(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 208 945 A1

(12) EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:
21.07.2010 Bulletin 2010/29

(21) Application number: **08835379.2**

(22) Date of filing: **12.09.2008**

(51) Int Cl.:
F24F 13/20 *(2006.01)* ***F24F 3/153*** *(2006.01)*

(86) International application number:
PCT/JP2008/002528

(87) International publication number:
WO 2009/044510 (09.04.2009 Gazette 2009/15)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

(30) Priority: **05.10.2007 JP 2007262461**

(71) Applicant: **Daikin Industries, Ltd.**
Osaka 530-8323 (JP)

(72) Inventors:
- **YABU, Tomohiro**
  Sakai-shi
  Osaka 591-8511 (JP)
- **OKUMURA, Yasunobu**
  Sakai-shi
  Osaka 591-8511 (JP)

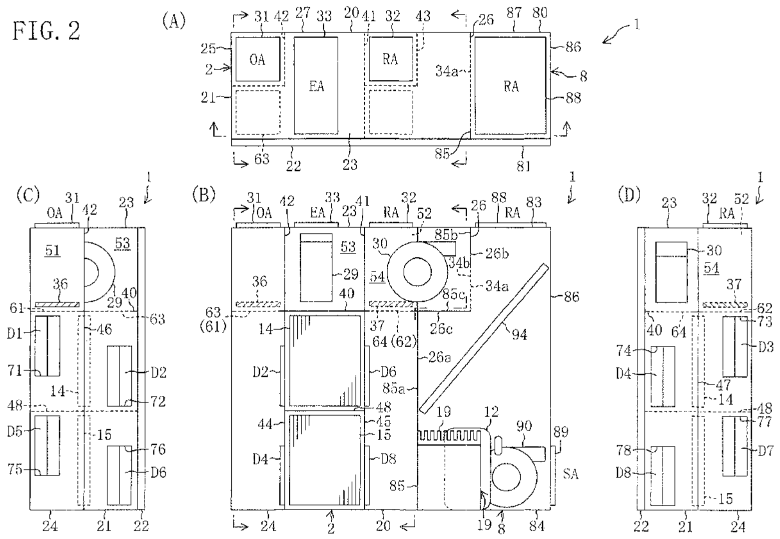
(74) Representative: **HOFFMANN EITLE**
Patent- und Rechtsanwälte
Arabellastrasse 4
81925 München (DE)

(54) AIR CONDITIONER

(57) The invention is directed to downsize a humidity adjustment unit as much as possible, thereby reducing the whole size of an air conditioner.

An air conditioner (1) includes a humidity adjustment unit (2) for adjusting air humidity, and a temperature adjustment unit (8) for adjusting air temperature. The humidity adjustment unit (2) includes a humidity adjustment casing (20), first and second adsorption heat exchangers (14, 15) for adjusting the humidity of the air in the humidity adjustment casing (20), and a humidity adjustment electrical component unit (19). The temperature adjustment unit (8) includes a temperature adjustment casing (80) aligned with the humidity adjustment casing (20), and a temperature adjustment heat exchanger (94) which is contained in the temperature adjustment casing (80), and adjusts the temperature of the air. The humidity adjustment electrical component unit (19) includes a radiator fin (19a) which dissipates generated heat, and is arranged in an air flow passage in the temperature adjustment casing (80).

FIG. 2



EP 2 208 945 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to air conditioners including a humidity adjustment unit for adjusting air humidity, and a temperature adjustment unit for adjusting air temperature.

BACKGROUND ART

[0002] Air conditioners for performing air humidity adjustment and air temperature adjustment separately have been known.

[0003] For example, an air conditioner of Patent Document 1 includes a temperature adjustment unit for handling sensible heat of air by performing a vapor compression refrigeration cycle, and a humidity adjustment unit for handling latent heat of air by means of an adsorbent capable of adsorbing/desorbing moisture in the air.

PATENT DOCUMENT 1: Japanese Patent Publication No. H09-318126

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0004] The above-described humidity adjustment unit includes various components, such as passages in which outside air and room air flow, respectively, fans for sucking the outside air and the room air into the passages, respectively, an adsorption unit for adsorbing the moisture in the air, a heat source for recovery of the adsorption unit, etc., and includes a casing for containing the components. Thus, the humidity adjustment unit includes a relatively large number of components. Therefore, the humidity adjustment unit tends to increase in size.

[0005] In view of the foregoing, the present invention has been achieved. An object of the invention is to downsize the humidity adjustment unit as much as possible, and to reduce the whole size of the air conditioner.

SOLUTION TO THE PROBLEM

[0006] According to the present invention, an electrical component unit of a humidity adjustment unit is arranged in a casing of a temperature adjustment unit.

[0007] Specifically, a first aspect of the invention is directed to an air conditioner including a humidity adjustment unit (2) for adjusting air humidity, and a temperature adjustment unit (8) for adjusting air temperature. The humidity adjustment unit (2) includes a humidity adjustment casing (20), a humidity adjustment section (11) for adjusting humidity of air in the humidity adjustment casing (20), and a humidity adjustment electrical component unit (19), the temperature adjustment unit (8) includes a temperature adjustment casing (80) aligned with the humidity adjustment casing (20), and a temperature adjustment section (91) which is contained in the temperature adjustment casing (80) to adjust temperature of air, and the humidity adjustment electrical component unit (19) includes a radiator (19a) which dissipates generated heat, and is arranged in an air flow passage in the temperature adjustment casing (80).

[0008] In the above-described configuration, the humidity adjustment electrical component unit (19) of the humidity adjustment unit (2) is arranged in the temperature adjustment casing (80) of the temperature adjustment unit (8). This can reduce the number of components arranged in the humidity adjustment casing (20) of the humidity adjustment unit (2), thereby downsizing the humidity adjustment unit (2). In general, the temperature adjustment unit (8) includes a smaller number of components than the humidity adjustment unit (2). Therefore, even if the humidity adjustment electrical component unit (19) is arranged in the temperature adjustment casing (80) of the temperature adjustment unit (8), the whole size of the air conditioner can be reduced as compared with the case where the humidity adjustment electrical component unit (19) is arranged in the humidity adjustment casing (20).

[0009] In addition, with the humidity adjustment electrical component unit (19) arranged in the air flow passage in the temperature adjustment casing (80), the humidity adjustment electrical component unit (19) can be cooled by the air flowing in the temperature adjustment casing (80) through the radiator (19a). This improves efficiency of heat dissipation of the humidity adjustment electrical component unit (19) as compared with the case where the humidity adjustment electrical component unit (19) is arranged in the humidity adjustment casing (20), thereby downsizing the radiator (19a), and reducing the whole size of the humidity adjustment electrical component unit (19). This alleviates size increase of the temperature adjustment unit, even when the humidity adjustment electrical component unit (19) is arranged in the temperature adjustment casing (80).

[0010] In a second aspect of the invention related to the first aspect of the invention, the temperature adjustment section (91) includes a temperature adjustment heat exchanger (94) for adjusting the temperature of the air flowing in the air flow passage in the temperature adjustment casing (80), and the humidity adjustment electrical component unit (19) is arranged upstream of the temperature adjustment heat exchanger (94).

[0011] If the humidity adjustment electrical component unit (19) is arranged downstream of the temperature adjustment heat exchanger (94), the air heated by the temperature adjustment heat exchanger (94) cools the humidity adjustment electrical component unit (19) when the temperature adjustment unit (8) performs heating operation, thereby decreasing the efficiency. Thus, in the above-described configuration, the humidity adjustment electrical component unit (19) is arranged upstream of the temperature adjustment heat exchanger (94). Therefore, the humidity adjustment electrical component unit (19) can be cooled by the air which is not temperature-adjusted yet, thereby efficiently cooling the humidity adjustment electrical component unit (19) even when the temperature adjustment unit (8) performs the heating operation.

[0012] In a third aspect of the invention related to the second aspect of the invention, the temperature adjustment heat exchanger (94) is obliquely arranged in the air flow passage in the temperature adjustment casing (80).

[0013] In the above-described configuration, the temperature adjustment heat exchanger (94) is obliquely arranged relative to the air flow passage in the temperature adjustment casing (80), thereby providing the temperature adjustment heat exchanger (94) of a sufficient area even if the temperature adjustment casing (80) has been reduced in size. Specifically, the temperature adjustment casing (80), i.e., the temperature adjustment unit (8), can be downsized, while providing the sufficient area for the temperature adjustment heat exchanger (94).

[0014] In a fourth aspect of the invention related to the first aspect of the invention, the humidity adjustment section (11) includes a refrigerant circuit (11) performing a refrigeration cycle, and connecting an adsorption heat exchanger (14, 15) which carries an adsorbent for adsorbing and desorbing moisture on a surface thereof, and a temperature adjustment compressor (12) which compresses a refrigerant, and the temperature adjustment compressor (12) is arranged in the temperature adjustment casing (80).

[0015] In the above-described configuration, the temperature adjustment compressor (12) is arranged in the temperature adjustment casing (80) together with the humidity adjustment electrical component unit (19). This can further downsize the humidity adjustment unit (2).

[0016] In a fifth aspect of the invention related to the first aspect of the invention, the temperature adjustment section (91) includes a refrigerant circuit (91) performing a refrigeration cycle, and connecting a temperature adjustment heat exchanger (94) which adjusts the temperature of the air flowing in the air flow passage in the temperature adjustment casing (80), and a compressor (92) which is arranged in an outdoor unit, and compresses a refrigerant, the humidity adjustment section (11) includes an adsorption heat exchanger (14, 15) which carries an adsorbent for adsorbing and desorbing moisture on a surface thereof, and the adsorption heat exchanger (14, 15) is connected to the refrigerant circuit (91).

[0017] In the above-described configuration, the temperature adjustment heat exchanger (94) of the temperature adjustment section (91) and the adsorption heat exchangers (14, 15) of the humidity adjustment section (11) are connected to the single refrigerant circuit (91), and the refrigerant is circulated by means of the shared compressor (92). Therefore, a compressor exclusive for the humidity adjustment is no longer necessary, and space for installation of the temperature adjustment compressor is not required any more. This can further reduce the humidity adjustment unit (2) and the temperature adjustment unit (8).

[0018] In a sixth aspect of the invention related to the first aspect of the invention, the humidity adjustment unit (2) and the temperature adjustment unit (8) are separately constructed, and are integrally assembled in assembly of the air conditioner.

[0019] In the above-described configuration, the humidity adjustment unit (2) and the temperature adjustment unit (8) can independently be handled before they are assembled. Further, both of the units can easily be handled by reducing their sizes.

ADVANTAGES OF THE INVENTION

[0020] According to the present invention, the humidity adjustment electrical component unit (19) of the humidity adjustment unit (2) is arranged in the temperature adjustment casing (80) of the temperature adjustment unit (8), thereby downsizing the humidity adjustment unit (2). In this case, the efficiency of heat dissipation of the humidity adjustment electrical component unit (19) is improved by arranging the humidity adjustment electrical component unit (19) in the air flow passage in the temperature adjustment casing (80). This can downsize the radiator (19a) of the humidity adjustment electrical component unit (19), and can reduce the whole size of the humidity adjustment electrical component unit (19), thereby alleviating size increase of the temperature adjustment unit (8).

[0021] According to the second aspect of the invention, the humidity adjustment electrical component unit (19) is arranged in the temperature adjustment casing (80) upstream of the temperature adjustment heat exchanger (94). Therefore, even when the temperature adjustment unit (8) performs the heating operation, the humidity adjustment electrical component unit (19) can efficiently be cooled.

[0022] According to the third aspect of the invention, the temperature adjustment heat exchanger (94) is obliquely arranged in the air flow passage in the temperature adjustment casing (80). This can downsize the temperature adjustment casing (80), i.e., the temperature adjustment unit (8), while providing a sufficient area for the temperature adjustment heat exchanger (94).

[0023] According to the fourth aspect of the invention, the temperature adjustment compressor (12) is arranged in the temperature adjustment casing (80) together with the humidity adjustment electrical component unit (19). This can further downsize the humidity adjustment unit (2).

[0024] According to the fifth aspect of the invention, the adsorption heat exchanger (14, 15) of the humidity adjustment section (11) is connected to the refrigerant circuit (91) connecting the temperature adjustment heat exchanger (94) and the compressor (92), and performing a refrigeration cycle. As a result, the compressor (92) can be shared between the humidity adjustment unit (2) and the temperature adjustment unit (8), thereby further downsizing the humidity adjustment unit (2) and the temperature adjustment unit (8).

[0025] According to the sixth aspect of the invention, the humidity adjustment unit (2) and the temperature adjustment unit (8) are separately constructed, and are integrally assembled in assembly of the air conditioner. Combined with the downsizing of the units, this allows for easy handling of the units.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026]

[FIG. 1] FIG. 1 is a specific perspective view of an air conditioner of a first embodiment.

[FIG. 2] FIG. 2 is a schematic view of the air conditioner, in which FIG. 2(A) is a plan view, FIG. 2(B) is a view observed in a direction of an arrow B-B in FIG. 2(A), FIG. 2(C) is a view observed in a direction of an arrow C-C in FIG. 2(A), and FIG. 2(D) is a view observed in a direction of an arrow D-D in FIG. 2(A).

[FIG. 3] FIG. 3 is a perspective view illustrating the inside of a humidity adjustment unit.

[FIG. 4] FIG. 4 is a perspective view schematically illustrating an adsorption heat exchanger.

[FIG. 5] FIG. 5 is a schematic view illustrating a refrigerant circuit of the humidity adjustment unit.

[FIG. 6] FIG. 6 is a schematic view illustrating a refrigerant circuit of a temperature adjustment unit.

[FIG. 7] FIG. 7 is a perspective view illustrating air flows in first operation of dehumidification/ventilation operation and humidification/ventilation operation of the air conditioner.

[FIG. 8] FIG. 8 is a perspective view illustrating air flows in second operation of the dehumidification/ ventilation operation and the humidification/ventilation operation of the air conditioner.

[FIG. 9] FIG. 9 is a perspective view illustrating air flows in first operation of dehumidification/circulation operation and humidification/circulation of the air conditioner.

[FIG. 10] FIG. 10 is a perspective view illustrating air flows in second operation of the dehumidification/ circulation operation and the humidification/circulation operation of the air conditioner.

[FIG. 11] FIG. 11 is a diagram of a refrigerant circuit schematically illustrating an air conditioner of a second embodiment, and cooling/dehumidification operation.

[FIG. 12] FIG. 12 is a diagram of the refrigerant circuit schematically illustrating the air conditioner, and heating/humidification operation.

DESCRIPTION OF REFERENCE CHARACTERS

[0027]

1	Air conditioner
2	Humidity adjustment unit
11	Humidity adjustment refrigerant circuit (Humidity adjustment section)
12	Temperature adjustment compressor
14	First adsorption heat exchanger (adsorption heat exchanger)
15	Second adsorption heat exchanger (adsorption heat exchanger)
19	Humidity adjustment electrical component unit
19a	Radiator fin (radiator)
20	Humidity adjustment casing
8	Temperature adjustment unit
80	Temperature adjustment casing
91	Temperature adjustment refrigerant circuit (temperature adjustment section)
94	Temperature adjustment heat exchanger

DESCRIPTION OF EMBODIMENTS

[0028] Embodiments of the present invention will be described in detail with reference to the drawings.

[First Embodiment of the Invention]

[0029] An air conditioner (1) of a first embodiment of the invention supplies temperature-adjusted air and humidity-adjusted air to the inside of a room. As shown in FIGS. 1 and 2, the air conditioner (1) includes a humidity adjustment unit (2) for adjusting air humidity, a temperature adjustment unit (8) for adjusting air temperature, and an outdoor unit as a heat source unit (not shown).

