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(71) Applicant: **LG Electronics, Inc.**
Seoul 150-721 (KR)

(72) Inventor: **Jang, Seokhoon**
153-802 Seoul (KR)

(74) Representative: **Vossius & Partner**
Siebertstrasse 4
81675 München (DE)

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

(57) Provided are an air conditioner and a control method thereof. The air conditioner includes a main body defining an outer appearance, an indoor heat exchanger disposed within the main body, a plurality of branch tubes guiding a refrigerant introduced into the indoor heat exchanger, a circulation tube connected to the plurality of branch tubes to guide the refrigerant, a bypass tube connecting a portion of the plurality of branch tubes to the circulation tube, and a branch tube valve disposed in the portion of the plurality of branch tubes to adjust a flow of the refrigerant flowing into the portion of the plurality of branch tubes. The portion of the plurality of branch tubes has a diameter less than that of each of the remaining branch tubes. In a cooling mode, the refrigerant is introduced from the circulation tube into the indoor heat exchanger through the portion of the plurality of branch tubes. In a heating mode, the refrigerant is discharged from the indoor heat exchanger into the circulation tube through the bypass tube.

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Description

BACKGROUND

[0001] The present disclosure relates to an air conditioner and a control method thereof.

[0002] Air conditioners are cooling/heating systems that cool an indoor space by repeatedly performing a series of operations, including suctioning indoor air, performing heat-exchange between a low-temperature refrigerant and the suctioned indoor air, and discharging the heat-exchanged air into the indoor space, or heats the indoor space by repeatedly performing the above operations for cooling in reverse. Such an air conditioner has a series of cycles constituted by a compressor, a condenser, an expansion valve, and an evaporator.

[0003] Air conditioners may be largely classified into separation type air conditioners in which indoor and outdoor units are separately installed and integrated air conditioners in which the indoor and outdoor units are integrated. In recent years, the separation type air conditioners are preferred in consideration of an installation space and noise.

[0004] An indoor unit of such an air conditioner includes an indoor heat exchanger in which a refrigerant circulated into the air conditioner with indoor air are heat-exchanged with each other. The indoor air absorbs or dissipates heat through the heat-exchange with the refrigerant.

[0005] Fig. 1 is a graph illustrating air speed distribution in upper and lower positions of an indoor heat exchanger. Referring to Fig. 1, a speed of air passing through the indoor heat exchanger varies according to vertical positions of the indoor heat exchangers.

[0006] However, since a refrigerant tube constituting the indoor heat exchanger has the same diameter regardless of the upper and lower-side indoor heat exchangers, it may be difficult to efficiently perform the heat-exchange.

SUMMARY

[0007] Embodiments provide an air conditioner and a control method thereof.

[0008] In one embodiment, an air conditioner includes: a main body defining an outer appearance; an indoor heat exchanger disposed within the main body; a plurality of branch tubes for guiding a refrigerant introduced into the indoor heat exchanger; a circulation tube connected to the plurality of branch tubes to guide the refrigerant; a bypass tube connecting a portion of the plurality of branch tubes to the circulation tube; and a branch tube valve disposed in the portion of the plurality of branch tubes to adjust a flow of the refrigerant flowing into the portion of the plurality of branch tubes, wherein the portion of the plurality of branch tubes has a diameter less than that of the remaining branch tubes, wherein the air conditioner is configured to direct the refrigerant, in a cooling mode, from the circulation tube into the indoor heat exchanger through the portion of the plurality of branch tubes; and, in a heating mode, from the indoor heat exchanger into the circulation tube through the bypass tube.

[0009] The branch tube valve may enable the refrigerant to flow in the cooling mode and black a flow of the refrigerant in the heating mode.

[0010] The indoor heat exchanger may include a plurality of heat exchangers vertically spaced apart from each other, and the plurality of branch tubes may be connected to the plurality of heat exchangers, respectively.

[0011] The portion of the plurality of branch tubes may be connected to a heat exchanger having a small amount of air flowing therethrough among the plurality of heat exchangers.

[0012] The bypass tube may have a diameter greater than the portion of the plurality of branch tubes.

[0013] A lower-side branch tube of the plurality of branch tubes may have a diameter less than that of an upper-side branch tube.

[0014] A bypass valve for adjusting a flow of the refrigerant flowing into the bypass tube may be disposed at the bypass tube.

[0015] The bypass valve may block a flow of the refrigerant in the cooling mode and enable the refrigerant to flow in the heating mode.

[0016] Each of the valves may include one of a solenoid valve, an electric expansion valve, and a check valve.

[0017] The branch tube valve may include a check valve that prevents the refrigerant from being discharged from the indoor heat exchanger through the portion of the plurality of branch tubes in the heating mode.

