

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
3 August 2006 (03.08.2006)

PCT

(10) International Publication Number
WO 2006/080599 A2

(51) International Patent Classification:
F24F 12/00 (2006.01)

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(21) International Application Number:
PCT/KR2005/000287

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(22) International Filing Date: 31 January 2005 (31.01.2005)

(25) Filing Language: Korean

(26) Publication Language: English

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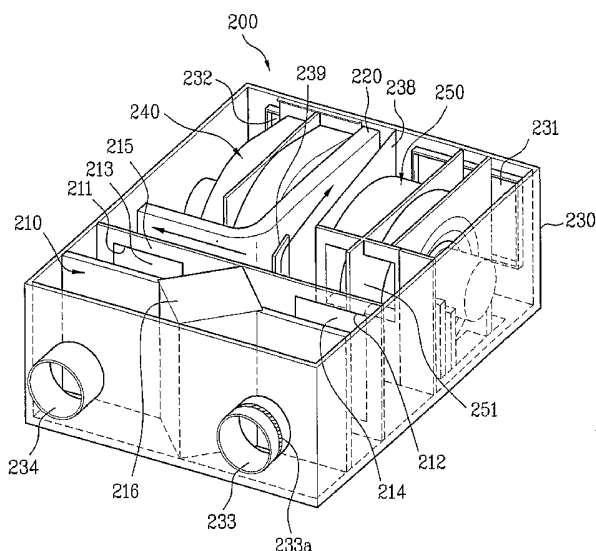
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report

[Continued on next page]

(54) Title: HEAT EXCHANGE UNIT WITH VENT



(57) Abstract: Ventilating and heat exchanging unit in an air conditioner, provided with a room cooling and heating function together with a ventilating function, for maintaining a more comfortable room environment. For this, the present invention provides a ventilating and heat exchanging unit including a regenerative heat exchanger portion for making outdoor air supplied to a room and room air discharged to an outside of the room for ventilation to heat exchange with each other, a heat exchanger for controlling a temperature of air supplied to the room, and a cabinet for housing the regenerative heat exchanger portion on one side of inside thereof and the heat exchanger on the other side of the inside thereof, thereby permitting easy installation, and maintaining a more comfortable room environment.

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HEAT EXCHANGE UNIT WITH VENT

Technical Field

The present invention relates to air conditioners, and more particularly, to a ventilating and heat exchanging unit in an air conditioner, for ventilating a room and temperature control of air being supplied to the room.

Background Art

In general, the air conditioner cools or heats a room, such as a residential space, a restaurant, a library, an office, and so on. For this, a related art air conditioner is provided with a compressor, a condenser, an expansion device, and an evaporator, for cooling or heating room air by phase change of refrigerant passing through the compressor, condenser, expansion device, and the evaporator.

In the air conditioners, there are a package type air conditioner which has an outdoor unit and an indoor unit fabricated as one unit, and a separate type air conditioner which has the outdoor unit and the indoor unit separated from each other.

Having the indoor unit which heat exchanges with room air, and the outdoor unit which heat exchanges with outdoor air integrated inside of a case, the package type air conditioner is mounted on a window, mostly.

With regard to the separate type air conditioner, the indoor unit which heat exchanges with room air is attached to a room wall or ceiling, and the outdoor unit which heat exchanges with outdoor air, separate from the indoor unit, is mounted on a

veranda of an apartment or on an exterior wall of a building.

However, recently, since the related art indoor unit of the air conditioner simply circulates air to cool or heat the room, development of an air conditioner for cooling and heating, as well as ventilating the room is required for maintaining a more comfortable
5 room environment.

Moreover, development of an indoor unit of an air conditioner, i.e., a ventilating and heat exchanging unit, is required for minimizing heat loss during ventilation, simple installation of the air conditioner, and utilization of a room space, effectively.

Furthermore, development of an air conditioner is required, for cooling, and
10 heating a plurality of room with one heat exchange unit.