[0030] As shown in FIGS. 1 to 3, the humidity adjustment unit (2) includes a humidity adjustment casing (20) which is substantially in the shape of a vertically oriented, rectangular parallelepiped, with an upper portion thereof partially protruded in the lateral direction. In the perspective view of FIG. 3 (and in the other perspective views), an upper portion of the humidity adjustment casing (20) and the other portion are divided for the sake of convenience. The humidity adjustment casing (20) includes a box-shaped casing body (21) with only a front side thereof opened, and a front panel (22) detachably attached to the opening front side of the casing body (21).

[0031] The casing body (21) includes a top plate (23) on an upper end thereof, and a bottom plate (24) on a lower end thereof. The casing body (21) includes a right plate (25) on a right end thereof, and a left plate (26) on a left end thereof. The left plate (26) includes a lower plate (26a) arranged in a lower position, an upper plate (26b) positioned above the lower plate (26a) and on the left of the lower plate (26a), and a center horizontal plate (26c) connecting an upper end of the lower plate (26a) and a lower end of the upper plate (26b). Thus, the left plate (26) protrudes leftward in an upper portion thereof. Further, the casing body (21) includes a rear plate (27) on a rear end thereof.

[0032] Three duct connection ports (31, 32, 33) are formed in the top plate (23). Specifically, the three duct connection ports (31, 32, 33) are an outside air inlet port (31) arranged in a rear right portion of the top plate (23), a room air inlet port (32) arranged in a rear center portion of the top plate (23), and an outward discharge port (33) arranged in a front center portion of the top plate (23).

[0033] Ducts through which the air can flow are connected to the three duct connection ports (31, 32, 33), respectively (see FIG. 1). The outside air inlet port (31) and the outward discharge port (33) communicate with the outside of the room through the ducts, and the room air inlet port (32) communicates with the inside of the room through the duct. The outside air inlet port (31) constitutes an opening for introducing outside air (OA) in the humidity adjustment casing (20), and the room air inlet port (32) constitutes an opening for introducing room air (RA) in the humidity adjustment casing (20). The outward discharge port (33) constitutes an opening for discharging the air in the humidity adjustment casing (20) outside the room as exhaust air (EA).

[0034] A humidity adjustment supply port (34a) is formed in the upper plate (26b) of the left plate (26). As described later in detail, the humidity adjustment supply port (34a) communicates with the temperature adjustment unit (8). The humidity adjustment supply port (34a) constitutes an opening for supplying the air in the humidity adjustment casing (20) as humidity-adjusted air to the temperature adjustment unit (8).

[0035] The front panel (22) is detachably attached to the casing body (21) to cover the opening front side of the casing body (21). The front panel (22) includes a control switch (not shown) for allowing a user, etc., to switch the operation of the air conditioner (1).

[0036] As shown in FIGS. 2 and 3, with the front panel (22) attached to the casing body (21), a substantially rectangular parallelepiped room is formed in the humidity adjustment casing (20). An upper divider plate (40) is arranged in an upper portion of the room in the humidity adjustment casing (20). The upper divider plate (40) is in the shape of a rectangular plate, and is horizontally supported by the humidity adjustment casing (20). A left end of the upper divider plate (40) is coupled to a right end of the center horizontal plate (26c).

[0037] The upper divider plate (40) divides the room inside the humidity adjustment casing (20) into an upper room and a lower room, as separately shown in FIG. 3.

[0038] The upper room formed between the upper divider plate (40) and the top plate (23) is in the shape of a flat, rectangular parallelepiped. The upper room contains a right-left divider plate (41). The right-left divider plate (41) is substantially rectangular-shaped, and is supported by the humidity adjustment casing (20) in such a manner that surfaces thereof extend in the vertical direction (lines normal to the surfaces are extending in the horizontal direction), and long sides thereof extend in the front-back direction. The right-left divider plate (41) is arranged at the same position as a left divider plate (45) described later in the lateral direction. The right-left divider plate (41) divides the upper room into two laterally aligned rooms of an upper right room on the right of the divider plate, and an upper left room on the left of the divider plate.

[0039] A vertically extending first passage providing plate (42), which is substantially L-shaped when viewed in section, is arranged at a rear right corner of the upper right room. The first passage providing plate (42) is coupled to the right plate (25) and the rear plate (27). An upper end of the first passage providing plate (42) is coupled to the top plate (23), and a lower end is coupled to the upper divider plate (40). In this way, the first passage providing plate (42) provides an outside air inlet passage (51) which is square-shaped when viewed in section at the rear right corner of the upper right room in cooperation with the right plate (25) and the rear plate (27). Further, the first passage providing plate (42) provides, in the other portion of the upper right room, an outward discharge passage (53) which is L-shaped when viewed in section in cooperation with the right plate (25), the rear plate (27), the right-left divider plate (41), and the front panel (22).

[0040] The outside air inlet port (31) is formed in the top plate (23) to face the outside air inlet passage (51), and a first communication port (61) is formed in the upper divider plate (40) to face the outside air inlet passage (51). The outward discharge port (33) is formed in the top plate (23) to face the outward discharge passage (53), and a third communication port (63) is formed in the upper divider plate (40) to face the outward discharge passage (53). The outward discharge port (33) is formed in the top plate (23) on the left of the outside air inlet port (31), and is in the shape of a rectangle extending in the front-back direction. The third communication port (63) is formed in the upper divider plate (40) forward of the first communication port (61).

[0041] A vertically extending second passage providing plate (43), which is substantially L-shaped when viewed in section, is arranged at a rear right corner of the upper left room. The second passage providing plate (43) is coupled to the right-left divider plate (41) and the rear plate (27). An upper end of the second passage providing plate (43) is coupled to the top plate (23), and a lower end is coupled to the upper divider plate (40). In this way, the second passage providing plate (43) provides a room air inlet passage (52) which is square-shaped when viewed in section at the right rear corner of the upper left room in cooperation with the right-left divider plate (41) and the rear plate (27). The second passage providing plate (43) provides, in the other portion of the upper left room, an inward supply passage (54) which is L-shaped when viewed in section in cooperation with the right-left divider plate (41), the rear plate (27), the left plate (26) (i.e., the upper plate (26b) and the center horizontal plate (26c)), and the front panel (22).

[0042] The room air inlet port (32) is formed in the top plate (23) to face the room air inlet passage (52), and a second communication port (62) is formed in the upper divider plate (40) to face the room air inlet passage (52).

The humidity adjustment supply port (34a) is formed in the upper plate (26b) of the left plate (26) to face the inward supply passage (54), and a fourth communication port (64) is formed in the upper divider plate (40) to face the inward supply passage (54). The fourth communication port (64) is formed in the upper divider plate (40) forward of the second communication port (62).

[0043] In this way, the outside air inlet port (31) communicates with the first communication port (61) through the outside air inlet passage (51), and the room air inlet port (32) communicates with the second communication port (62) through the room air inlet passage (52). The outward discharge port (33) communicates with the third communication port (63) through the outward discharge passage (53), and the humidity adjustment supply port (34a) communicates with the fourth communication port (64) through the inward supply passage (54).

[0044] The outside air inlet passage (51) contains an outside air filter (36), and the room air inlet passage (52) contains a room air filter (37). Each of the filters (36, 37) is in the shape of a plate or a sheet, and is kept in a horizontal position to cover every part of a lateral cross section of the corresponding inlet passage (51, 52). The filters (36, 37) are arranged to be able to move back and forth in the corresponding inlet passages (51, 52), and are detachable from the corresponding inlet passages (51, 52).

[0045] The outward discharge passage (53) contains a discharge fan (29), and the inward supply passage (54) contains a supply fan (30) (see FIG. 2). The fans (29, 30) are centrifugal multi-blade fans (so-called sirocco fans). In the perspective view of FIG. 3 (and in the other perspective views), the fans (29, 30) are not shown. The discharge fan (29) blows the air introduced through the outward discharge passage (53) toward the outward discharge port (33). The supply fan (30) blows the air introduced through the inward supply passage (54) toward the humidity adjustment supply port (34a).

[0046] The lower room formed between the upper divider plate (40) and the bottom plate (24) is substantially in the shape of a rectangular parallelepiped. The room contains a right divider plate (44) and a left divider plate (45). The right divider plate (44) and the left divider plate (45) vertically extend from the bottom plate (24) to the upper divider plate (40), and are supported by the humidity adjustment casing (20) to be parallel to the right and left plates (25, 26) of the humidity adjustment casing (20). The right divider plate (44) and the left divider plate (45) divide the lower room between the bottom plate (24) and the upper divider plate (40) into three rooms.

[0047] A right room in the three rooms is divided by a first front-back divider plate (46) into two rooms aligned in the front-back direction. A left room in the three rooms is divided by a second front-back divider plate (47) into two rooms aligned in the front-back direction. The room behind the first front-back divider plate (46) constitutes a first intermediate passage (55), and the room behind the second front-back divider plate (47) constitutes a second intermediate passage (56). The room in front of the first front-back divider plate (46) constitutes a third intermediate passage (57), and the room in front of the second front-back divider plate (47) constitutes a fourth intermediate passage (58).

[0048] An upper end of the first intermediate passage (55) communicates with the first communication port (61), and an upper end of the second intermediate passage (56) communicates with the second communication port (62), an upper end of the third intermediate passage (57) communicates with the third communication port (63), and an upper end of the fourth intermediate passage (58) communicates with the fourth communication port (64). Lower ends of the intermediate passages (55, 56, 57, 58) are closed by the bottom plate (24).

[0049] A center room in the three rooms is divided by the right and left divider plates (44, 45) into two rooms aligned in the vertical direction by an upper-lower divider plate (48). An upper room of the two rooms constitutes a first humidity adjustment chamber (65), and a lower room constitutes a second humidity adjustment chamber (66). Specifically, the first humidity adjustment chamber (65) and the second humidity adjustment chamber (66) are aligned in the vertical direction to be adjacent to each other with the upper-lower divider plate (48) interposed therebetween.

[0050] The first humidity adjustment chamber (65) contains a first adsorption heat exchanger (14), and the second humidity adjustment chamber (66) contains a second adsorption heat exchanger (15). The first adsorption heat exchanger (14) and the second adsorption heat exchanger (15) are connected in series to a humidity adjustment refrigerant circuit (11) described in detail later.

[0051] As shown in FIG. 4, the adsorption heat exchangers (14, 15) are cross-fin type fin-and-tube heat exchangers, respectively. Each of the adsorption heat exchangers (14, 15) includes copper heat transfer tubes (16), and aluminum fins (17). Each of the fins (17) of the adsorption heat exchangers (14, 15) is in the shape of a rectangular plate, and they are arranged at regular intervals. The heat transfer tubes (16) extend in the direction of alignment of the fins (17) in serpentine form. That is, the heat transfer tube (16) includes straight parts penetrating the fins (17), and U-shaped parts connecting the adjacent straight parts, and they are alternately connected.

[0052] In each of the adsorption heat exchangers (14, 15), an adsorbent is carried on the surfaces of the fins (17), and the air passing through the fins (17) comes into contact with the adsorbent carried on the fins (17). The adsorbent may be a material capable of adsorbing vapor in the air, such as zeolite, silica gel, activated carbon, an organic polymer material having a hydrophilic functional group, etc.

[0053] Each of the adsorption heat exchangers (14, 15) is vertically arranged in the corresponding humidity adjustment chamber (65, 66). Specifically, each of the adsorption heat exchangers (14, 15) is supported in the corresponding humidity adjustment chamber (65, 66) in such a manner that the fins (17) are parallel to the right divider plate (44) and the left divider plate (45), and the longitudinal direction of the fins (17) corresponds to the vertical direction.

[0054] Each of the adsorption heat exchangers (14, 15) may be arranged obliquely in the corresponding humidity adjustment chamber (65, 66). Specifically, each of the adsorption heat exchangers (14, 15) are supported in the corresponding humidity adjustment chamber (65, 66) in such a manner that the fins (17) are parallel to the right divider plate (44) and the left divider plate (45), and upper ends of the fins (17) are inclined forward or rearward relative to the perpendicular direction. Thus, the length of the fins (17) of the adsorption heat exchangers (14, 15) can be increased in the longitudinal direction, thereby increasing an area of the adsorption heat exchangers (14, 15) passed by the air. This increases efficiency in contact between the adsorbent and the air.

[0055] Each of the right divider plate (44) and the left divider plate (45) is provided with four flow ports through which the air enters or exits. Specifically, a first flow port (71) is formed in an upper rear portion of the right divider plate (44), and a second flow port (72) is formed in an upper front portion of the right divider plate (44). A fifth flow port (75) is formed in a lower rear portion of the right divider plate (44), and a sixth flow port (76) is formed in a lower front portion of the right divider plate (44). A third flow port (73) is formed in an upper rear portion of the left divider plate (45), and a fourth flow port (74) is formed in an upper front portion of the left divider plate (45). A seventh flow port (77) is formed in a lower rear portion of the left divider plate (45), and an eighth flow port (78) is formed in a lower front portion of the second divider plate (45).

[0056] The first flow port (71) allows the first intermediate passage (55) and the first humidity adjustment chamber (65) to communicate with each other. The second flow port (72) allows the third intermediate passage (57) and the first humidity adjustment chamber (65) to communicate with each other. The third flow port (73) allows the second intermediate passage (56) and the first humidity adjustment chamber (65) to communicate with each other. The fourth flow port (74) allows the fourth intermediate passage (58) and the first humidity adjustment chamber (65) to communicate with each other. The fifth flow port (75) allows the first intermediate passage (55) and the second humidity adjustment chamber (66) to communicate with each other. The sixth flow port (76) allows the third intermediate passage (57) and the second humidity adjustment chamber (66) to communicate with each other. The seventh flow port (77) allows the second intermediate passage (56) and the second humidity adjustment chamber (66) to communicate with each other. The eighth flow port (78) allows the fourth intermediate passage (58) and the second humidity adjustment chamber (66) to communicate with each other.

[0057] Each of the right divider plate (44) and the left divider plate (45) includes four dampers for opening/closing the corresponding flow ports. Specifically, the right divider plate (44) and the left divider plate (45) constitute damper carrying divider plates including a plurality of dampers, respectively. Specifically, the right divider plate (44) includes a first damper (D1) for opening/closing the first flow port (71), a second damper (D2) for opening/closing the second flow port (72), a third damper (D3) for opening/closing the third flow port (73), and a fourth damper (D4) for opening/closing the fourth flow port (74). The left divider plate (45) includes a fifth damper (D5) for opening/closing the fifth flow port (75), a sixth damper (D6) for opening/closing the sixth flow port (76), a seventh damper (D7) for opening/closing the seventh flow port (77), and an eighth damper (D8) for opening/closing the eighth flow port (78).

[0058] Each of the dampers (D1-D8) includes, for example, two shutters, and a motor for supporting the shutters by a horizontal axis thereof, and rotating the shutters about the horizontal axis. Specifically, each of the dampers (D1-D8) closes the corresponding flow port (71-78) when the two shutters are shifted to the perpendicular position by the rotation of the motor, and opens the corresponding flow port (71-78) when the two shutters are shifted to the horizontal position by the rotation of the motor.

<Structure of Refrigerant Circuit>

[0059] A humidity adjustment refrigerant circuit (11) mounted in the humidity adjustment unit (2) will be described with reference to FIG. 5.

[0060] The humidity adjustment refrigerant circuit (11) is a closed circuit including the first adsorption heat exchanger (14), the second adsorption heat exchanger (15), a temperature adjustment compressor (12), a four-way switching valve (13), and a motor-operated expansion valve (18). The humidity adjustment refrigerant circuit (11) performs a vapor compression refrigeration cycle by circulating a refrigerant filled therein. The humidity adjustment refrigerant circuit (11) including the first and second adsorption heat exchangers (14, 15) constitutes a humidity adjustment section. The temperature adjustment compressor (12) is constituted of, for example, a scroll type or a rotary type compressor, etc.