[0018] The bypass valve may include a check valve that prevents the refrigerant from being introduced into the indoor heat exchanger through the bypass tube in the cooling mode.

[0019] In another embodiment, an air conditioner includes: a main body defining an outer appearance; a circulation tube in which a refrigerant flows; a first heat exchanger disposed in a side of the main body; a first inflow-side branch tube guiding the refrigerant from the circulation tube into the first heat exchanger in a cooling mode; a second heat exchanger disposed above the first heat exchanger; a second inflow-side branch tube guiding the refrigerant from the circulation tube into the second heat exchanger in the cooling mode; and a bypass tube bypassing the refrigerant, which is introduced from the first heat exchanger into the first branch tube, into the circulation tube in a heating mode, wherein the first inflow-side branch tube has a diameter less than that of the second inflow-side branch tube.

[0020] A branch tube valve selectively opening or closing the first inflow-side branch tube may be disposed in the first inflow-side branch tube, and a bypass valve selectively opening or closing the bypass tube may be disposed in the bypass tube.

[0021] The bypass tube may have a diameter greater than that of the first inflow-side branch tube.

[0022] The bypass tube may have the same diameter as that of the second inflow-side branch tube.

[0023] In further another embodiment, a method for controlling an air conditioner including a plurality of indoor heat exchangers, a plurality of branch tubes respectively connected to the plurality of indoor heat exchangers, and a refrigerant circulation tube connected to the plurality of branch tubes includes: selectively closing a first branch tube having the smallest diameter of the plurality of branch tubes on the basis of an operation mode of the air conditioner; and allowing a refrigerant discharged from the indoor heat exchangers to bypass the first branch tube by selectively opening a bypass tube for guiding the refrigerant into the circulation tube on the basis of the operation mode of the air conditioner.

[0024] When one of the bypass tube and the first branch tube is opened, the other one may be closed.

[0025] When the air conditioner is in a cooling mode, the bypass tube is blocked, and the first branch tube may be open.

[0026] When the air conditioner is in a heating mode, the bypass tube may be open, and the first branch tube may be blocked.

[0027] The details of one or more embodiments are set forth in the accompanying drawings and the description below. Other features will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] Fig. 1 is a graph illustrating air speed distribution in upper and lower-side indoor heat exchangers.

[0029] Fig. 2 is a perspective view illustrating an indoor unit of an air conditioner according to an embodiment.

[0030] Fig. 3 is a schematic view of the air conditioner according to an embodiment.

[0031] Fig. 4 is a flowchart illustrating a method of controlling an indoor unit of an air conditioner according to an embodiment.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0032] Reference will now be made in detail to the embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings.

[0033] In the following detailed description of the preferred embodiments, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration specific preferred embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is understood that other embodiments may be utilized and that logical structural, mechanical, electrical, and chemical changes may be made without departing from the scope of the invention. To avoid detail not necessary to enable those skilled in the art to practice the invention, the description may omit certain information known to those skilled in the art. The following detailed description is, therefore, not to be taken in a limiting sense.

[0034] Fig. 2 is a perspective view illustrating an indoor unit of an air conditioner according to an embodiment. Although a ceiling type indoor unit is provided in Fig. 2, the present disclosure is not limited to the ceiling type indoor unit.

[0035] Referring to Fig. 2, an indoor unit 100 of an air conditioner according to an embodiment includes a front panel 120 defining an edge portion of an outer appearance of a bottom surface thereof, a suction grill 130 disposed in a central portion of the front panel 120 to introduce indoor air into the indoor unit 100, a cabinet 140 defining an upper outer appearance of the indoor unit 100 and including a plurality of components therein, and a base 150 covering a top surface of the cabinet 140 and configured to mount the indoor unit 100 on a ceiling. An overall outer appearance of the indoor unit 100 is defined by the front panel 120, the suction grill 130, the cabinet 140, and the base 150.

[0036] The front panel 120 is punched in a square shape so that the suction grill 130 is mounted therein. Also, discharge holes 160 having a rectangular shape are defined in a bottom surface of the front panel 120. The discharge holes 160 discharge air heat-exchanged within the indoor unit 100 again into an indoor space. Front, rear, left, and right portions of the front panel 120 are punched in the same shape to define the discharge holes, respectively.

[0037] Also, a louver 170 configured to force a flow direction of the air discharged into the indoor space through each of the discharge holes 160 is disposed in the discharge hole 160. The louver 170 has a square plate shape corresponding to a shape and size of the discharge hole 160. The louver 170 is connected to a motor (not shown) for generating rotation force to rotate, thereby forcing a flow direction of air.