Disclosure of Invention

An object of the present invention is to provide a ventilating and heat exchanging unit in an air conditioner, in which a room cooling and heating function is provided together with a ventilating function, for maintaining a more comfortable room
15 environment.

Another object of the present invention is to provide a ventilating and heat exchanging unit which can minimize heat loss during ventilation of room, and can be installed, conveniently.

The objects of the present invention can be achieved by providing a ventilating
20 and heat exchanging unit including a regenerative heat exchanger portion for making

outdoor air supplied to a room and room air discharged to an outside of the room for ventilation to heat exchange with each other, a heat exchanger for controlling a temperature of air supplied to the room, and a cabinet for housing the regenerative heat exchanger portion on one side of inside thereof and the heat exchanger on the other side
5 of the inside thereof.

The cabinet includes a first inlet for introduction of the room air thereto, a first outlet for discharging air from the heat exchanger to the room, a second inlet for supplying the outdoor air to the regenerative heat exchanger portion, and a second outlet for discharging the room air heat exchanged at the regenerative heat exchanger.

10 The first inlet is in communication with the second outlet selectively, and the second inlet is in communication with the first outlet selectively.

The regenerative heat exchanger includes a first opening for discharging the outdoor air drawn through the second inlet to the heat exchanger, a second opening for drawing the room air introduced into the cabinet through the first inlet, a first damper on
15 the first opening for opening/closing the first opening, and a second damper on the second opening for opening/closing the second opening.

The first damper and the second damper are opened/closed by rotation of the first damper and the second damper, respectively.

The second damper guides the room air introduced into the cabinet through the
20 first inlet to the second opening in a total ventilating mode, and guides a portion of the

room air introduced into the cabinet through the first inlet to the second opening in a partial ventilating mode.

The cabinet further includes a guide wall which forms a suction flow passage of the room air introduced thereto through the first inlet, and a discharge flow passage of the air discharged through the first outlet.

The guide wall includes one end connected to an inside wall of the cabinet between the first inlet and the first outlet, and the other end spaced a distance from the regenerative heat exchanger portion, for making the suction flow passage and the discharge flow passage in communication, and connected to the second damper in the total ventilating mode.

The ventilating and heat exchanging unit further includes a first fan between the heat exchanger and the first outlet for forcing air to flow from the heat exchanger to the first outlet, and a second fan for forcing air to flow from the first inlet to the second outlet when the first inlet and the second outlet are in communication.

The second fan is mounted on one side of the second outlet, or in the suction flow passage.

The first fan and the second fan are driven by the same motor.

Brief Description of Drawings

The accompanying drawings, which are included to provide a further understanding of the invention, illustrate embodiment(s) of the invention and together

with the description serve to explain the principle of the invention. In the drawings;

FIG. 1 illustrates a perspective view showing a state of installation of an air conditioner having a ventilating and heat exchanging unit of the present invention applied thereto, schematically;

5 FIG. 2 illustrates a perspective view showing an inside of a ventilating and heat exchanging unit in accordance with a first preferred embodiment of the present invention;

FIG. 3 illustrates a plan view showing an inside of a ventilating and heat exchanging unit in accordance with a first preferred embodiment of the present
10 invention;

FIG. 4 illustrates a partial longitudinal sectional view of a ventilating and heat exchanging unit in accordance with a first preferred embodiment of the present invention;

FIGS. 5A and 5B illustrate a perspective view and a section of a double suction
15 sirocco fan provided to a ventilating and heat exchanging unit in accordance with a first preferred embodiment of the present invention, respectively;

FIG. 6 illustrates a plan view showing an inside of a ventilating and heat exchanging unit in accordance with a second preferred embodiment of the present invention, schematically;

20 FIG. 7 illustrates a plan view showing an inside of a ventilating and heat

exchanging unit in accordance with a third preferred embodiment of the present invention, schematically;

FIG. 8 illustrates a plan view showing an inside of a ventilating and heat exchanging unit in accordance with a fourth preferred embodiment of the present invention, schematically;

FIG. 9 illustrates a plan view showing an inside of a ventilating and heat exchanging unit in accordance with a fifth preferred embodiment of the present invention, schematically; and

FIGS. 10A and 10B illustrate a plan view and a perspective view of an X-fan assembly and an X-fan provided to a ventilating and heat exchanging unit in accordance with a fifth preferred embodiment of the present invention, respectively.