[0061] In the humidity adjustment refrigerant circuit (11), a discharge side of the temperature adjustment compressor (12) is connected to a first port of the four-way switching valve (13), and a suction side of the temperature adjustment compressor (12) is connected to a second port of the four-way switching valve (13). An end of the first adsorption heat exchanger (14) is connected to a third port of the four-way switching valve (13). The other end of the first adsorption heat exchanger (14) is connected to an end of the second adsorption heat exchanger (15) through the motor-operated expansion valve (18). The other end of the second adsorption heat exchanger (15) is connected to a fourth port of the four-way switching valve (13).

[0062] The four-way switching valve (13) is configured to be able to switch between a first state where the first and fourth ports communicate with each other, and the second and third ports communicate with each other (a state shown in FIG. 5(A)), and a second state where the first and third ports communicate with each other, and the second and fourth ports communicate with each other (a state shown in FIG. 5(B)).

[0063] In the humidity adjustment refrigerant circuit (11), a high pressure gaseous refrigerant is supplied as a heating medium to one of the two adsorption heat exchangers (14, 15) serving as a condenser (a radiator), and a low pressure gas-liquid two-phase refrigerant is supplied as a cooling medium to the other adsorption heat exchanger (14, 15) serving as an evaporator.

[0064] The temperature adjustment compressor (12) and the four-way switching valve (13) are arranged in a temperature adjustment casing (80) of a temperature adjustment unit (8) described later.

[0065] A humidity adjustment electrical component unit (hereinafter merely referred to as an "electrical component unit") (19) containing electrical components for operating the temperature adjustment compressor (12), the dampers (D1-D8), and the fans (29, 30) is also arranged in the temperature adjustment casing (80) of the temperature adjustment unit (8).

[0066] The temperature adjustment unit (8) will be described below.

[0067] The temperature adjustment unit (8) includes a temperature adjustment casing (80) substantially in the shape of a vertically oriented rectangular parallelepiped. The temperature adjustment casing (80) includes a box-shaped casing body (81) with only a front side thereof opened, and a front panel (82) detachably attached to the opening front side of the casing body (81).

[0068] The casing body (81) includes a top plate (83) on an upper end thereof, and a bottom plate (84) on a lower end thereof. The casing body (81) includes a right plate (85) on a right end thereof, and a left plate (86) on a left end thereof. Further, the casing body (81) includes a rear plate (87) on a rear end thereof.

[0069] The right plate (85) includes a lower plate (85a) arranged in a lower position, an upper plate (85b) positioned above the lower plate (85a) and on the left of the lower plate (85a), and a center horizontal plate (85c) connecting an upper end of the lower plate (85a) and a lower end of the upper plate (85b). Thus, the right plate (85) protrudes leftward in an upper portion thereof. The right plate (85) is in the same shape as the left plate (26) of the humidity adjustment casing (20). Specifically, the temperature adjustment unit (8) and the humidity adjustment unit (2) are configured to be adjacent to each other with the right plate (85) and the left plate (26) in contact with each other.

[0070] A temperature adjustment room air inlet port (88) is formed in the top plate (83). A duct which communicates with the inside of the room, and through which the air can flow, is connected to the temperature adjustment room air inlet port (88) (see FIG. 1). A temperature adjustment supply port (34b) communicating with the humidity adjustment supply port (34a) formed in the left plate (26) of the humidity adjustment casing (20) is formed in the upper plate (85b) of the right plate (85). Further, an inward supply port (89) is formed in a lower portion of the left plate (86). A duct which communicates with the inside of the room, and through which the air can flow, is connected to the inward supply port (89) (see FIG. 1). The inward supply port (89) constitutes an opening for supplying the air in the temperature adjustment casing (80) to the inside of the room as dehumidified, temperature-adjusted air (SA).

[0071] A supply fan (90) is arranged in the temperature adjustment casing (80) near the inward supply port (89) (see FIG. 2). The supply fan (90) is a centrifugal multi-blade fan (a so-called sirocco fan). The supply fan (90) blows the air introduced through the temperature adjustment room air inlet port (88) and the humidity adjustment supply port (34a) toward the inward supply port (89). Specifically, the air enters the temperature adjustment casing (80) through the temperature adjustment room air inlet port (88) and the humidity adjustment supply port (34a), and the entered air flows downward in the temperature adjustment casing (80), and is supplied to the inside of the room through the inward supply port (89).

[0072] The temperature adjustment casing (80) configured as described above contains a temperature adjustment heat exchanger (94).

[0073] The temperature adjustment heat exchanger (94) is a cross-fin type fin-and-tube heat exchanger, like the adsorption heat exchangers (14, 15). The temperature adjustment heat exchanger (94) does not carry the adsorbent on the surfaces of the fins, unlike the adsorption heat exchangers (14, 15).

[0074] The temperature adjustment heat exchanger (94) is obliquely arranged in the temperature adjustment casing (80). Specifically, the temperature adjustment heat exchanger (94) is arranged in such a manner that an upper end thereof is close to an upper portion of the left plate (86) of the temperature adjustment casing (80), and a lower end thereof is close to the lower plate (85a) of the right plate (85). Specifically, the temperature adjustment heat exchanger (94) is arranged obliquely relative to the direction of air flow in the temperature adjustment casing (80).

[0075] As shown in FIG. 6, the temperature adjustment heat exchanger (94) is connected to a temperature adjustment refrigerant circuit (91).

[0076] The temperature adjustment refrigerant circuit (91) is a closed circuit including the temperature adjustment heat exchanger (94), an outdoor heat exchanger (95) which is a heat source heat exchanger, a temperature adjustment compressor (92), a four-way switching valve (93), and a motor-operated expansion valve (98). The temperature adjustment refrigerant circuit (91) performs a vapor compression refrigeration cycle by circulating a refrigerant filled therein. The temperature adjustment refrigerant circuit (91) including the temperature adjustment heat exchanger (94) constitutes a temperature adjustment section.

[0077] In the temperature adjustment refrigerant circuit (91), a discharge side of the temperature adjustment compressor (92) is connected to a first port of the four-way switching valve (93), and a suction side of the temperature adjustment compressor (92) is connected to a second port of the four-way switching valve (93). An end of the temperature adjustment heat exchanger (94) of the temperature adjustment refrigerant circuit (91) is connected to a third port of the four-way switching valve (93), and the other end of the temperature adjustment heat exchanger (94) is connected to an end of the outdoor heat exchanger (95) through the motor-operated expansion valve (98). The other end of the outdoor heat exchanger (95) is connected to a fourth port of the four-way switching valve (93).

[0078] The four-way switching valve (93) is configured to be able to switch between a first state where the first and fourth ports communicate with each other, and the second and third ports communicate with each other (a state shown in FIG. 6(A)), and a second state where the first and third ports communicate with each other, and the second and fourth ports communicate with each other (a state shown in FIG. 6(B)).

[0079] In the temperature adjustment refrigerant circuit (91), by switching the four-way switching valve (93), a low pressure gas-liquid two-phase refrigerant is supplied to the temperature adjustment heat exchanger (94) to operate the temperature adjustment heat exchanger (94) as an evaporator, thereby performing cooling operation, and a high pressure gaseous refrigerant is supplied to the temperature adjustment heat exchanger (94) to operate the temperature adjustment heat exchanger (94) as a condenser, thereby performing heating operation. In this way, temperature of the air passing around the temperature adjustment heat exchanger (94) is adjusted.

[0080] The four-way switching valve (93), the temperature adjustment compressor (92), and the outdoor heat exchanger (95) of the temperature adjustment refrigerant circuit (91) are contained in an outdoor unit (not shown).

-Operation Mechanism-

[0081] The air conditioner (1) described above selectively performs "dehumidification/ventilation operation," "humidification/ventilation operation," "dehumidification/circulation operation," and "humidification/circulation operation." In the "dehumidification/ventilation operation" and the "humidification/ventilation operation," admitted outside air (OA) is humidity-adjusted, and is supplied to the inside of the room as supply air (SA), and simultaneously, admitted room air (RA) is discharged outside the room as exhaust air (EA). In the "dehumidification/circulation operation" and the "humidification/circulation operation," the admitted room air(RA) is humidity-adjusted, and is supplied to the inside of the room as the supply air (SA), and simultaneously, admitted outside air (OA) is discharged outside the room as exhaust air (EA).

[0082] In addition to the above-described operations, the air conditioner (1) selectively performs "cooling operation" and "heating operation."

[0083] The dehumidification and humidification operations of the humidity adjustment unit (2) will be described first, and then the cooling and heating operations of the temperature adjustment unit (8) will be described.

<Dehumidification/Ventilation Operation>

[0084] In the air conditioner (1) performing the dehumidification/ventilation operation, first operation and second operation described later are alternately performed at predetermined time intervals (e.g., every three minutes).

[0085] When the supply fan (30) of the air conditioner (1) is operated during the dehumidification/ventilation operation, the outside air enters the humidity adjustment casing (20) through the outside air inlet port (31) as first air. When the discharge fan (29) is operated, the room air enters the humidity adjustment casing (20) through the room air inlet port (32) as second air.

[0086] The first operation of the dehumidification/ventilation operation will be described below. As shown in FIG. 7, in the first operation, the first flow port (71), the fourth flow port (74), the sixth flow port (76), and the seventh flow port (77) are opened, and the second flow port (72), the third flow port (73), the fifth flow port (75), and the eighth flow port (78) are closed by switching the first to eighth dampers (D1-D8).

[0087] In the first operation, the four-way switching valve (13) in the refrigerant circuit (11) is set to the first state as shown in FIG. 5(A). In this state, the refrigerant in the refrigerant circuit (11) circulates to perform a refrigeration cycle. In this case, in the refrigerant circuit (11), the refrigerant discharged from the temperature adjustment compressor (12) sequentially passes through the second adsorption heat exchanger (15), the motor-operated expansion valve (18), and the first adsorption heat exchanger (14). The second adsorption heat exchanger (15) functions as a condenser, and the first adsorption heat exchanger (14) functions as an evaporator.

[0088] As shown in FIG. 7, the first air that entered the outside air inlet passage (51) through the outside air inlet port (31) passes through the outside air filter (36). The outside air filter (36) traps dust contained in the first air. The first air that passed through the outside air filter (36) sequentially flows through the first communication port (61) and the first intermediate passage (55), and enters the first humidity adjustment chamber (65) through the first flow port (71). The first air flows forward, and passes through the first adsorption heat exchanger (14). In the first adsorption heat exchanger (14), moisture in the first air is adsorbed by the adsorbent, and heat generated by the adsorption is absorbed by the refrigerant. The first air dehumidified by the first adsorption heat exchanger (14) enters the fourth intermediate passage (58) through the fourth flow port (74). The first air sequentially flows through the fourth communication port (64) and the inward supply passage (54), and enters the temperature adjustment unit (8) through the humidity adjustment supply port (34a) and the temperature adjustment supply port (34b).

[0089] The second air that entered the room air inlet passage (52) through the room air inlet port (32) passes through the room air filter (37). The room air filter (37) traps dust contained in the second air. The second air that passed through the room air filter (37) sequentially flows through the second communication port (62) and the second intermediate passage (56), and enters the second humidity adjustment chamber (66) through the seventh flow port (77). The second air flows forward, and passes through the second adsorption heat exchanger (15). In the second adsorption heat exchanger (15), moisture is desorbed from the adsorbent heated by the refrigerant, and the desorbed moisture is given to the second air. The second air used for the recovery of the adsorbent of the second adsorption heat exchanger (15) flows into the third intermediate passage (57) through the sixth flow port (76). The second air sequentially flows through the third communication port (63) and the outward discharge passage (53), enters the duct through the outward discharge port (33), and is discharged outside the room.

[0090] The second operation of the dehumidification/ventilation operation will be described below. As shown in FIG. 8, in the second operation, the second flow port (72), the third flow port (73), the fifth flow port (75), and the eighth flow port (78) are opened, and the first flow port (71), the fourth flow port (74), the sixth flow port (76), and the seventh flow port (77) are closed by switching the first to eighth dampers (D1-D8).

[0091] In the second operation, the four-way switching valve (13) of the refrigerant circuit (11) is set to the second state as shown in FIG. 5(B). In this state, the refrigerant in the refrigerant circuit (11) circulates to perform a refrigeration cycle. In this case, in the refrigerant circuit (11), the refrigerant discharged from the temperature adjustment compressor (12) sequentially passes through the first adsorption heat exchanger (14), the motor-operated expansion valve (18), and the second adsorption heat exchanger (15). The first adsorption heat exchanger (14) functions as the condenser, and the second adsorption heat exchanger (15) functions as the evaporator.

[0092] As shown in FIG. 8, the first air that entered the outside air inlet passage (51) through the outside air inlet port (31) passes through the outside air filter (36). The outside air filter (36) traps dust contained in the first air. The first air that passed through the outside air filter (36) sequentially flows through the first communication port (61) and the first intermediate passage (55), and enters the second humidity adjustment chamber (66) through the fifth flow port (75). The first air flows forward, and passes through the second adsorption heat exchanger (15). In the second adsorption heat exchanger (15), moisture in the first air is adsorbed by the adsorbent, and heat generated by the adsorption is absorbed by the refrigerant. The first air dehumidified by the second adsorption heat exchanger (15) flows into the fourth intermediate passage (58) through the eighth flow port (78). The first air sequentially flows through the fourth communication port (64) and the inward supply passage (54), and enters the temperature adjustment unit (8) through the humidity adjustment supply port (34a) and the temperature adjustment supply port (34b).

[0093] The second air that entered the room air inlet passage (52) through the room air inlet port (32) passes through the room air filter (37). The room air filter (37) traps dust contained in the second air. The second air that passed through the room air filter (37) sequentially flows through the second communication port (62) and the second intermediate passage (56), and enters the first humidity adjustment chamber (65) through the third flow port (73). The second air flows forward, and passes through the first adsorption heat exchanger (14). In the first adsorption heat exchanger (14), moisture is desorbed from the adsorbent heated by the refrigerant, and the desorbed moisture is given to the second air. The second air used for the recovery of the adsorbent of the first adsorption heat exchanger (14) flows into the third intermediate passage (57) through the second flow port (72). The second air sequentially flows through the third communication port (63) and the outward discharge passage (53), enters the duct through the outward discharge port (33), and is discharged outside the room.

<Humidification/Ventilation Operation>

[0094] In the air conditioner (1) performing the humidification/ventilation operation, first operation and second operation described later are alternately performed at predetermined time intervals (e.g., every three minutes).

[0095] When the supply fan (30) of the air conditioner (1) is operated during the humidification/ventilation operation, the outside air enters the humidity adjustment casing (20) through the outside air inlet port (31) as first air. When the discharge fan (29) is operated, the room air enters the humidity adjustment casing (20) through the room air inlet port (32) as second air.

[0096] In the first operation of the humidification/ventilation operation, as shown in FIG. 7, the first flow port (71), the fourth flow port (74), the sixth flow port (76), and the seventh flow port (77) are opened, and the second flow port (72), the third flow port (73), the fifth flow port (75), and the eighth flow port (78) are closed. The refrigerant circuit (11) enters the state shown in FIG. 5(B), in which the first adsorption heat exchanger (14) functions as a condenser, and the second adsorption heat exchanger (15) functions as an evaporator.

[0097] As shown in FIG. 7, the first air that entered the outside air inlet passage (51) through the outside air inlet port (31) sequentially flows through the outside air filter

(36), the first communication port (61), the first intermediate passage (55), and the first flow port (71) to enter the first humidity adjustment chamber (65), and passes through the first adsorption heat exchanger (14). In the first adsorption heat exchanger (14), moisture is desorbed from the adsorbent heated by the refrigerant, and the desorbed moisture is given to the first air. The first air humidified by the first adsorption heat exchanger (14) sequentially flows through the fourth flow port (74), the fourth intermediate passage (58), the fourth communication port (64), and the inward supply passage (54), and enters the temperature adjustment unit (8) through the humidity adjustment supply port (34a) and the temperature adjustment supply port (34b).