[0038] The suction grill 130 having an approximately square shape is mounted in a central portion of the front panel 120. As described above, the suction grill 130 suctions indoor air into the indoor unit 100. Thus, a plurality of suction holes 180 that are longitudinally cut in a horizontal direction and vertically penetrated are defined in a central portion of the suction grill 130.

[0039] A blower unit (not shown) for forcibly introducing the indoor air into the indoor unit 100 and a heat exchanger 200 in which the air introduced into the indoor unit 100 is heat-exchanged with the refrigerant are disposed above the suction grill 130, i.e., within the cabinet 140.

[0040] The indoor heat exchanger 200 may include a tube that is bent several times. The tube that is bent several times may have a predetermined distance between the bent portions thereof. Also, the indoor air may pass through the distance.

[0041] The indoor heat exchanger 200 may be vertically disposed between the front panel 120 and the base 150. That is to say, the indoor heat exchanger 200 may be vertically disposed with respect to the ground. Also,

the indoor heat exchanger 200 may include a plurality of heat exchangers that are vertically separated from each other. That is to say, each of the heat exchangers constituting the indoor heat exchanger 200 is horizontally disposed with respect to the ground, and the plurality of heat exchangers are vertically stacked on each other. Also, the plurality of heat exchangers may be vertically arranged to be spaced apart from each other. A detailed structure of the indoor heat exchanger 200 will be described below.

[0042] Fig. 3 is a schematic view of the air conditioner according to an embodiment.

[0043] Referring to Fig. 3, an air conditioner 10 according to an embodiment may include a circulation tube 11 in which a refrigerant that is a working fluid is circulated, a compressor 12 for compressing a suctioned refrigerant to discharge the compressed fluid, an outer heat exchanger 14 in which the refrigerant is heat-exchanged with outdoor air, an expansion device 15 for expanding the refrigerant passing therethrough, and the indoor unit 100. Also, the compressor 12, the outdoor heat exchanger 14, the expansion device 15, and the indoor unit 100 are connected to the circulation tube 11.

[0044] The indoor unit may include the indoor heat exchanger 200, branch tubes 210 and 220 connecting the circulation tube 11 to the indoor heat exchanger 200, and an indoor expansion valve 230 for expanding the refrigerant introduced into the indoor heat exchanger 200.

[0045] The indoor heat exchanger 200 may include a plurality of heat exchangers 200a, 200b, and 200c which are distinguished according to upper and lower positions thereof. In the current embodiment, the plurality of heat exchangers may be independently provided, or one heat exchanger may be distinguished according to a portion of a refrigerant tube.

[0046] The plurality of heat exchangers 200a, 200b, and 200c may be successively referred to as a first heat exchanger 200a, a second heat exchanger 200b, and a third heat exchanger 200c when defined from a heat exchanger close to the front panel 120. That is to say, the plurality of heat exchangers 200a, 200b, and 200c may be successively referred to as a third heat exchanger 200c, a second heat exchanger 200b, and a first heat exchanger 200a when defined from a heat exchanger close to the base 110. In the current embodiment, for convenience of description, the indoor heat exchanger including three heat exchangers will be described as an example. However, the present disclosure is not limited to the number of heat exchangers.

[0047] The branch tubes 210 and 220 includes a plurality of cooling mode inflow-side branch tubes 210 and a plurality of cooling mode discharge-side branch tubes 220 which are respectively connected to both sides of the indoor heat exchanger 200. The plurality of cooling mode inflow-side branch tubes 210 and the plurality of cooling mode discharge-side branch tubes 220 are vertically spaced apart from each other.

[0048] According to an operation mode of the air conditioner 10, the cooling mode inflow-side branch tube 210 may be called a heating mode discharge-side branch tube 210. Similarly, the cooling mode discharge-side branch tube 220 may be called a heating mode inflow-side branch tube 220. Hereinafter, the air conditioner on the basis of a flow direction of a refrigerant in a cooling mode will be described.

[0049] The cooling mode inflow-side branch tube 210 may include first, second, and third cooling mode inflow-side branch tubes 210a, 210b, and 210c which are disposed between the outdoor heat exchanger 14 and the indoor heat exchanger 200 to respectively guide a refrigerant into the first, second, and third heat exchangers 200a, 200b, and 200c.

[0050] Similarly, the cooling mode discharge-side branch tube 220 may include first, second, and third cooling mode discharge-side branch tubes 220a, 220b, and 220c which are disposed between the indoor heat exchanger 200 and the compressor 12 to respectively guide a refrigerant from the first, second, and third heat exchangers 200a, 200b, and 200c.