Best Mode for Carrying Out the Invention

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

Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

An air conditioner having a ventilating and heat exchanging unit applied thereto will be described with reference to FIG. 1.

Referring to FIG. 1, the air conditioner having a ventilating and heat exchanging unit applied thereto includes an outdoor unit 100 for heat exchange with outdoor air, a

ventilating and heat exchanging unit 200 having a ventilating function and a temperature controlling function of air supplied to a room, and duct portion 300 connected to the ventilating and heat exchanging unit for guiding air.

The outdoor unit 100 is installed on an exterior wall or a veranda of a building, and includes a compressor (not shown) for compressing and discharging circulating refrigerant, an outdoor heat exchanger (not shown) for heat exchange with outdoor air, a fan (not shown) on one side of the outdoor heat exchanger for forcing flow of air, and an outdoor unit case (not shown) for forming an exterior, and accommodating the compressor, the outdoor heat exchanger, and the fan.

The ventilating and heat exchanging unit 200 performs a function of conventional indoor unit in which air supplied to the room is cooled, or heated, as well as a ventilating function.

Moreover, the ventilating and heat exchanging unit 200 has a system to perform a function of minimizing a heat loss by making outdoor air being supplied to the room and room air being discharged to an outside of the room to heat exchange.

Though the ventilating and heat exchanging unit 200, having above functions, can be mounted on a ceiling or a wall of a room, it is preferable that the ventilating and heat exchanging unit 200 is on a ceiling of the veranda for effective utilization of a room space.

In general, the veranda adjoins with a living room, and has a ceiling higher than

the living room or the room. According to this, formation of a space of a predetermined size in the ceiling or the wall is not required for mounting the ventilating and heat exchanging unit 200 therein.

Moreover, harm to a fine view of the room caused by installation of the ventilating and heat exchanging unit 200 can be avoided, and a plurality of rooms can be cooled or heated with only one ventilating and heat exchanging unit 200.

The duct part includes a first duct 310 for guiding room air to the ventilating and heat exchanging unit 200, and a second duct 320 for guiding air from the ventilating and heat exchanging unit 200 to the room.

It is preferable that the ducts 310, and 320 of the duct portion 300 are mounted inside of the ceiling of the room, and has a double pipe structure for minimizing a heat loss. In more detail, each of the ducts 310 and 320 has an inner pipe, and an outer pipe around the inner pipe (not shown). There is an air layer between the inner pipe and the outer pipe having a heat insulating function, for minimizing heat loss during flow of air.

In addition to this, there is a fan power unit 400 at an end of the second duct 320 for drawing air from the room, and discharging to the room together with air supplied from the ventilating and heat exchanging unit 200. The fan power unit 400 includes a housing (not shown) forming an exterior, and a fan (not shown) in the housing. It is preferable that a filter is provided in the housing for cleaning air discharged to the room.

A first embodiment of the ventilating and heat exchanging unit will be described with reference to FIGS. 2 and 4. FIG. 2 illustrates a perspective view showing an inside of a ventilating and heat exchanging unit in accordance with a first preferred embodiment of the present invention, FIG. 3 illustrates a plan view showing an inside of a ventilating and heat exchanging unit in accordance with a first preferred embodiment of the present invention, and FIG. 4 illustrates a partial longitudinal sectional view of a ventilating and heat exchanging unit in accordance with a first preferred embodiment of the present invention.