[0098] The second air that entered the room air inlet passage (52) through the room air inlet port (32) sequentially flows through the room air filter (37), the second communication port (62), the second intermediate passage (56), and the seventh flow port (77) to enter the second humidity adjustment chamber (66), and passes through the second adsorption heat exchanger (15). In the second adsorption heat exchanger (15), moisture in the second air is adsorbed by the adsorbent, and heat generated by the adsorption is absorbed by the refrigerant. The second air that gave the moisture to the adsorbent of the second adsorption heat exchanger (15) sequentially flows through the sixth flow port (76), the third intermediate passage (57), the third communication port (63), and the outward discharge passage (53), enters the duct through the outward discharge port (33), and is discharged outside the room.

[0099] In the second operation of the humidification/ventilation operation, as shown in FIG. 8, the second flow port (72), the third flow port (73), the fifth flow port (75), and the eighth flow port (78) are opened, and the first flow port (71), the fourth flow port (74), the sixth flow port (76), and the seventh flow port (77) are closed. The refrigerant circuit (11) enters the state shown in FIG. 5(A), in which the second adsorption heat exchanger (15) functions as a condenser, and the first adsorption heat exchanger (14) functions as an evaporator.

[0100] As shown in FIG. 8, the first air that entered the outside air inlet passage (51) through the outside air inlet port (31) sequentially flows through the outside air filter (36), the first communication port (61), the first intermediate passage (55), and the fifth flow port (75) to enter the second humidity adjustment chamber (66), and passes through the second adsorption heat exchanger (15). In the second adsorption heat exchanger (15), moisture is desorbed from the adsorbent heated by the refrigerant, and the desorbed moisture is given to the first air. The first air humidified by the second adsorption heat exchanger (15) sequentially flows through the eighth flow port (78), the fourth intermediate passage (58), the fourth communication port (64), and the inward supply passage (54), and enters the temperature adjustment unit (8) through the humidity adjustment supply port (34a) and the temperature adjustment supply port (34b).

[0101] The second air that entered the room air inlet passage (52) through the room air inlet port (32) sequentially flows through the room air filter (37), the second communication port (62), the second intermediate passage (56), and the third flow port (73) to enter the first humidity adjustment chamber (65), and passes through the first adsorption heat exchanger (14). In the first adsorption heat exchanger (14), moisture in the second air is adsorbed by the adsorbent, and heat generated by the adsorption is absorbed by the refrigerant. The second air that gave the moisture to the adsorbent of the first adsorption heat exchanger (14) sequentially flows through the second flow port (72), the third intermediate passage (57), the third communication port (63), and the outward discharge passage (53), enters the duct through the outward discharge port (33), and is discharged outside the room.

<Dehumidification/Circulation Operation>

[0102] In the air conditioner (1) performing the dehumidification/circulation operation, first operation and second operation described later are alternately performed at predetermined time intervals (e.g., every three minutes).

[0103] When the supply fan (30) of the air conditioner (1) is operated during the dehumidification/circulation operation, the room air enters the humidity adjustment casing (20) through the room air inlet port (32) as first air. When the discharge fan (29) is operated, the outside air enters the humidity adjustment casing (20) through the outside air inlet port (31) as second air.

[0104] In the first operation of the dehumidification/circulation operation, as shown in FIG. 9, the third flow port (73), the fourth flow port (74), the fifth flow port (75), and the sixth flow port (76) are opened, and the first flow port (71), the second flow port (72), the seventh flow port (77), and the eighth flow port (78) are closed. The refrigerant circuit (11) enters the state shown in FIG. 5(A), in which the second adsorption heat exchanger (15) functions as a condenser, and the first adsorption heat exchanger (14) functions as an evaporator.

[0105] As shown in FIG. 9, the first air that entered the room air inlet passage (52) through the room air inlet port (32) sequentially flows through the room air filter (37), the second communication port (62), the second intermediate passage (56), and the third flow port (73) to enter the first humidity adjustment chamber (65), and passes through the first adsorption heat exchanger (14). In the first adsorption heat exchanger (14), moisture in the first air is adsorbed by the adsorbent, and heat generated by the adsorption is absorbed by the refrigerant. The first air dehumidified by the first adsorption heat exchanger (14) sequentially flows through the fourth flow port (74), the fourth intermediate passage (58), the fourth communication port (64), and the inward supply passage (54), and enters the temperature adjustment unit (8) through the humidity adjustment supply port (34a) and the temperature adjustment supply port (34b).

[0106] The second air that entered the outside air inlet passage (51) through the outside air inlet port (31) sequentially flows through the outside air filter (36), the first communication port (61), the first intermediate passage (55), and the fifth flow port (75) to enter the second humidity adjustment chamber (66), and passes through the second adsorption heat exchanger (15). In the second adsorption heat exchanger (15), moisture is desorbed from the adsorbent heated by the refrigerant, and the desorbed moisture is given to the second air. The second air used for the recovery of the adsorbent of the second adsorption heat exchanger (15) sequentially flows through the sixth flow port (76), the third intermediate passage (57), the third communication port (63), and the outward discharge passage (53), enters the duct through the outward discharge port (33), and is discharged outside the room.

[0107] In the second operation of the dehumidification/circulation operation, as shown in FIG. 10, the first flow port (71), the second flow port (72), the seventh flow port (77), and the eighth flow port (78) are opened, and the third flow port (73), the fourth flow port (74), the fifth flow port (75), and the sixth flow port (76) are closed. The refrigerant circuit (11) enters the state shown in FIG. 5 (B), in which the first adsorption heat exchanger (14) functions as a condenser, and the second adsorption heat exchanger (15) functions as an evaporator.

[0108] As shown in FIG. 10, the first air that entered the room air inlet passage (52) through the room air inlet port (32) sequentially flows through the room air filter (37), the second communication port (62), the second intermediate passage (56), and the seventh flow port (77) to enter the second humidity adjustment chamber (66), and passes through the second adsorption heat exchanger (15). In the second adsorption heat exchanger (15), moisture in the first air is adsorbed by the adsorbent, and heat generated by the adsorption is absorbed by the refrigerant. The first air dehumidified by the second adsorption heat exchanger (15) sequentially flows through the eighth flow port (78), the fourth intermediate passage (58), the fourth communication port (64), and the inward supply passage (54), and enters the temperature adjustment unit (8) through the humidity adjustment supply port (34a) and the temperature adjustment supply port (34b).

[0109] The second air that entered the outside air inlet passage (51) through the outside air inlet port (31) sequentially flows through the outside air filter (36), the first communication port (61), the first intermediate passage (55), and the first flow port (71) to enter the first humidity adjustment chamber (65), and passes through the first adsorption heat exchanger (14). In the first adsorption heat exchanger (14), moisture is desorbed from the adsorbent heated by the refrigerant, and the desorbed moisture is given to the second air. The second air used for the recovery of the first adsorption heat exchanger (14) sequentially flows through the second flow port (72), the third intermediate passage (57), the third communication port (63), and the outward discharge passage (53), enters the duct through the outward discharge port (33), and is discharged outside the room.

<Humidification/Circulation Operation>

[0110] In the air conditioner (1) performing the humidification/circulation operation, first operation and second operation described later are alternately performed at predetermined time intervals (e.g., every three minutes).

[0111] When the supply fan (30) of the air conditioner (1) is operated during the humidification/circulation operation, the room air enters the humidity adjustment casing (20) through the room air inlet port (32) as first air. When the discharge fan (29) is operated, the outside air enters the humidity adjustment casing (20) through the outside air inlet port (31) as second air.

[0112] In the first operation of the humidification/circulation operation, as shown in FIG. 9, the third flow port (73), the fourth flow port (74), the fifth flow port (75), and the sixth flow port (76) are opened, and the first flow port (71), the second flow port (72), the seventh flow port (77), and the eighth flow port (78) are closed. The refrigerant circuit (11) enters the state shown in FIG. 5(B), in which the first adsorption heat exchanger (14) functions as a condenser, and the second adsorption heat exchanger (15) functions as an evaporator.

[0113] As shown in FIG. 9, the first air that entered the room air inlet passage (52) through the room air inlet port (32) sequentially flows through the room air filter (37), the second communication port (62), the second intermediate passage (56), and the third flow port (73) to enter the first humidity adjustment chamber (65), and passes through the first adsorption heat exchanger (14). In the first adsorption heat exchanger (14), moisture is desorbed from the adsorbent heated by the refrigerant, and the desorbed moisture is given to the first air. The first air humidified by the first adsorption heat exchanger (14) sequentially flows through the fourth flow port (74), the fourth intermediate passage (58), the fourth communication port (64), and the inward supply passage (54), and enters the temperature adjustment unit (8) through the humidity adjustment supply port (34a) and the temperature adjustment supply port (34b).

[0114] The second air that entered the outside air inlet passage (51) through the outside air inlet port (31) sequentially flows through the outside air filter (36), the first communication port (61), the first intermediate passage (55), and the fifth flow port (75) to enter the second humidity adjustment chamber (66), and passes through the second adsorption heat exchanger (15). In the second adsorption heat exchanger (15), moisture in the second air is adsorbed by the adsorbent, and heat generated by the adsorption is absorbed by the refrigerant. The second air that gave the moisture to the adsorbent of the second adsorption heat exchanger (15) sequentially flows through the sixth flow port (76), the third intermediate passage (57), the third communication port (63), and the outward discharge passage (53), enters the duct through the outward discharge port (33), and is discharged outside the room.

[0115] In the second operation of the humidification/circulation operation, as shown in FIG. 10, the first flow port (71), the second flow port (72), the seventh flow port (77), and the eighth flow port (78) are opened, and the third flow port (73), the fourth flow port (74), the fifth flow port (75), and the sixth flow port (76) are closed. The refrigerant circuit (11) enters the state shown in FIG. 5 (A), in which the second adsorption heat exchanger (15) functions as a condenser, and the first adsorption heat exchanger (14) functions as an evaporator.

[0116] As shown in FIG. 10, the first air that entered the room air inlet passage (52) through the room air inlet port (32) sequentially flows through the room air filter (37), the second communication port (62), the second intermediate passage (56), and the seventh flow port (77) to enter the second humidity adjustment chamber (66), and passes through the second adsorption heat exchanger (15). In the second adsorption heat exchanger (15), moisture is desorbed from the adsorbent heated by the refrigerant, and the desorbed moisture is given to the first air. The first air humidified by the second adsorption heat exchanger (15) sequentially flows through the eighth flow port (78), the fourth intermediate passage (58), the fourth communication port (64), and the inward supply passage (54), and enters the temperature adjustment unit (8) through the humidity adjustment supply port (34a) and the temperature adjustment supply port (34b).

[0117] The second air that entered the outside air inlet passage (51) through the outside air inlet port (31) sequentially flows through the outside air filter (36), the first communication port (61), the first intermediate passage (55), and the first flow port (71) to enter the first humidity adjustment chamber (65), and passes through the first adsorption heat exchanger (14). In the first adsorption heat exchanger (14), moisture in the second air is adsorbed by the adsorbent, and heat generated by the adsorption is absorbed by the refrigerant. The second air that gave the moisture to the adsorbent of the first adsorption heat exchanger (14) sequentially flows through the second flow port (72), the third intermediate passage (57), the third communication port (63), and the outward discharge passage (53), enters the duct through the outward discharge port (33), and is discharged outside the room.

<Cooling and Heating Operation>

[0118] The first air dehumidified or humidified by the humidity adjustment unit (2) is temperature-adjusted by the temperature adjustment unit (8). The air conditioner (1) of the present embodiment performs heating/humidification operation and cooling/dehumidification operation. The air conditioner (1) may be configured to perform cooling/humidification operation and heating/humidification operation.

[0119] In the cooling operation, the four-way switching valve (93) of the refrigerant circuit (91) is set to the first state as shown in FIG. 6(A). In this state, in the refrigerant circuit (91), the refrigerant discharged from the temperature adjustment compressor (92) sequentially circulates through the outdoor heat exchanger (95), the motor-operated expansion valve (98), and the temperature adjustment heat exchanger (94) to perform a refrigeration cycle. In this case, in the refrigerant circuit (91), the outdoor heat exchanger (95) functions as a condenser, and the temperature adjustment heat exchanger (94) functions as an evaporator.

[0120] Specifically, the first air that entered the temperature adjustment casing (80) is cooled as it passes through the temperature adjustment heat exchanger (94), and the cooled first air enters the duct through the inward supply port (89), and is supplied to the inside of the room.

[0121] In the heating operation, the four-way switching valve (93) of the refrigerant circuit (91) is set to the second state as shown in FIG. 6(B). In this state, in the refrigerant circuit (91), the refrigerant discharged from the temperature adjustment compressor (92) sequentially circulates through the temperature adjustment heat exchanger (94), the motor-operated expansion valve (98), and the outdoor heat exchanger (95) to perform a refrigeration cycle. In this case, in the refrigerant circuit (91), the outdoor heat exchanger (95) functions as an evaporator, and the temperature adjustment heat exchanger (94) functions as a condenser.

[0122] Specifically, the first air that entered the temperature adjustment casing (80) is heated as it passes through the temperature adjustment heat exchanger (94), and the heated first air enters the duct through the inward supply port (89), and is supplied to the inside of the room.

[0123] In this way, the air conditioner (1) adjusts the humidity and the temperature of the air by combining three operations of dehumidification or humidification, ventilation or circulation, and cooling or heating. That is, when the air conditioner (1) selects any one of the operations, the first air is dehumidified or humidified, and is cooled or heated to be supplied to the inside of the room, while passing through or circulating in the inside of the room.

[0124] In the air conditioner (1) configured as described above, the electrical component unit (19) and the temperature adjustment compressor (12) of the humidity adjustment unit (2) are arranged in the temperature adjustment casing (80) of the temperature adjustment unit (8). The electrical component unit (19) contains an inverter circuit for driving the temperature adjustment compressor (12), etc., and a radiator fin (19a) for dissipating heat generated in the electrical component unit (19). The radiator fin (19a) constitutes a radiator.

[0125] As described above, the humidity adjustment unit (2) includes a large number of components, such as the passages (51-58) through which the air flows, the dampers (D1-D8), the heat exchangers (14, 15), the filters (36, 37), etc. Therefore, the humidity adjustment unit (2) tends to increase in size. By contrast, the air flow passages in the temperature adjustment unit (8) are simpler than those in the humidity adjustment unit (2). Further, key components contained in the humidity adjustment casing (20) are only the temperature adjustment heat exchanger (94) and the supply fan (90). Thus, the number of the key components is small.

[0126] Specifically, the electrical component unit (19) and the temperature adjustment compressor (12) of the humidity adjustment unit (2) are arranged in the temperature adjustment casing (80) having a relatively large empty space. This can alleviate size increase of the temperature adjustment unit (8), and can downsize the humidity adjustment unit (2) as much as possible. Therefore, the whole size of the air conditioner (1) can be downsized.

[0127] In general, the flow rate of air in the temperature adjustment unit (8) is higher than that in the humidity adjustment unit (2) (in particular, in the present embodiment, the temperature adjustment unit (8) admits therein the room air through the temperature adjustment room air inlet port (88), in addition to the humidity-adjusted air from the humidity adjustment unit (2)). Thus, the arrangement of the electrical component unit (19) in the air flow passage in the temperature adjustment casing (80) can improve efficiency of heat dissipation. Therefore, with the electrical component unit (19) arranged in the air flow passage in the temperature adjustment casing (80), the dimension of the radiator fin (19a) required for a unit heat value can be reduced, thereby downsizing the electrical component unit (19). That is, the arrangement of the electrical component unit (19) in the temperature adjustment casing (80) can reduce space for installation of the electrical component unit (19) as compared with the case where the electrical component unit (19) is arranged in the humidity adjustment casing (20). This can downsize the whole size of the air conditioner (1).

[0128] Further, in the above-described embodiment, the humidity adjustment unit (2) can further be downsized by arranging the temperature adjustment compressor (12) in the temperature adjustment casing (80).