[0051] Referring to Fig. 1, a speed of air passing through the first heat exchanger 200a disposed at a lower side is relatively slower than that of air passing though the second or third heat exchangers 200b or 200c. Thus, the first inflow-side branch tube 210a disposed at a lower side may have a diameter less than those of other branch tubes. That is, the first inflow-side branch tube 210a having the relatively small diameter may be connected to the first heat exchanger 200a in which a flow rate of air passing through is relatively less among the plurality of heat exchangers. That is to say, the branch tube 210 may have a diameter to correspond to a flow rate of air passing through the heat exchanger 200 connected to the branch tube 210.

[0052] Thus, when the cooling operation is performed, an amount of refrigerant introduced into the first heat exchanger 200a disposed at the lower side may be less than that of refrigerant introduced into other heat exchangers 200b and 200c.

[0053] A branch tube valve 250 for adjusting an amount of refrigerant flowing into the first cooling mode inflow-side branch tube 210a may be disposed in the first cooling mode inflow-side branch tube 210a.

[0054] The branch tube valve 250 may be a solenoid valve that is selectively openable or an electric expansion valve (EEV) of which an opened degree is adjustable.

[0055] Also, the branch tube valve 250 may be a check valve for guiding a refrigerant in only one direction. In this case, the check valve may guide a refrigerant so that the refrigerant is introduced into the first heat exchanger 200a through the first cooling mode inflow-side branch tube 210a in the cooling mode and prevent a refrigerant from being discharged from the first heat exchanger 200a through the first cooling mode inflow-side branch tube 210a in the heating mode.

[0056] Since the first cooling mode inflow-side branch tube 210a (the first heating mode discharge-side branch

tube) has a diameter less than that of the first cooling mode discharge-side branch tube 220a (the first heating mode inflow-side branch tube), when the indoor unit is converted in operation mode to perform the heating mode, the refrigerant introduced into the first cooling mode discharge-side branch tube 220a may be stagnated in the first cooling mode inflow-side branch tube 210a.

[0057] To prevent the above-described phenomenon from occurring, a bypass tube 260 may be connected between the first cooling mode inflow-side branch tube 210a and the circulation tube 11.

[0058] The bypass tube 260 may be configured so that a portion of the refrigerant discharged from the indoor heat exchanger 200 bypasses the branch tube 210 and then is introduced into the circulation tube 11. The bypass tube 260 may have one side connected to the first cooling mode inflow-side branch tube 210a and the other side connected between the expansion device 15 and the cooling mode inflow-side branch tube 210.

[0059] That is to say, the bypass tube 260 may have one side connected to the first heating mode discharge-side branch tube 210a and the other side connected between the expansion device 15 and the heating mode discharge-side branch tube 210.

[0060] The bypass tube 260 may have a diameter greater than that of the first cooling mode inflow-side branch tube 210a. Also, the bypass tube 260 may have the same diameter as that of the second cooling mode inflow-side branch tube 210b or the third cooling mode inflow-side branch tube 210c. Also, the bypass tube 260 may have a diameter to correspond to that of the first cooling mode discharge-side branch tube 220a.

[0061] In the heating mode, a refrigerant may be guided from the first heat exchanger 200a into the expansion device 15 through the bypass tube 260 having a sufficient diameter without the stagnation phenomenon.

[0062] A bypass valve 265 for adjusting an amount of refrigerant flowing into the bypass tube 260 may be disposed in the bypass tube 260.

[0063] The bypass valve 265 may be opened in the heating mode and closed in the cooling mode. Thus, it may prevent a refrigerant from being introduced into the first heat exchanger 200a through the bypass tube 260 in the cooling mode. The bypass valve 265 may be a solenoid valve or an EEV valve.

[0064] Also, the bypass valve 265 may be a check valve for guiding a refrigerant in only one direction. In this case, the check valve may prevent a refrigerant from being introduced into the first heat exchanger 200a through the bypass tube 260 in the cooling mode and guide a refrigerant so that the refrigerant is discharged from the first heat exchanger 200a through the bypass tube 260 in the heating mode.

[0065] According to an embodiment, the first cooling mode inflow-side branch tube 210a disposed at the lower side may be changed in structure to improve cooling efficiency.

[0066] In the heating mode, since a refrigerant introduced into the indoor heat exchanger 200 mainly has a gaseous sate, the refrigerant is not considerably influenced from the gravity. However, in the cooling mode, a refrigerant introduced into the indoor heat exchanger 200 mainly has a liquid state.

[0067] Thus, unlike the speed or amount distribution of air, the refrigerant may be considerably influenced from the gravity. As a result, more amount of refrigerant may be introduced into the branch tube disposed at the lower side.