Referring to FIGS. 2 to 4, the ventilating and heat exchanging unit in accordance with a first preferred embodiment of the present invention includes a regenerative heat exchanger portion 210 for making outdoor air being supplied from outdoor for ventilation, and room air being discharged to an outside of room to heat exchange with each other, a heat exchanger 220 for temperature control of air supplied to the room, and a cabinet 230 for accommodating the regenerative heat exchanger portion 210 and the heat exchanger 220.

The cabinet 230 has the regenerative heat exchanger portion 210 mounted on one side of an inside thereof, and the heat exchanger 220 mounted on the other side of an inside thereof.

In more detail, the cabinet 230 includes a first inlet 231 for drawing room air, a first outlet 232 for discharging air from the heat exchanger 220 to the room, a second

inlet 233 for supplying outdoor air to the regenerative heat exchanger portion 210, and a second outlet 234 for discharging room air heat exchanged at the regenerative heat exchanger portion 210 to an outside of the room.

In the cabinet 230 of a shape of a hexahedron box, the first duct 310 is
5 connected to the first inlet 231, and the second duct 320 is connected to the first outlet 232. There may be a preheater 233a at the second inlet 233 for heating outdoor air introduced into the regenerative heat exchanger portion 210.

In the meantime, it is preferable that the first inlet 231 and the first outlet 232 are formed at one side, i.e., at a back surface of the cabinet 230, and it is preferable that
10 the second inlet 233 and the second outlet 234 are formed at the other side opposite to the one side, i.e., a front surface.

It is preferable that the cabinet 230 of above configuration is installed on the ceiling of the veranda such that the back surface of the cabinet 230 having the first inlet 231 and the first outlet 232 faces the room, more preferably, the cabinet 230 of above
15 configuration is installed at a corner of the ceiling of the veranda such that the other side surface perpendicular both to the front surface and the back surface of the cabinet 230 is in close contact with one side wall of the veranda.

For this, the ventilating and heat exchanging unit 200 is constructed such that the first inlet 231 is in communication with the second outlet 234 selectively, and the
20 second inlet 233 is in communication with the first outlet 232, selectively.

The regenerative heat exchanger portion 210 will be described in more detail.

The regenerative heat exchanger portion 210 includes a first opening 211 for discharging outdoor air drawn through the second inlet 233 toward the heat exchanger 220, a second opening 212 for passing the room air introduced into the cabinet 230 through the first inlet 231, a first damper 213 for opening/closing the first opening 211, and a second damper 214 for opening/closing the second opening 212.

The regenerative heat exchanger portion 210 has a partition wall 215 with the first opening 211 and the second opening 212 formed therein, which also forms a space for housing the heat exchanger 220.

10 The regenerative heat exchanger portion 210 includes a regenerative heat exchanger 216 of a hexahedron box shape therein. However, the shape of the regenerative heat exchanger 216 is not limited to the hexahedron.

The regenerative heat exchanger 216 has a first flow passage (not shown) for flow of room air discharged to an outside of the room, and a second flow passage (not shown) perpendicular to the first flow passage for flow of the outdoor air supplied to the room.

In order to enhance heat exchange efficiency of the regenerative heat exchanger 216, though it is preferable that the regenerative heat exchanger 216 has a layered structure in which the first flow passages and the second flow passages stacked alternately perpendicular to each other. However, the structure of the regenerative heat

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exchanger 216 is not limited to the layered structure.

The first flow passage makes the second opening 212 and the second outlet 234 in communication, and the second flow passage makes the first opening and the second inlet 233 in communication. According to above structure, the room air passing through the first flow passage is made to heat exchange with the outdoor air passing through the second flow passage, thereby minimizing a heat loss.

Though the regenerative heat exchanger 216 may be mounted in various directions depending on design conditions, the regenerative heat exchanger 216 may be mounted on one side of an inside of the cabinet such that one of the first and the second flow passages is perpendicular to the front surface of the cabinet 230.

For an example, one side of the regenerative heat exchanger 216 having an opening of the second flow passage formed therein may be mounted in close contact with, or adjacent to a front inside wall of the cabinet 230, and the second inlet is formed in the front surface of the cabinet 230 opposite to one side of the regenerative heat exchanger 216, for introduction of outdoor air. In this case, a total length of the cabinet 230 can be reduced.