[Second Embodiment of the Invention]

[0129] An air conditioner (201) of a second embodiment of the invention will be described below. The air conditioner (201) of the second embodiment is different from that of the first embodiment in that the air conditioner (201) of the second embodiment includes a refrigerant circuit (211) shared between the humidity adjustment unit (2) and the temperature adjustment unit (8), whereas the air conditioner of the first embodiment includes the separate refrigerant circuits (11, 91) for the humidity adjustment unit (2) and the temperature adjustment unit (8). In the following description, components similar to those of the first embodiment are designated by the same reference characters, and the difference between the first and second embodiments will be described below.

[0130] Like the first embodiment, the air conditioner (201) includes a humidity adjustment unit (202), a temperature adjustment unit (208), and an outdoor unit (209).

[0131] The outdoor unit (209) contains an outdoor circuit (291a). The outdoor circuit (291a) includes a compressor (292), an outdoor motor-operated expansion valve (298), an outdoor four-way switching valve (293), an outdoor heat exchanger (295) as a heat source heat exchanger, and four stop valves (221-224). Although not shown, the outdoor unit (209) contains an outdoor fan. The outdoor fan supplies outside air to the outdoor heat exchanger (295).

[0132] In the outdoor circuit (291a), a discharge side of the compressor (292) is connected to a first port of the outdoor four-way switching valve (293), and a suction side of the compressor (292) is connected to a second port of the outdoor four-way switching valve (293). A fourth port of the outdoor four-way switching valve (293) is connected to a second stop valve (222). An end of the outdoor heat exchanger (295) is connected to a third port of the outdoor four-way switching valve (293), and the other end of the outdoor heat exchanger (295) is connected to a first stop valve (221) through the outdoor motor-operated expansion valve (298). A third stop valve (223) is connected between the discharge side of the compressor (292) and the outdoor four-way switching valve (293). A fourth stop valve (224) is connected between the suction side of the compressor (292) and the outdoor four-way switching valve (293).

[0133] The outdoor four-way switching valve (293) is configured to be able to switch between a first state where the first and third ports communicate with each other, and the second and fourth ports communicate with each other (a state shown in FIG. 11), and a second state where the first and fourth ports communicate with each other, and the second and third ports communicate with each other (a state shown in FIG. 12).

[0134] The temperature adjustment unit (208) contains a temperature adjustment circuit (291b). The temperature adjustment circuit (291b) includes a single temperature adjustment heat exchanger (294) as a utilization heat exchanger. An end of the temperature adjustment circuit (291b) is connected to the first stop valve (221) of the outdoor circuit (291a), and the other end is connected to the second stop valve (222) of the outdoor circuit (291a). Although not shown, the temperature adjustment unit (208) contains an indoor fan. The indoor fan supplies room air to the temperature adjustment heat exchanger (294).

[0135] The humidity adjustment unit (202) contains a humidity adjustment circuit (291c). The humidity adjustment circuit (291c) includes a humidity adjustment motor-operated expansion valve (218), a humidity adjustment four-way switching valve (213), and two adsorption heat exchangers (214, 215).

[0136] In the humidity adjustment circuit (291c), a first adsorption heat exchanger (214), the humidity adjustment motor-operated expansion valve (218), and a second adsorption heat exchanger (215) are sequentially arranged between the third port and the fourth port of the humidity adjustment four-way switching valve (213). A first port of the humidity adjustment four-way switching valve (213) is connected to the third stop valve (223) of the outdoor circuit (291a), and a second port is connected to the fourth stop valve (224) of the outdoor circuit (291a).

[0137] The humidity adjustment four-way switching valve (213) is configured to be able to switch between a first state where the first and third ports communicate with each other, and the second and fourth ports communicate with each other (a state shown in FIGS. 11(A) and 12(A)), and a second state where the first and fourth ports communicate with each other, and the second and third ports communicate with each other (a state shown in FIGS. 11(B) and 12(B)).

[0138] In the air conditioner (201) configured in this manner, the humidity adjustment four-way switching valve (213) and the outdoor four-way switching valve (293) are controlled, respectively, while circulating the refrigerant in the refrigerant circuit (291) by the single compressor (292), thereby performing switching of the operation states of the two heat exchangers (214, 215) of the humidity adjustment unit (202) (adsorption and desorption of moisture), and switching of the cooling and heating operations of the temperature adjustment unit (208).

<Cooling/Dehumidification Operation>

[0139] Specifically, in the cooling/dehumidification operation, the outdoor four-way switching valve (293) is set to the first state, and the degree of opening of the outdoor motor-operated expansion valve (298) is suitably adjusted. In this state, in the refrigerant circuit (291), the outdoor heat exchanger (295) functions as a condenser, and the temperature adjustment heat exchanger (294) functions as an evaporator. Then, the air which absorbed heat from the refrigerant in the outdoor heat exchanger (295) is discharged outside the room, and the air cooled by the temperature adjustment heat exchanger (294) is supplied to the inside of the room.

[0140] By controlling the humidity adjustment four-way switching valve (213), the humidity adjustment unit (202) alternately performs operation in which the first adsorption heat exchanger (214) and the second adsorption heat exchanger (215) in the humidity adjustment circuit (291c) function as the condenser and the evaporator, respectively, and operation in which the second adsorption heat exchanger (215) and the first adsorption heat exchanger (214) in the humidity adjustment circuit (291c) function as the condenser and the evaporator, respectively. In combination with this, the humidity adjustment unit (202) adjusts the dampers (D1-D8), thereby performing any one of dehumidification/ventilation operation of passing the outside air through the adsorption heat exchanger serving as the evaporator to supply the outside air to the inside of the room, and passing the room air through the adsorption heat exchanger serving as the condenser to discharge the room air outside the room, and dehumidification/circulation operation of passing the room air through the adsorption heat exchanger serving as the evaporator to supply the room air to the inside of the room, and passing the outside air through the adsorption heat exchanger serving as the condenser to discharge the outside air outside the room.

<Heating/Humidification Operation>

[0141] In the heating/humidification operation, the outdoor four-way switching valve (293) is set to the second state, and the degree of opening of the outdoor motor-operated expansion valve (298) is suitably adjusted. In this state, in the refrigerant circuit (291), the temperature adjustment heat exchanger (294) functions as the condenser, and the outdoor heat exchanger (295) functions as the evaporator. Then, the air that dissipated heat to the refrigerant in the outdoor heat exchanger (295) is discharged outside the room, and the air heated by the temperature adjustment heat exchanger (294) is supplied to the inside of the room.

[0142] By controlling the humidity adjustment four-way switching valve (213), the humidity adjustment unit (202) alternately performs operation in which the first adsorption heat exchanger (214) and the second adsorption heat exchanger (215) in the humidity adjustment circuit (291c) function as the condenser and the evaporator, respectively, and operation in which the second adsorption heat exchanger (215) and the first adsorption heat exchanger (214) in the humidity adjustment circuit (291c) function as the condenser and the evaporator, respectively. In combination with this, the humidity adjustment unit (202) adjusts the dampers (D1-D8), thereby performing any one of humidification/ventilation operation of passing the outside air through the adsorption heat exchanger serving as the condenser to supply the outside air to the inside of the room, and passing the room air through the adsorption heat exchanger serving as the evaporator to discharge the room air outside the room, and humidification/circulation operation of passing the room air through the adsorption heat exchanger serving as the condenser to supply the room air to the inside of the room, and passing the outside air through the adsorption heat exchanger serving as the evaporator to discharge the outside air outside the room.

[0143] As described above, even in the case where the first and second adsorption heat exchangers (214, 215) of the humidity adjustment unit (202), and the temperature adjustment heat exchanger and the outdoor heat exchanger (294, 295) of the temperature adjustment unit (208) are connected to the single refrigerant circuit (291) including the single compressor (292), the cooling dehumidification/ventilation operation, the cooling dehumidification/circulation operation, the heating humidification/ventilation operation, and the heating humidification/circulation operation can selectively be performed by controlling the humidity adjustment four-way switching valve (213), the outdoor four-way switching valve (293), and the dampers (D1-D8), respectively.

[0144] The compressor (292) of the outdoor unit (209) connected to the temperature adjustment circuit (291b) is also utilized as the humidity adjustment circuit (291c). This eliminates the need to provide the compressors in the humidity adjustment casing (20) and the temperature adjustment casing (80), respectively. Therefore, the humidity adjustment unit (202) and the temperature adjustment unit (208) can be downsized, thereby downsizing the whole size of the air conditioner (201).

[Other Embodiments]

[0145] The above-described embodiments may be modified in the following manner.

[0146] Specifically, in the above-described embodiments, the humidity adjustment unit (2) is capable of selectively performing the dehumidification/ventilation operation, the humidification/ventilation operation, the dehumidification/circulation operation, and the humidification/circulation operation. However, the humidity adjustment unit is not limited thereto. Any humidity adjustment unit can be employed as long as it can adjust the humidity of the air.

[0147] In the above-described embodiments, the air which is humidity-adjusted by the humidity adjustment unit (2) is admitted in the temperature adjustment unit (8) upstream of the temperature adjustment heat exchanger (94), thereby adjusting the temperature of the humidity-adjusted air. However, the humidity and temperature adjustment is not limited thereto. For example, the air that has been humidity-adjusted by the humidity adjustment unit (2) may be introduced to the downstream of the temperature adjustment heat exchanger (94) to merge with the air introduced through the temperature adjustment room air inlet port (88), and has been temperature-adjusted by the temperature adjustment heat exchanger (94), and the merged air may be supplied to the inside of the room through the inward supply port (89).

[0148] For merging the humidity-adjusted air and the temperature-adjusted air, the humidity adjustment supply port (34a) and the temperature adjustment supply port (34b) may be provided below the temperature adjustment heat exchanger (94) in FIG. 2, or the position of the temperature adjustment room air inlet port (88) and the position of the inward supply port (89) may be replaced in FIG. 2.

[0149] In the latter case, as shown in FIG. 11, space below the temperature adjustment heat exchanger (94) is upstream space containing the air which is not temperature-adjusted yet, and space above the temperature adjustment heat exchanger (94) is downstream space containing the temperature-adjusted air. The humidity adjustment supply port (34a) and the temperature adjustment supply port (34b) are provided in the downstream space downstream of the temperature adjustment heat exchanger (94). In this case, the electrical component unit (19) is positioned in the upstream space upstream of the temperature adjustment heat exchanger (94). Therefore, even when the temperature adjustment unit (8) performs the heating operation, the electrical component unit (19) can be cooled by the air which is not heated yet, thereby allowing for efficient cooling.

[0150] The above-described embodiments have been set forth merely for the purposes of preferred examples in nature, and are not intended to limit the scope, applications, and use of the invention.

INDUSTRIAL APPLICABILITY

[0151] As described above, the present invention is useful for an air conditioner including a humidity adjustment unit for adjusting air humidity, and a temperature adjustment unit for adjusting air temperature.

Claims

1. An air conditioner comprising:

   a humidity adjustment unit (2) for adjusting air humidity, and a temperature adjustment unit (8) for adjusting air temperature, wherein
   the humidity adjustment unit (2) includes a humidity adjustment casing (20), a humidity adjustment section (11) for adjusting humidity of air in the humidity adjustment casing (20), and a humidity adjustment electrical component unit (19),
   the temperature adjustment unit (8) includes a temperature adjustment casing (80) aligned with the humidity adjustment casing (20), and a temperature adjustment section (91) which is contained in the temperature adjustment casing (80) to adjust temperature of air, and
   the humidity adjustment electrical component unit (19) includes a radiator (19a) which dissipates generated heat, and is arranged in an air flow passage in the temperature adjustment casing (80).

2. The air conditioner of claim 1, wherein
   the temperature adjustment section (91) includes a temperature adjustment heat exchanger (94) for adjusting the temperature of the air flowing in the air flow passage in the temperature adjustment casing (80), and
   the humidity adjustment electrical component unit (19) is arranged upstream of the temperature adjustment heat exchanger (94).

3. The air conditioner of claim 2, wherein

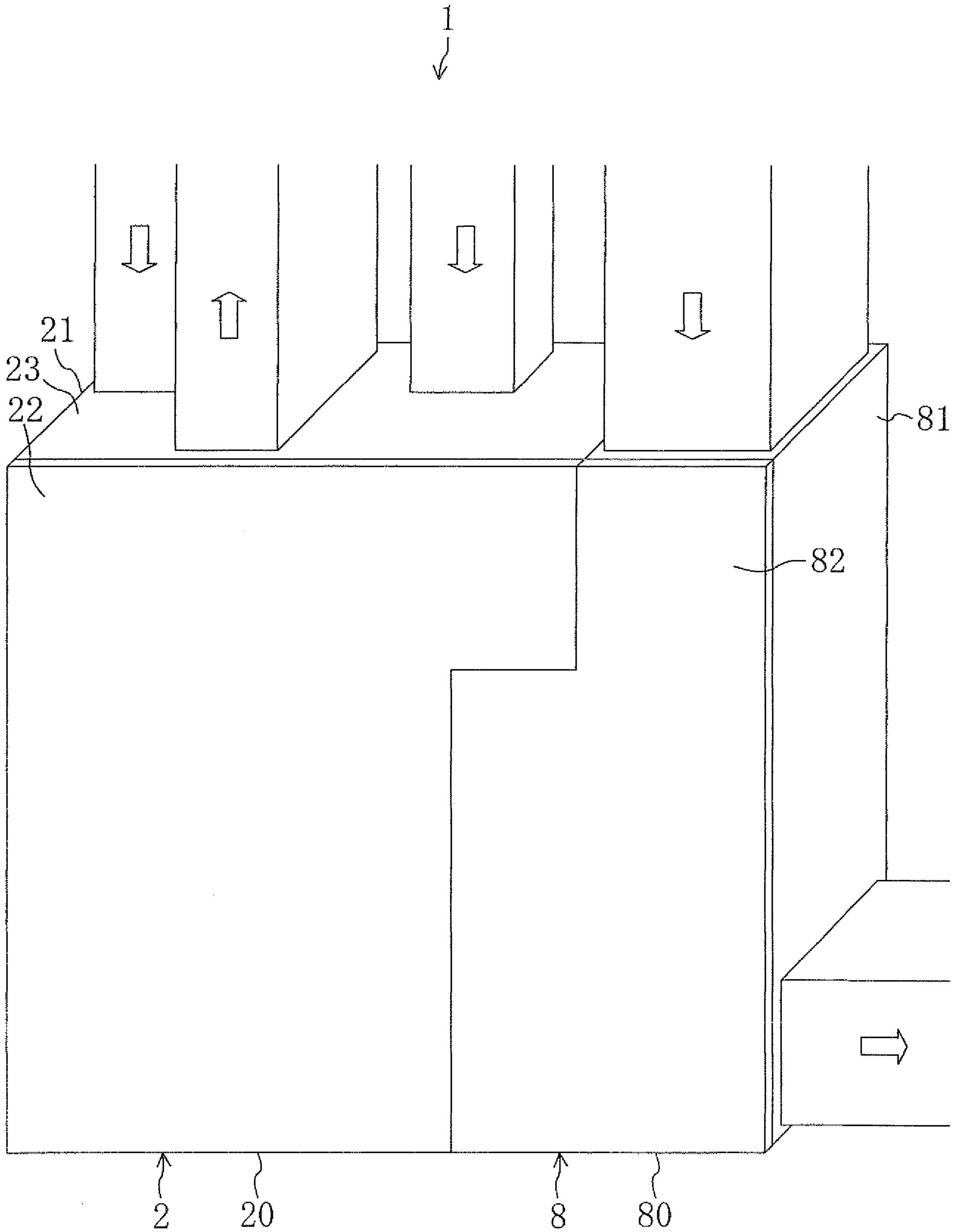
the temperature adjustment heat exchanger (94) is obliquely arranged in the air flow passage in the temperature adjustment casing (80).

4. The air conditioner of claim 1, wherein
the humidity adjustment section includes a refrigerant circuit (11) performing a refrigeration cycle, and connecting an adsorption heat exchanger (14, 15) which carries an adsorbent for adsorbing and desorbing moisture on a surface thereof, and a temperature adjustment compressor (12) which compresses a refrigerant, and
the temperature adjustment compressor (12) is arranged in the temperature adjustment casing (80).

