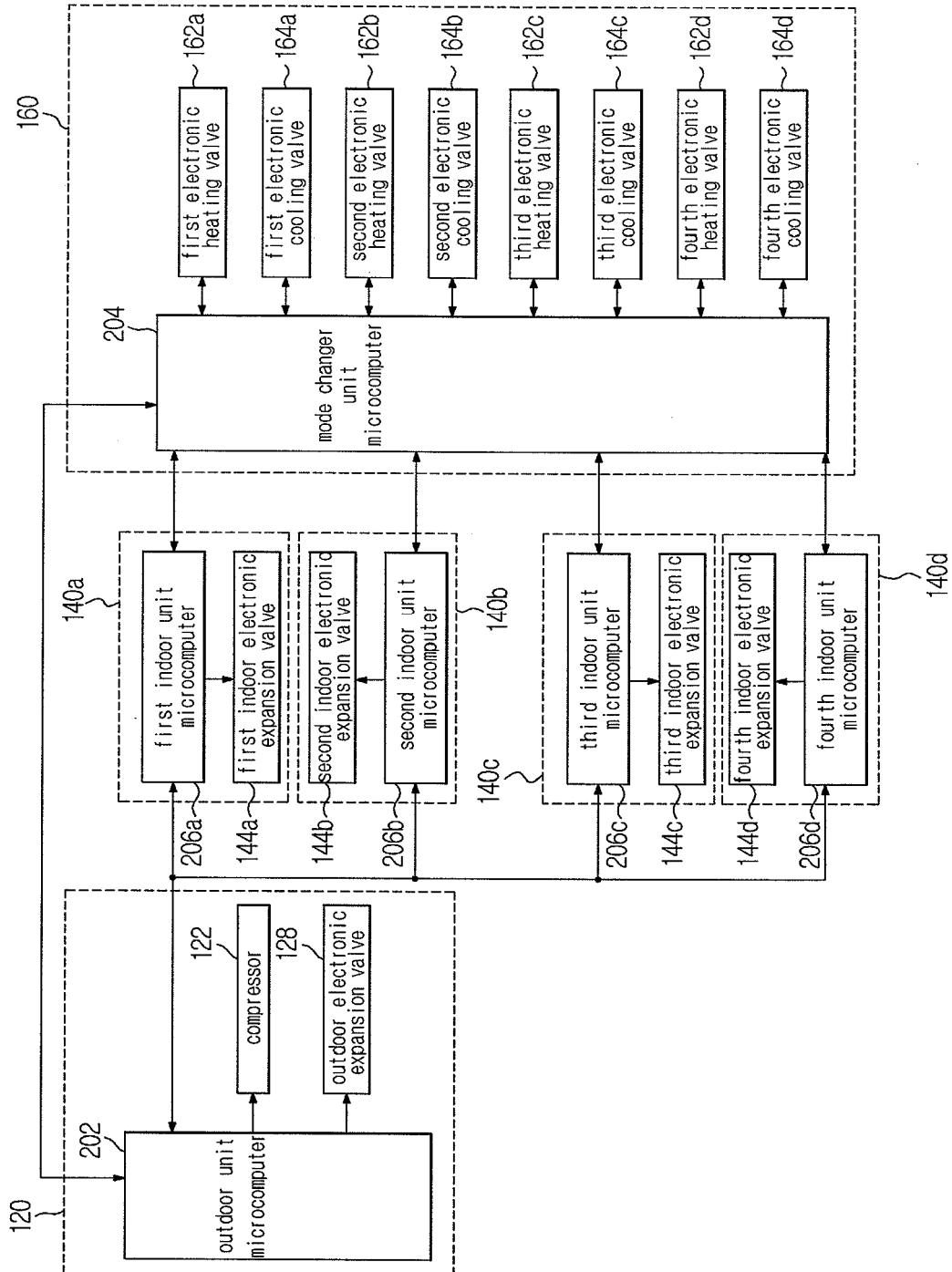


FIG 3.