In the meantime, it is preferable that the cabinet 230 has an inspection opening 235 in a bottom, particularly under the regenerative heat exchanger 216, for maintenance of the regenerative heat exchanger 216, and the inspection opening 235 has an opening/closing door 236.

The inspection opening 235 has supporting bars 237 on upper edges for supporting edges of the regenerative heat exchanger 216, to prevent the regenerative heat exchanger 216 from falling down when a door 236 thereon is opened.

Different from this, a bottom of the regenerative heat exchanger 216 may be
5 constructed from metal, and the door 236 may be provided with a magnet for holding the regenerative heat exchanger 216.

Accordingly, when the door 236 is opened for maintenance of the regenerative heat exchanger 216, the regenerative heat exchanger 216 does not fall down, but drawn out of the cabinet 230 through the inspection opening 235 in a state the regenerative
10 heat exchanger 216 is attached to the door 236. Of course, it is preferable that the regenerative heat exchanger 216 is formed of a light material.

The first damper 213 and the second damper 214 are rotatably mounted for opening/closing. Opening angles of the first damper 213 and the second damper 214 controlled according to operation modes of the air conditioner.

15 The ventilating and heat exchanging unit of the present invention has operation modes including a total ventilating mode in which entire room air introduced into the cabinet 230 through the first inlet 231 is discharged through the second outlet 234, a partial ventilating mode in which a portion of room air introduced into the cabinet 230 through the first inlet 231 is discharged through the second outlet 234, and a room air
20 circulating mode ventilating mode in which entire air introduced into the cabinet 230

through the first inlet is supplied to the room again through the first outlet 232.

For this, in the total ventilating mode, the second damper 214 guides entire room air introduced into the cabinet 230 through the first inlet 231 to the second opening 212. In the partial ventilating mode, the second damper 214 guides a portion of room air introduced into the cabinet 230 through the first inlet 231 to the second opening 212. In the room air circulating mode, the second damper 214 closes the second opening 212, so that entire room air drawn through the first inlet 231 is introduced to the heat exchanger 220.

The heat exchanger 220, having a refrigerant pipe (not shown) connected thereto for flow of refrigerant, performs an air conditioning function as the refrigerant flowing through an inside of the heat exchanger 220 absorbs heat from, or discharges heat to the air passing through the heat exchanger 220.

In addition to above, it is preferable that the cabinet 230 has a guide wall 238 which forms a suction flow passage of the room air introduced thereto through the first inlet 231, and a discharge flow passage of the air discharged through the first outlet 232, which discharge flow passage is in communication with the suction flow passage.

In the discharge flow passage, there is the heat exchanger 220, so that the room air introduced thereto through the first inlet 231, and/or the outdoor air supplied thereto through the first opening 211 is cooled or heated at the heat exchanger 220, and supplied to the room through the second duct 320 connected to the first outlet 232.

In more detail, the guide wall 238 has one end connected to an inside wall of the cabinet between the first inlet 231 and the first outlet 232, and the other end spaced a distance from the regenerative heat exchanger portion 210, to form an opening (not shown) for making the suction flow passage and the discharge flow passage in communication.

The guide wall 238 is connected to the second damper 214 such that the room air introduced through the first inlet 231 is guided to the second opening 212 of the regenerative heat exchanger portion 210 in the total ventilating mode.

It is preferable that the ventilating and heat exchanging unit 200 of the present invention includes a first fan 240 for forcing air to flow from the heat exchanger 220 to the first outlet 232, and a second fan 250 for forcing air to flow from the first inlet 231 to the second outlet 234 when the first inlet 231 and the second outlet 234 are in communication.

In more detail, the first fan 240 is mounted between the heat exchanger 220 and the first outlet 232, i.e., in the discharge flow passage, for drawing the room air introduced through the first inlet 231 and/or the outdoor air discharged through the first opening 211, and blows toward the first outlet 232.