5. The air conditioner of claim 1, wherein
the temperature adjustment section includes a refrigerant circuit (91) performing a refrigeration cycle, and connecting a temperature adjustment heat exchanger (94) which adjusts the temperature of the air flowing in the air flow passage in the temperature adjustment casing (80), and a compressor (92) which is arranged in an outdoor unit, and compresses a refrigerant,
the humidity adjustment section (11) includes an adsorption heat exchanger (14, 15) which carries an adsorbent for adsorbing and desorbing moisture on a surface thereof, and
the adsorption heat exchanger (14, 15) is connected to the refrigerant circuit (91).

6. The air conditioner of claim 1, wherein
the humidity adjustment unit (2) and the temperature adjustment unit (8) are separately constructed, and are integrally assembled in assembly of the air conditioner.

FIG. 1



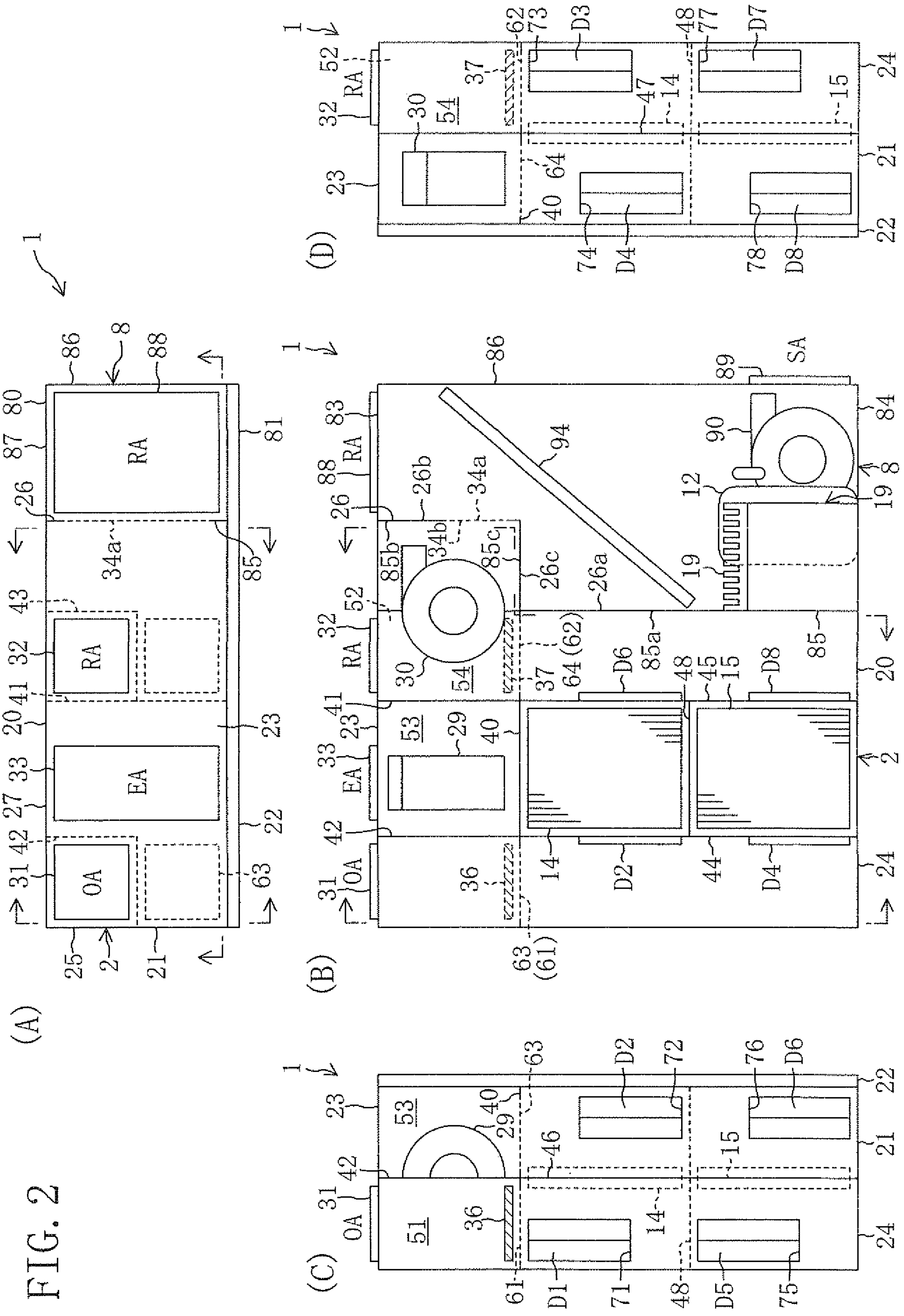


FIG. 2

FIG. 3

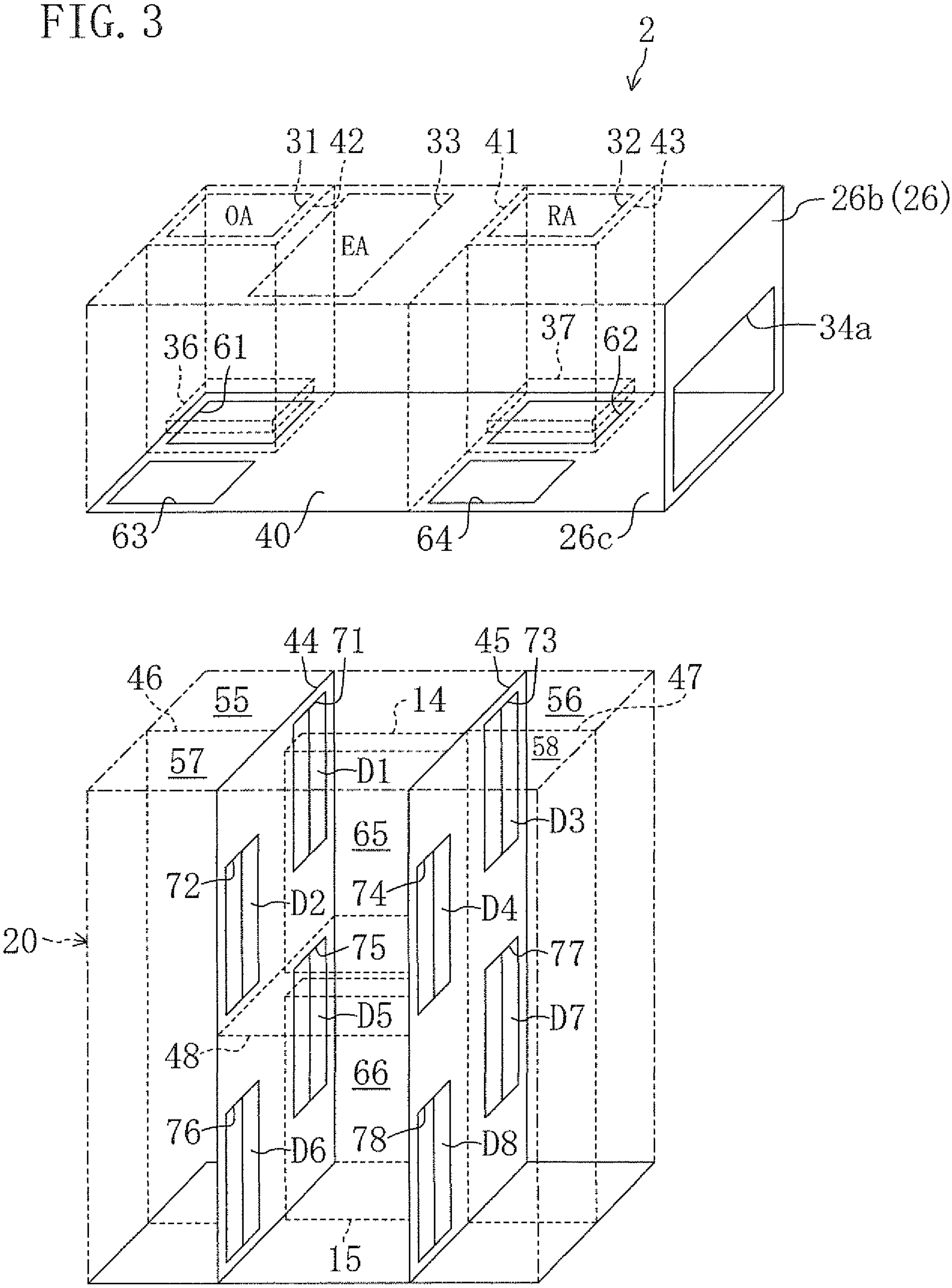

2
31 42
33
41
32 43
OA
EA
RA
26b (26)
34a
36 61
37
62
63
40
64
26c
44 71
45 73
46
55
14
56
47
57
58
D1
D3
65
72
D2
74
D4
20
75
77
D5
D7
48
66
76
D6
78
D8
15