[0068] Therefore, in the current embodiment, the lower-side inflow branch tube may be designed to have a small diameter in the cooling mode. Thus, an optimum passage may be designed in the cooling mode on the basis of the air speed distribution in the upper and lower positions of the heat exchanger in the cooling mode.

[0069] However, on the other hand, the first heating mode inflow-side branch tube 220a may be changed in structure to design an optimum passage in the heating mode. Detailed descriptions with respect to the design of the optimum passage will be omitted.

[0070] Fig. 4 is a flowchart illustrating a method of controlling an indoor unit of an air conditioner according to an embodiment. The method of controlling the indoor unit of the air conditioner will be described with reference to Fig. 4.

[0071] When an air conditioner is turned on (S100), an operation mode of the air conditioner may be determined (S110).

[0072] When the determined operation mode is the cooling mode, a bypass valve 265 is blacked (S120). As the bypass valve 265 is blocked, it prevent a refrigerant from being introduced into the bypass tube 260.

[0073] Then, a branch tube valve 250 is opened (S130). As the branch tube valve 250 is opened, the refrigerant may be introduced into a first heat exchanger 200a through a first cooling mode inflow-side branch tube 210a.

[0074] When the determined operation mode is a heating mode, the bypass valve 265 is opened (S140). As the bypass valve 265 is opened, a refrigerant discharged from the first heat exchanger 200a may smoothly flow through the bypass tube 260 without a stagnation phenomenon.

[0075] Then, a branch tube valve 250 is blocked (S150). As the branch tube valve 250 is blocked, it prevent the refrigerant discharged from the first heat exchanger 200a from being introduced into a first heating mode discharge-side branch tube 210a.

[0076] As described above, when the bypass valve 265 or the branch tube valve 250 is a check valve, an operation for controlling the bypass valve 265 or the branch tube valve 250 may be omitted.

[0077] According to the embodiment, an amount of guided refrigerant may vary according to vertical positions of the indoor heat exchanger to improve the heat-exchange efficiency and the performance of the air conditioner. Also, the optimum refrigerant passage in the

cooling mode may be designed to improve cooling efficiency. Also, when the heating operation is performed, the refrigerant may be bypassed through the predetermined bypass tube to prevent the refrigerant stagnation phenomenon that may occur according to the optimized design for cooling from occurring.

[0078] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the scope of claims. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

Claims

1. An air conditioner comprising:

a main body defining an outer appearance;
an indoor heat exchanger (200) disposed within the main body;
a plurality of branch tubes (210) for guiding a refrigerant into the indoor heat exchanger (200);
a circulation tube (11) connected to the plurality of branch tubes (210) to guide the refrigerant;
a bypass tube (260) connecting a portion of the plurality of branch tubes (210a) to the circulation tube (11); and
a branch tube valve (250) disposed in the portion of the plurality of branch tubes (210a) to adjust a flow of the refrigerant flowing into the portion of the plurality of branch tubes (210a),
wherein the portion of the plurality of branch tubes (210a) has a diameter less than that of the remaining branch tubes (210b, 210c),
wherein the air conditioner is configured to direct the refrigerant, in a cooling mode, from the circulation tube (11) into the indoor heat exchanger (200) through the portion of the plurality of branch tubes (210a); and, in a heating mode, from the indoor heat exchanger (200) into the circulation tube (11) through the bypass tube (260).

2. The air conditioner according to claim 1, wherein the branch tube valve (250) is configured to enable the refrigerant to flow in the cooling mode and block a flow of the refrigerant in the heating mode.

3. The air conditioner according to claim 1 or 2, wherein the indoor heat exchanger (200) comprises a plurality of heat exchangers (200a, 200b, 200c) vertically spaced apart from each other, and
the plurality of branch tubes (210a, 210b, 210c) are connected to the plurality of heat exchangers (200a, 200b, 200c), respectively.

4. The air conditioner according to claim 3, wherein the portion of the plurality of branch tubes (210a) is connected to a heat exchanger (200a) having a small amount of air flowing therethrough among the plurality of heat exchangers.

5. The air conditioner according to any one of the preceding claims, wherein the bypass tube (260) has a diameter greater than the portion of the plurality of branch tubes (210a).

6. The air conditioner according to any one of the preceding claims, wherein a lower-side branch tube (210a) of the plurality of branch tubes has a diameter less than that of an upper-side branch tubes (210b, 210c).

7. The air conditioner according to any one of the preceding claims, wherein a bypass valve (265) for adjusting a flow of the refrigerant flowing into the bypass tube (260) is disposed at the bypass tube (260).

8. The air conditioner according to claim 7, wherein the bypass valve (265) is configured to block a flow of the refrigerant in the cooling mode and enable the refrigerant to flow in the heating mode.