FIG. 4

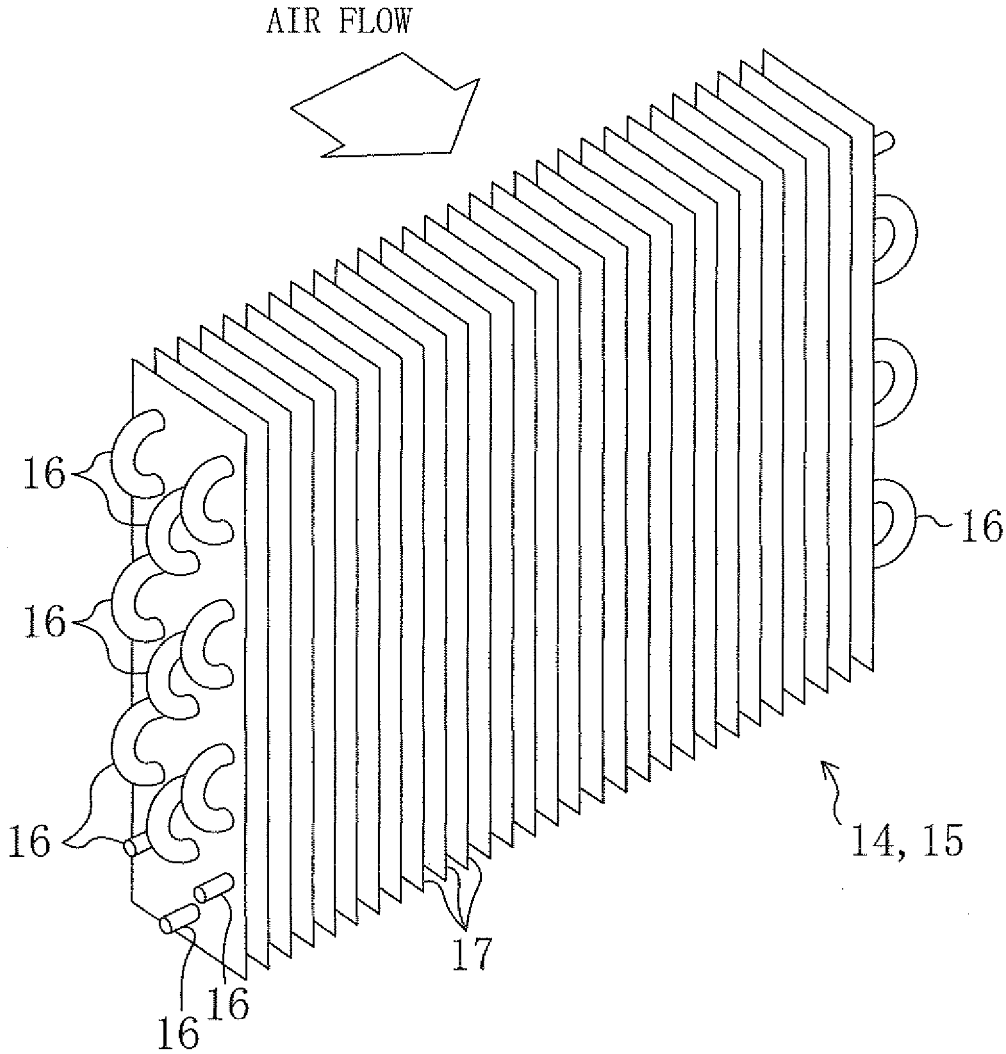


FIG. 5

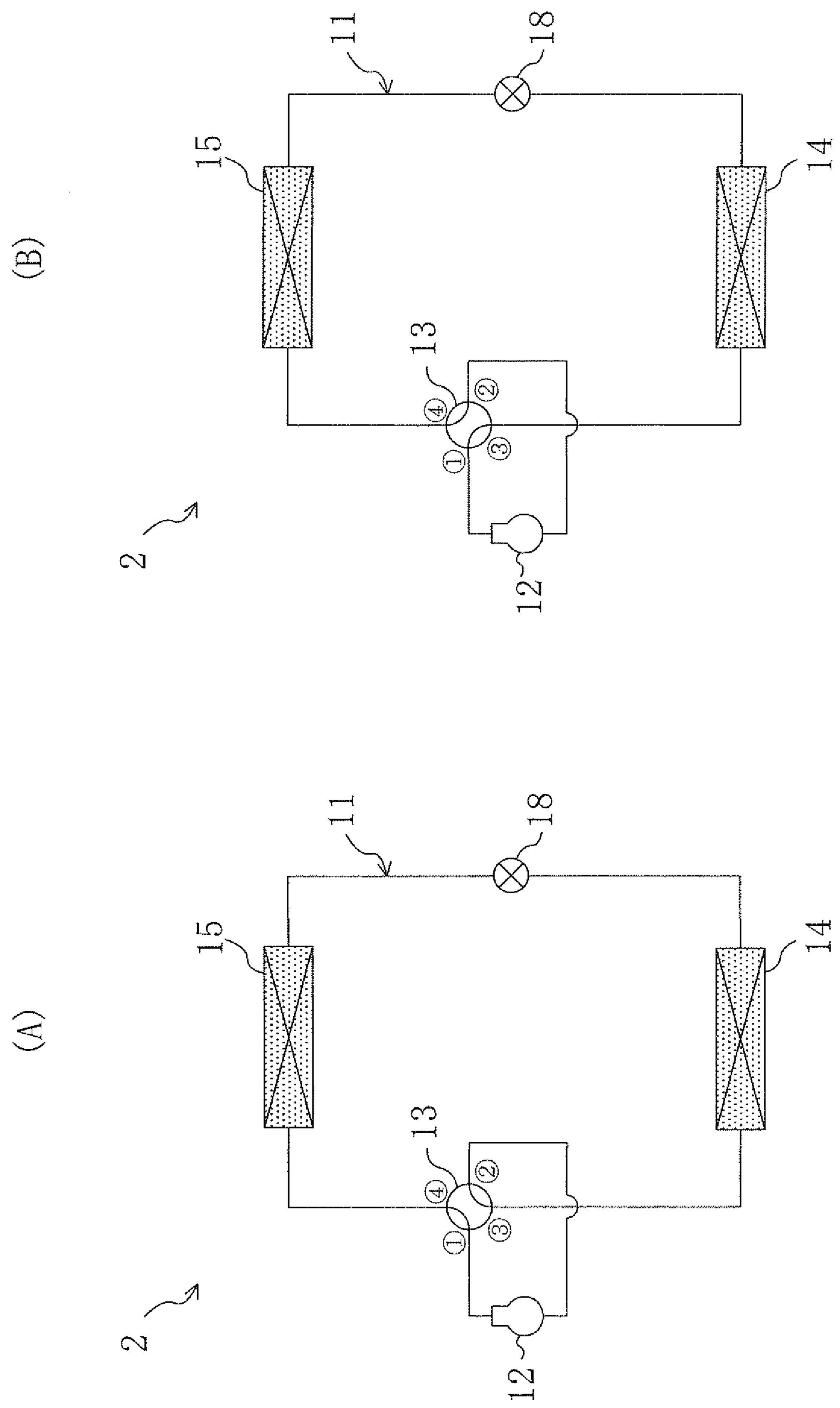


FIG. 6

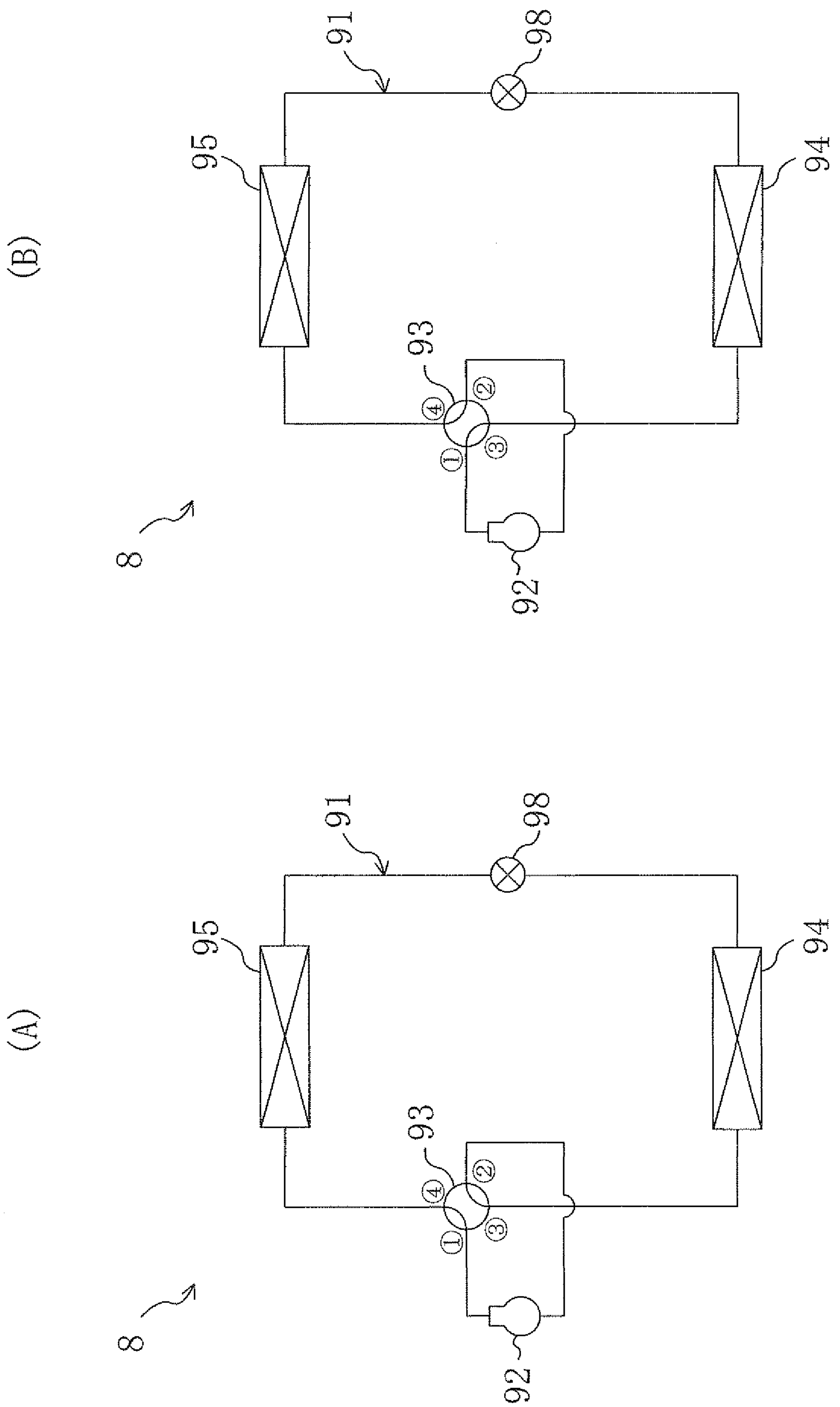


FIG. 7

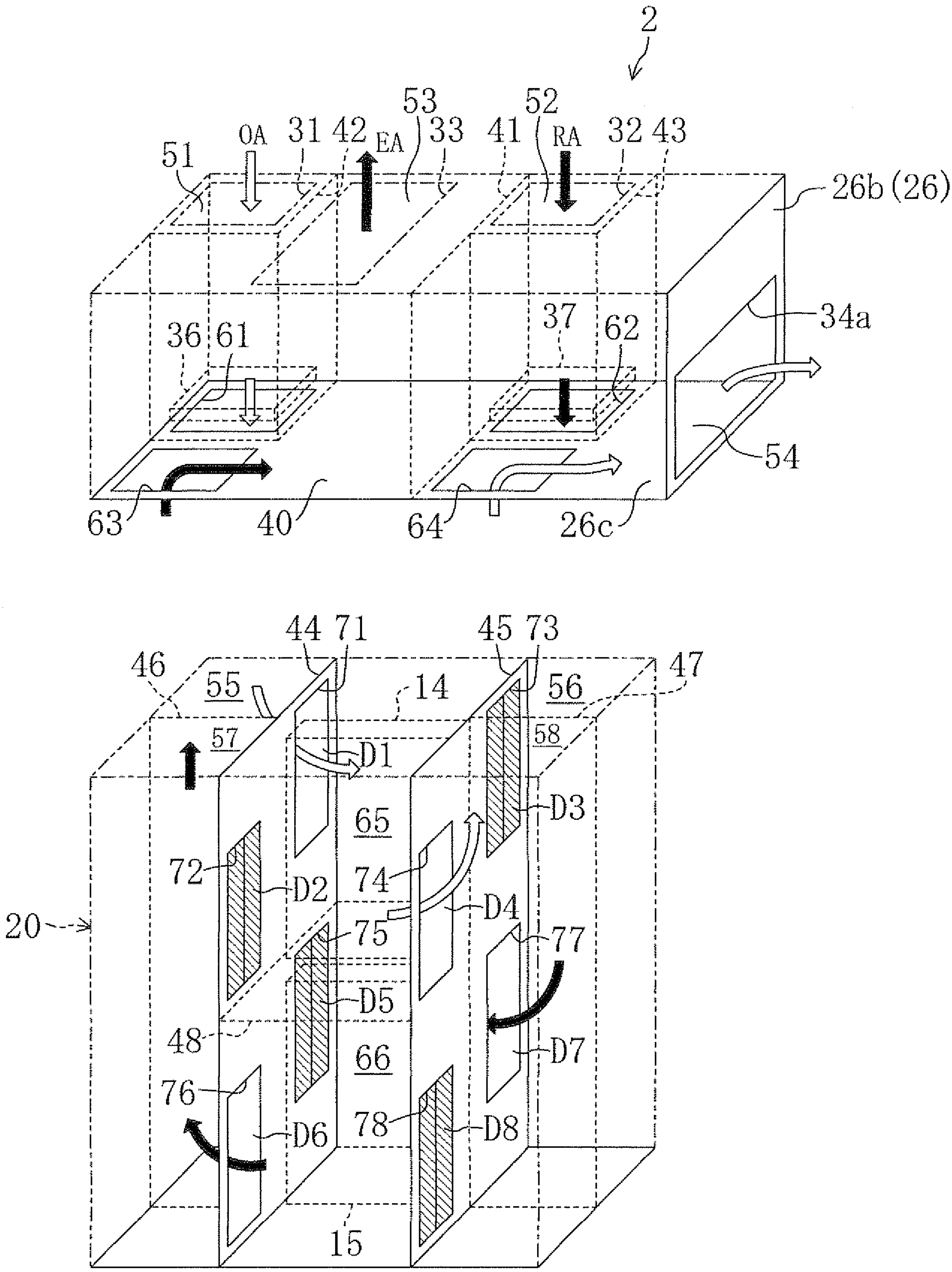

2
OA
31
42
EA
53
33
41
52
RA
32
43
51
26b (26)
34a
36
61
37
62
54
63
40
64
26c
44
71
45
73
46
55
14
56
47
57
58
D1
D3
65
72
D2
74
D4
20
75
77
D5
48
66
D7
76
D6
78
D8
15

FIG. 8

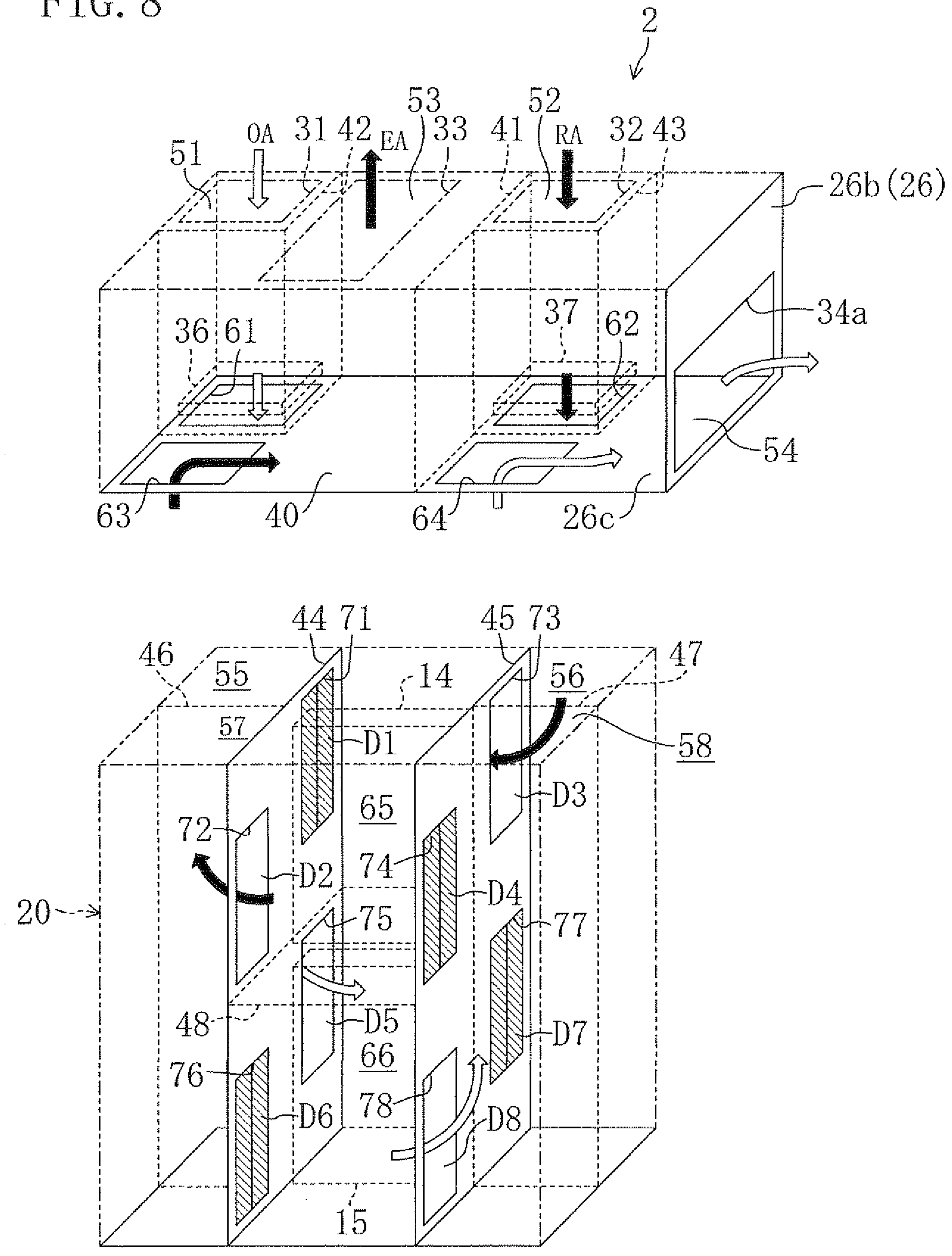

2
OA
31
42
EA
53
33
41
52
RA
32
43
51
26b(26)
34a
36
61
37
62
54
63
40
64
26c
44
71
45
73
46
55
14
56
47
57
D1
58
D3
65
72
74
D2
D4
20
75
77
D5
48
D7
66
76
78
D8
D6
15

FIG. 9

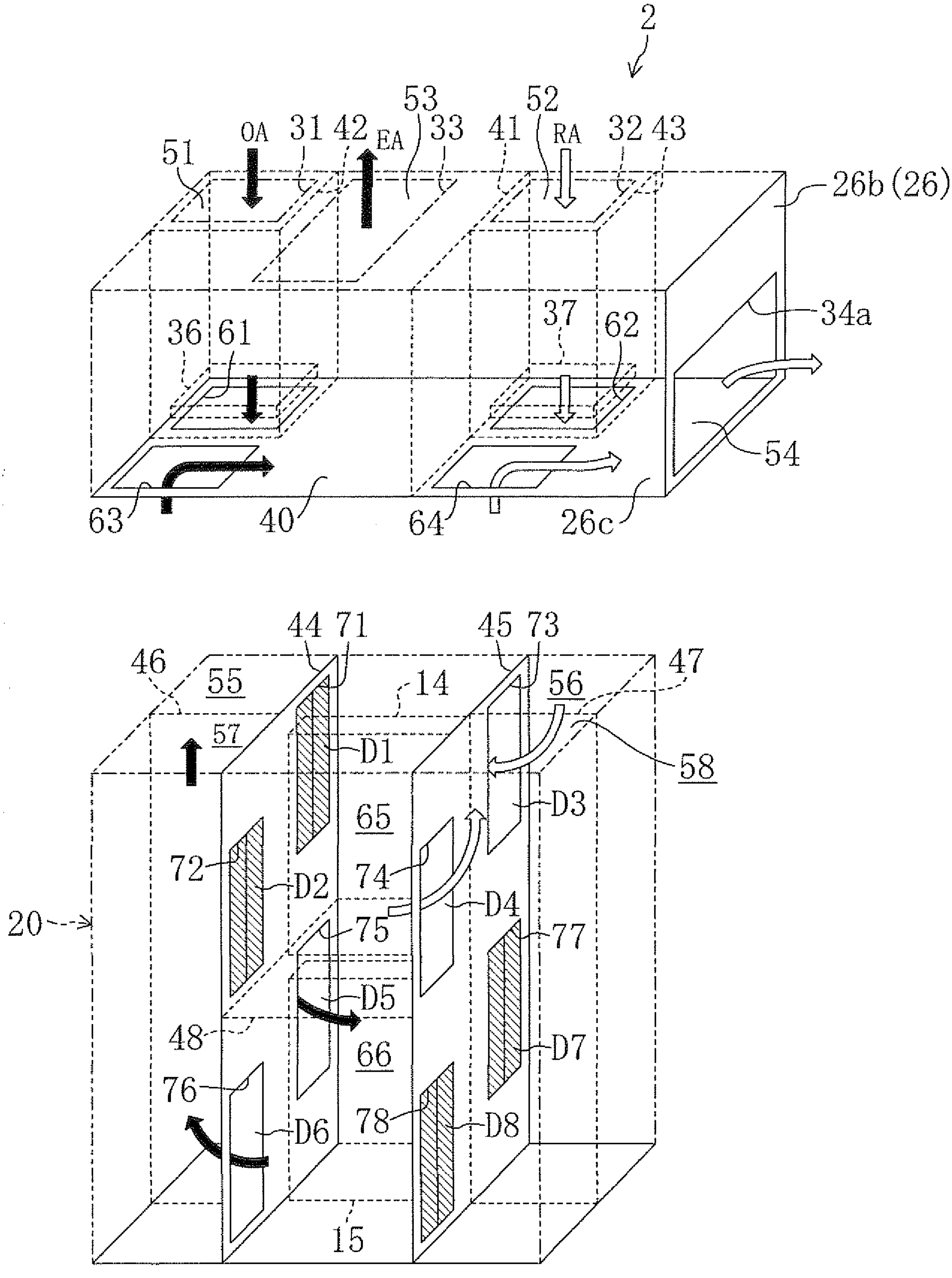
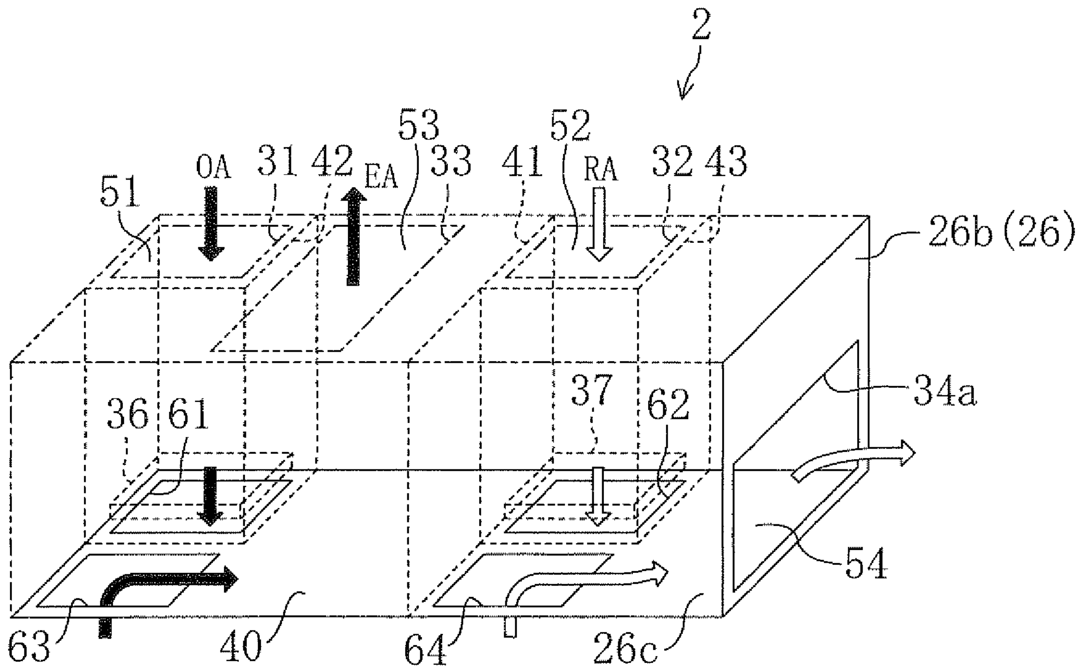