9. The air conditioner according to any one of the preceding claims, wherein the branch tube valve (250) comprises a check valve that is configured to prevent the refrigerant from being discharged from the indoor heat exchanger (200) through the portion of the plurality of branch tubes (210a) in the heating mode.

10. The air conditioner according to claim 7 or 8, wherein the bypass valve (265) comprises a check valve that is configured to prevent the refrigerant from being introduced into the indoor heat exchanger (200) through the bypass tube (260) in the cooling mode.

11. A method for controlling an air conditioner comprising a plurality of indoor heat exchangers (200a, 200b, 200c), a plurality of branch tubes (210a, 210b, 210c) respectively connected to the plurality of indoor heat exchangers, and a refrigerant circulation tube (11) connected to the plurality of branch tubes, the method comprising:

selectively closing a first branch tube (210a) having the smallest diameter of the plurality of branch tubes on the basis of an operation mode of the air conditioner; and
allowing a refrigerant discharged from the indoor

heat exchangers to bypass the first branch tube (210a) by selectively opening a bypass tube (260) for guiding the refrigerant into the circulation tube (11) on the basis of the operation mode of the air conditioner.

12. The method according to claim 11, wherein, when one of the bypass tube (260) and the first branch tube (210a) is opened, the other one is closed.

13. The method according to claim 11 or 12, wherein, when the air conditioner is in a cooling mode, the bypass tube (260) is blocked, and the first branch tube (210a) is open.

14. The method according to any of claims 11 to 13, wherein, when the air conditioner is in a heating mode, the bypass tube (260) is open, and the first branch tube (210a) is blocked.

Fig. 1

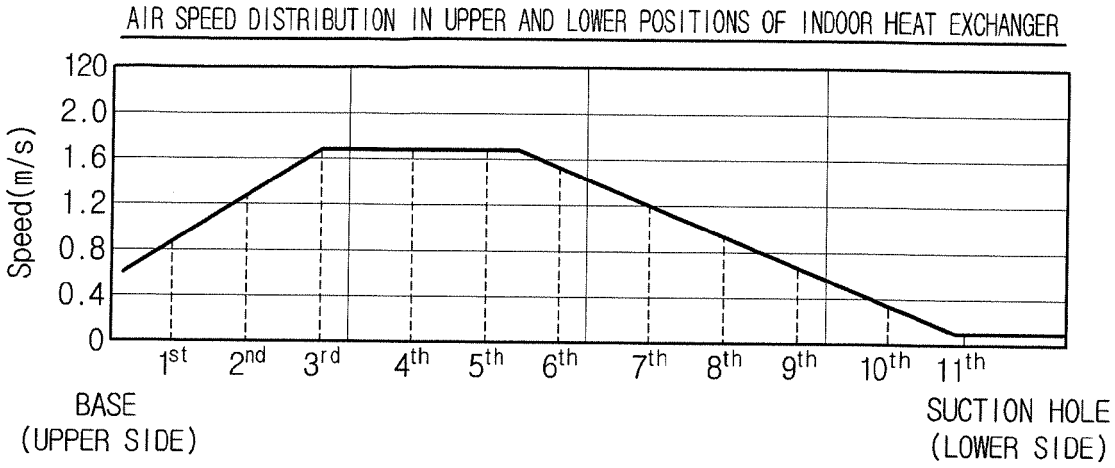

AIR SPEED DISTRIBUTION IN UPPER AND LOWER POSITIONS OF INDOOR HEAT EXCHANGER
Speed(m/s)
120
2.0
1.6
1.2
0.8
0.4
0
1st
2nd
3rd
4th
5th
6th
7th
8th
9th
10th
11th
BASE
(UPPER SIDE)
SUCTION HOLE
(LOWER SIDE)

Fig. 2

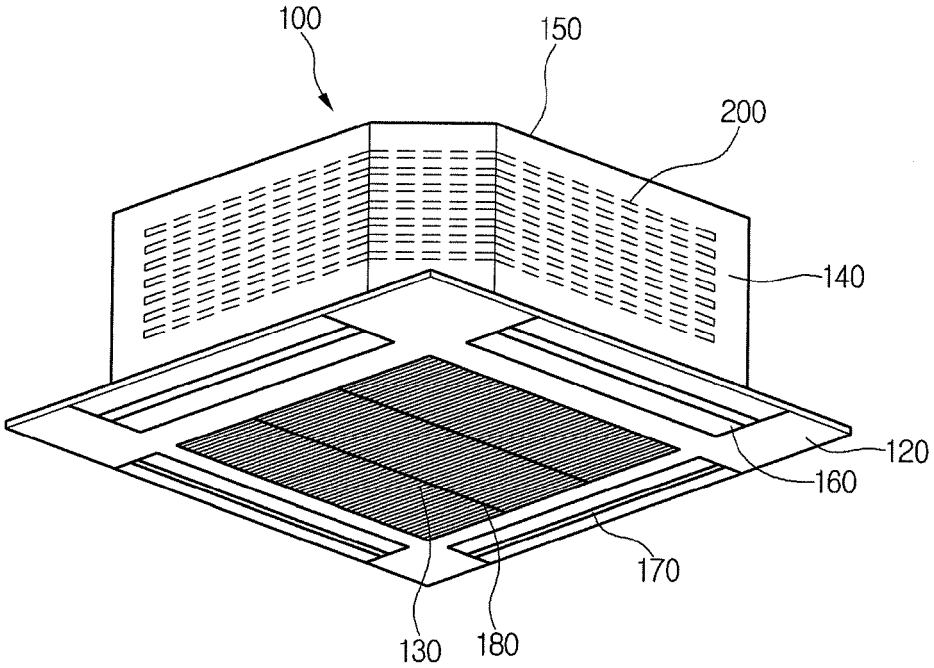

100
150
200
140
120
160
170
130
180

Fig. 3

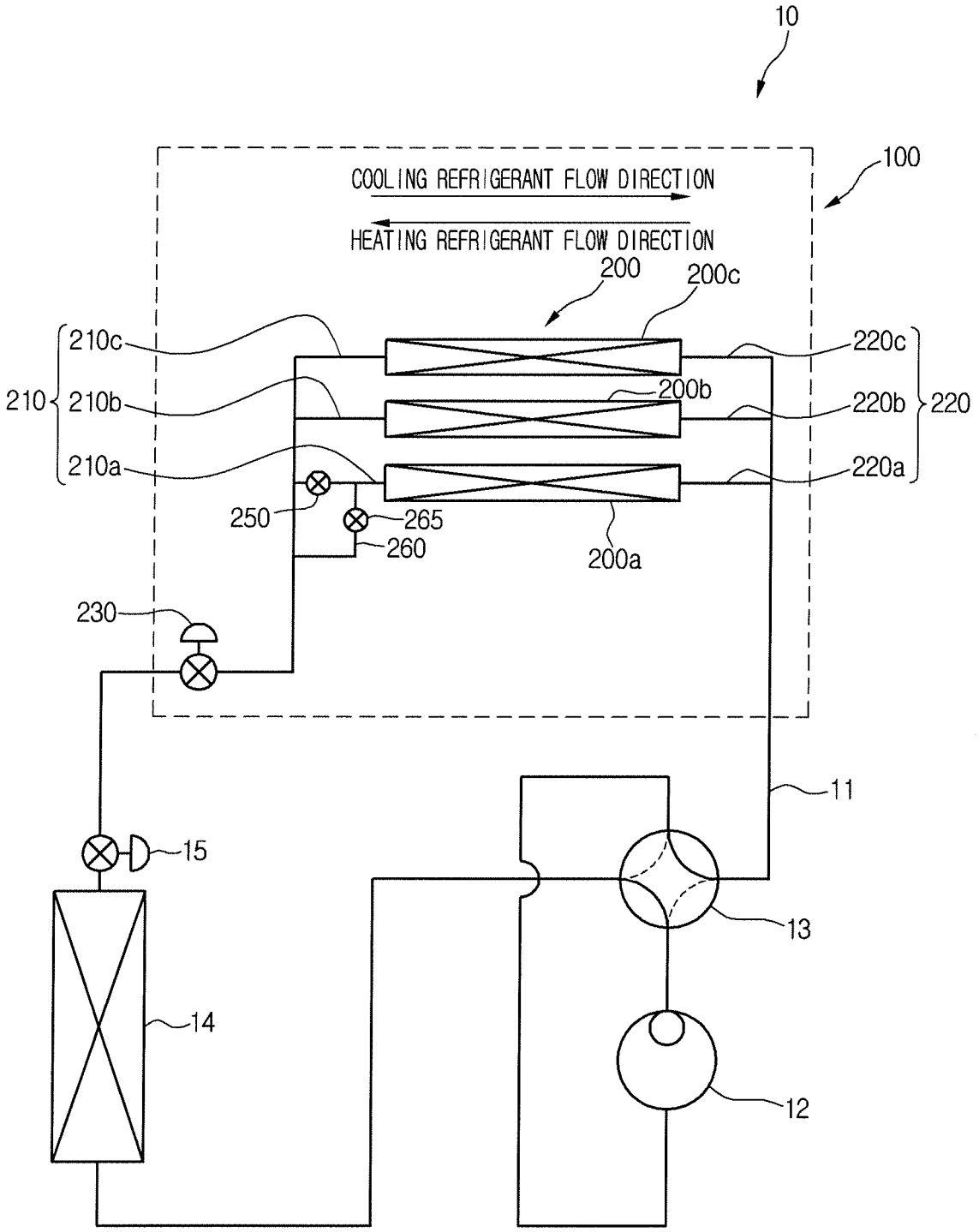
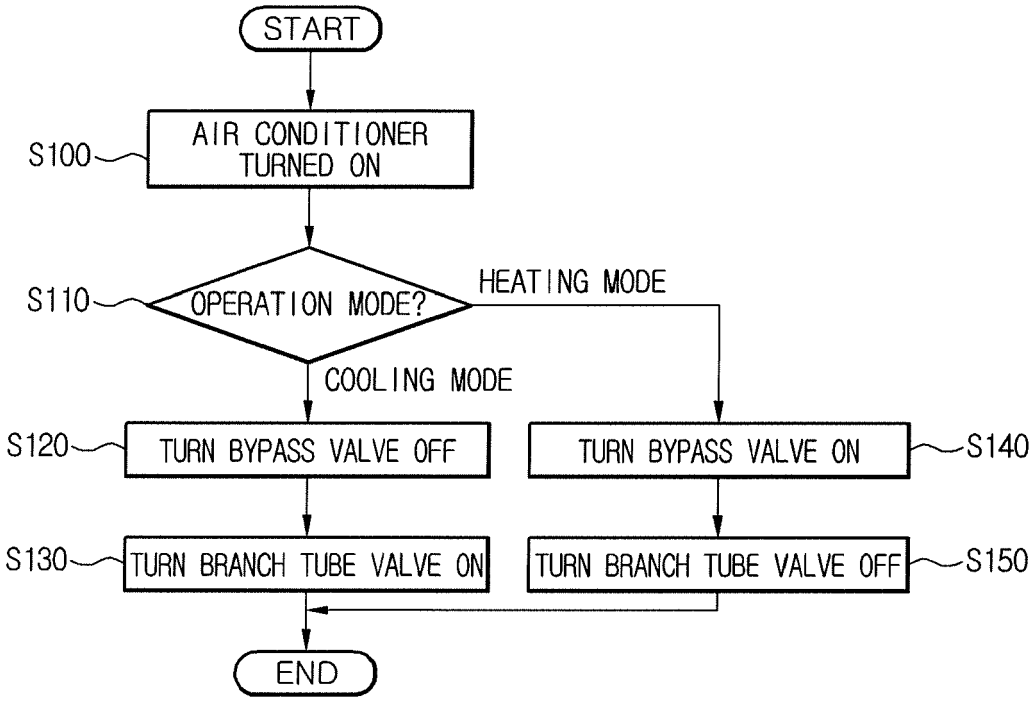