2
53
52
OA
31
42
EA
33
41
RA
32
43
51
26b (26)
34a
36
61
37
62
54
63
40
64
26c
44
71
45
73
46
55
14
56
47
57
D1
58
65
D3
72
74
D2
D4
20
75
77
D5
48
66
D7
76
78
D6
D8
15

FIG. 10


2
53
52
OA
31
42
EA
33
41
RA
32
43
51
26b(26)
34a
36
61
37
62
54
63
40
64
26c

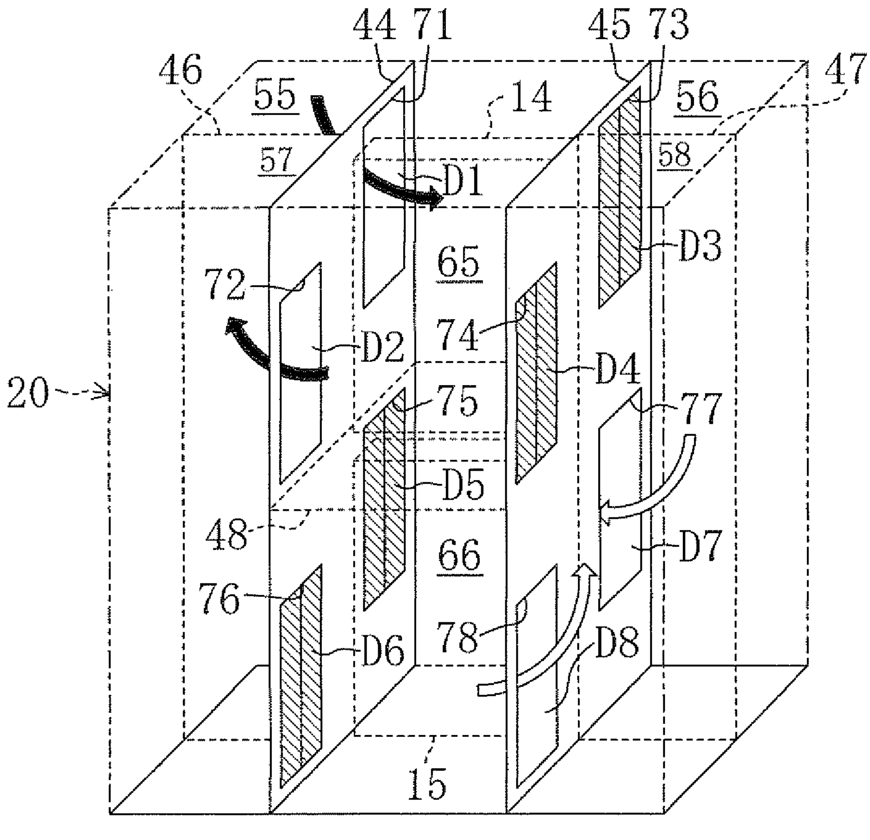

44
71
45
73
47
46
55
14
56
57
D1
58
D3
65
72
74
D2
D4
20
75
77
D5
48
D7
66
76
78
D8
D6
15

FIG. 11

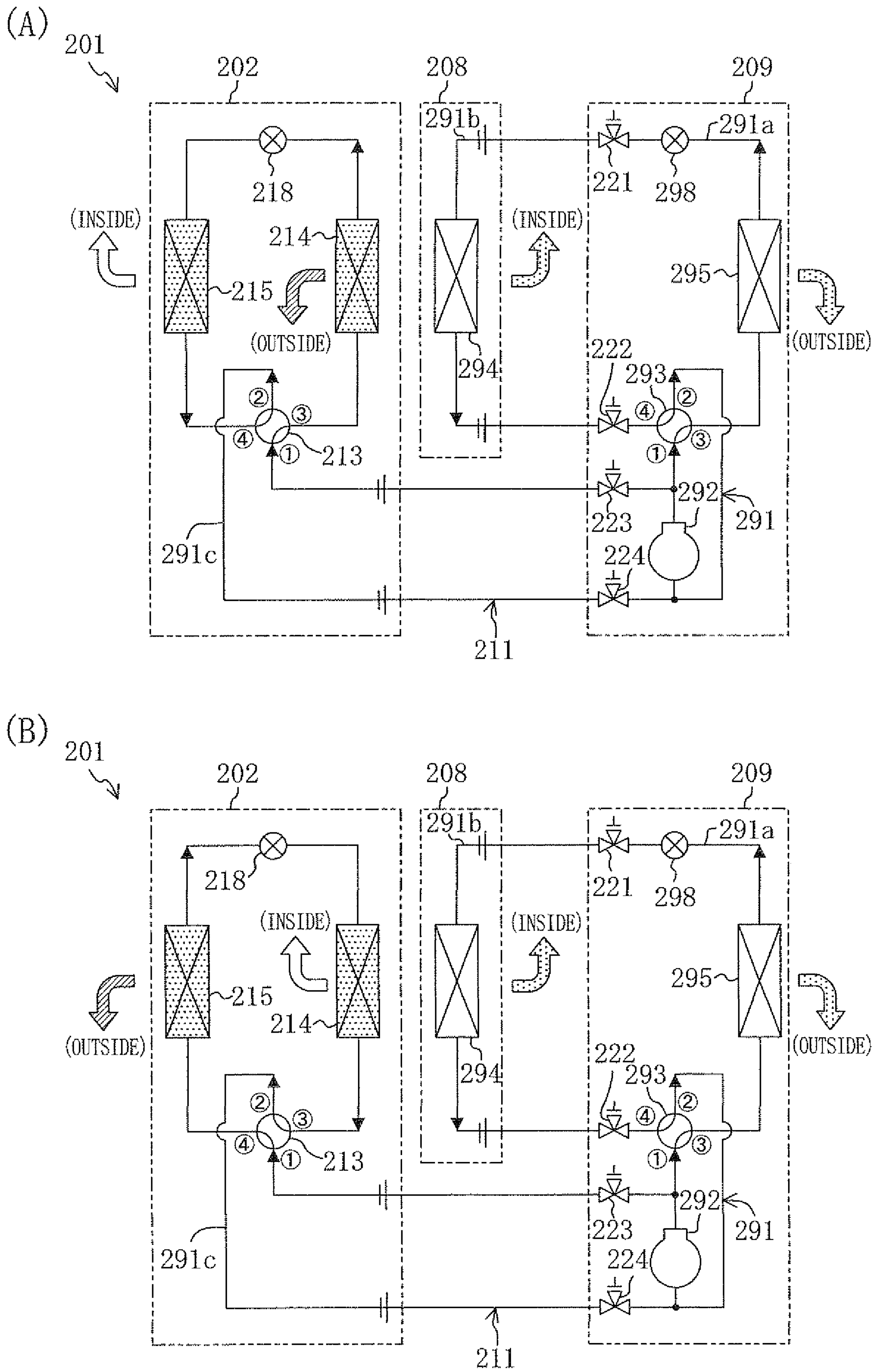
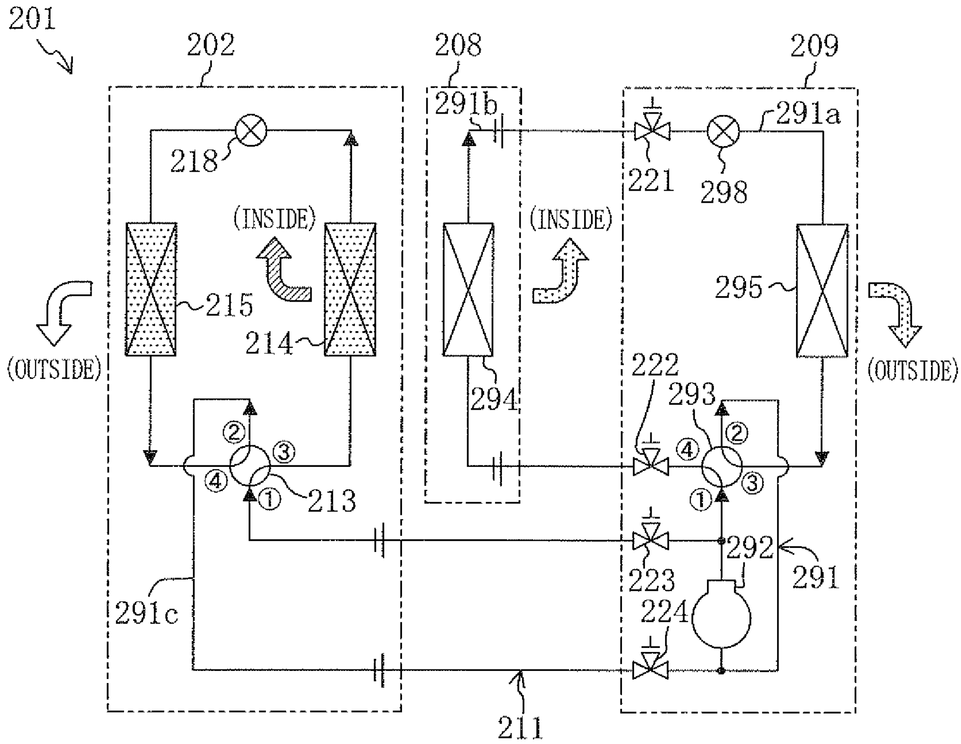
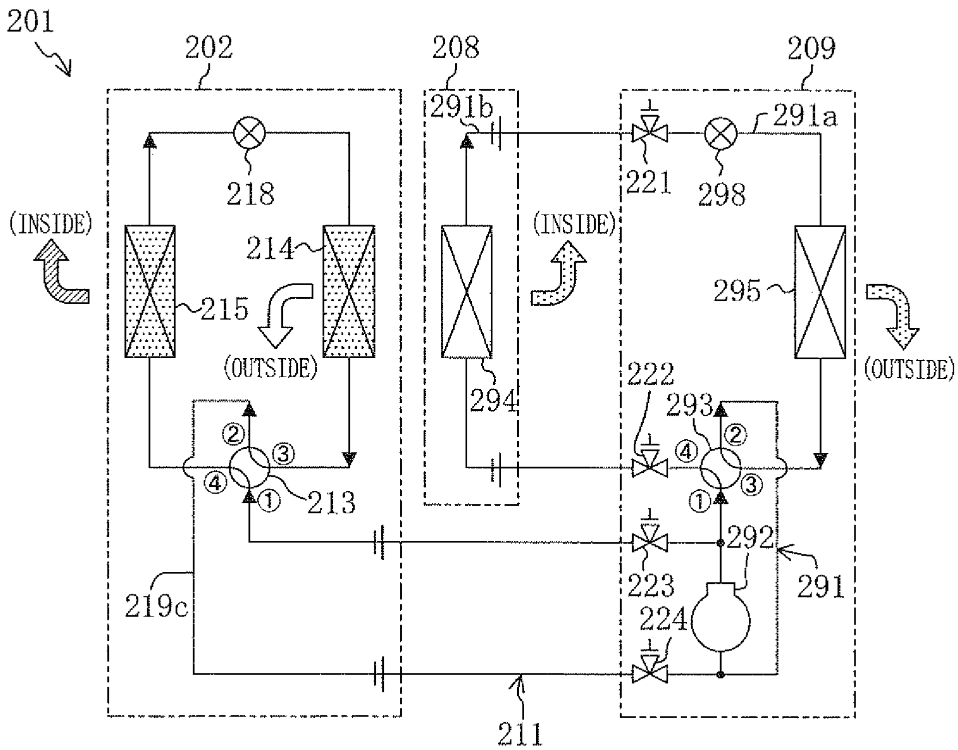

(A)
201
202
208
209
291b
291a
218
221
298
(INSIDE)
214
(INSIDE)
295
215
(OUTSIDE)
(OUTSIDE)
222
294
293
②
③
④
①
213
292
291
223
224
291c
211
(B)
201
202
208
209
291b
291a
218
221
298
(INSIDE)
(INSIDE)
215
295
214
(OUTSIDE)
(OUTSIDE)
222
294
293
②
③
④
①
213
292
291
223
224
291c
211

FIG. 12

(A)


201
202
208
209
218
(INSIDE)
(INSIDE)
291b
221
298
291a
215
214
295
(OUTSIDE)
(OUTSIDE)
294
222
293
②
③
④
①
213
②
④
③
①
292
291
223
224
291c
211

(B)


201
202
208
209
218
(INSIDE)
(INSIDE)
291b
221
298
291a
214
215
(OUTSIDE)
295
(OUTSIDE)
294
222
293
②
③
④
①
213
②
④
③
①
292
291
223
224
219c
211

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2008/002528

A. CLASSIFICATION OF SUBJECT MATTER
F24F13/20(2006.01)i, *F24F3/153*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F24F13/20, F24F3/153

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2008
Kokai Jitsuyo Shinan Koho	1971-2008	Toroku Jitsuyo Shinan Koho	1994-2008

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2005-283064 A (Daikin Industries, Ltd.), 13 October, 2005 (13.10.05), Par. No. [0047]; Figs. 1, 2 (Family: none)	1-6
A	JP 7-158887 A (Matsushita Electric Industrial Co., Ltd.), 20 June, 1995 (20.06.95), Par. No. [0002]; Fig. 5 (Family: none)	1-6
A	JP 2005-9760 A (Daikin Industries, Ltd.), 13 January, 2005 (13.01.05), Par. No. [0135]; Fig. 10 (Family: none)	1-6

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 November, 2008 (18.11.08)	02 December, 2008 (02.12.08)

Name and mailing address of the ISA/	Authorized officer
Japanese Patent Office	
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (April 2007)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP H09318126 B **[0003]**