10
100
COOLING REFRIGERANT FLOW DIRECTION
HEATING REFRIGERANT FLOW DIRECTION
200
200c
200b
200a
210
210c
210b
210a
220
220c
220b
220a
250
265
260
230
11
15
14
13
12

Fig. 4


START
AIR CONDITIONER TURNED ON
S100
OPERATION MODE?
S110
HEATING MODE
COOLING MODE
TURN BYPASS VALVE OFF
S120
TURN BYPASS VALVE ON
S140
TURN BRANCH TUBE VALVE ON
S130
TURN BRANCH TUBE VALVE OFF
S150
END

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European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 13 18 1163

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2012/014345 A1 (MITSUBISHI ELECTRIC CORP [JP]; WAKAMOTO SHINICHI [JP]; TAKENAKA NAOFUM) 2 February 2012 (2012-02-02)	1-9, 11-14	INV. F25B13/00 F25B41/04
A	* paragraphs [0009], [0049] - [0051], [0075], [0017], [0022], [0033], [0064]; figures 1,23 * & EP 2 600 082 A1 (MITSUBISHI ELECTRIC CORP [JP]) 5 June 2013 (2013-06-05)	10	
X	GB 2 194 651 A (TOSHIBA KK TOSHIBA KK [JP]) 9 March 1988 (1988-03-09) * page 2, line 49 - line 65; figure 1 *	1-6,9, 12-14	
A	EP 1 589 299 A2 (DAEWOO ELECTRONICS CORP [KR]) 26 October 2005 (2005-10-26) * paragraph [0040] - paragraph [0059]; figures 3,4 *	1-14	
A	EP 2 365 253 A2 (LG ELECTRONICS INC [KR]) 14 September 2011 (2011-09-14) * the whole document *	1-14	

TECHNICAL FIELDS SEARCHED (IPC)

F25B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 January 2014	Gasper, Ralf

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

& : member of the same patent family, corresponding document

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