The second fan 250 is mounted in the suction flow passage, for forced suction of room air through the first inlet 231 and discharge toward the second opening 212. It is preferable that the second fan 250 has a partition 251 at an outlet portion for splitting

the outlet portion at a predetermined ratio.

It is preferable that the partition 251 is extended toward the partition wall 215 of the regenerative heat exchanger 210, for dividing the air discharged from the discharge portion at a predetermined ratio, and being connected to the second damper 214 to be opened at a predetermined angle in the partial ventilating mode.

According to above configuration, in a case the second opening 212 is closed by the second damper 214, the air from the second fan 250 is introduced into the discharge flow passage, and passes through a heat exchange process at the heat exchanger 220.

If the second damper 214 is connected to the guide wall 238 to close the opening between the suction flow passage and the discharge flow passage, the air from the second fan 250 is introduced into the regenerative heat exchanger 216 through the second opening 212, and discharged to an outside of the cabinet through the second outlet 234.

If the second damper 214 is rotated at a predetermined angle to open both the second opening 212 and the opening between the discharge flow passage and the suction passage, that is, if the second damper is connected to the partition, the air from the second fan 250 is split at a predetermined ratio, and introduced into the discharge flow passage and the regenerative heat exchanger 216, respectively.

Of course, the second fan 250 may be mounted on one side of the second outlet

234 or between the first flow passage of the regenerative heat exchanger and the second opening 212.

Moreover, the fans may be mounted, not in the ventilating and heat exchanging unit 200, but in the duct portion 300, for forcing the air to flow.

- 5 Embodiments of the fans will be described in more detail, with reference to FIGS. 5A and 5B. FIGS. 5A and 5B illustrate a perspective view and a section of a double suction sirocco fan provided to a ventilating and heat exchanging unit in accordance with a first preferred embodiment of the present invention, respectively;

At least one of the first fan 240 and the second fan 250 may be sirocco fan. The
10 sirocco fan, a fan for drawing air in an axial direction and discharging the air in a circumferential direction, has low flow noise, is easy to install inside of the cabinet 230, and raises a static pressure, to increase an air flow rate.

In the embodiment, the sirocco fan is a double suction sirocco fan 260 having a suction in opposite sides with an increased air flow rate. The double suction sirocco fan
15 260 includes a fan housing 261, an exterior thereof, having suction openings 261a in opposite sides, and a plurality of blades 262 rotatably mounted in the fan housing 261 by a motor.

It is preferable that the double suction sirocco fan 260 is provided with a partition 263 for splitting an inside portion thereof such that a ratio of an air flow rate
20 drawn into one side suction opening to an air flow rate drawn into the other side suction

opening is at a predetermined ratio.

In the embodiment, both the first fan 240 and the second fan 250 are the double suction sirocco fan 260.

If the first fan is the double suction sirocco fan 260, it is preferable that the
5 partition 263 is formed to pass through the heat exchanger 220, and extend toward the
first opening 211 of the regenerative heat exchanging portion such that the partition 263
is connected to the first damper 213 opened at a predetermined angle in the partial
ventilating mode. However, the structure of the partition is not limited to above
structure.

10 If the second fan is the double suction sirocco fan 260, it is preferable that the
partition 263 is formed to extend toward the second opening 212 of the regenerative
heat exchanging portion 210 such that the partition 263 is connected to the second
damper 214 opened at a predetermined angle in the partial ventilating mode.

According to this, in the partial ventilating mode, the room air drawn through
15 the first inlet 231 is split at a predetermined ratio, and introduced into the heat
exchanger 220 and the regenerative heat exchanger 216, respectively.

The first fan 240 also has the outdoor air introduced thereto at a flow rate
corresponding to a flow rate of the room air discharged to an outside of the room, and
discharged to the first outlet 232 together with the room air introduced into the heat
20 exchanger 220 from the first inlet 231.

Of course, the first fan 240 and/or the second fan 250 may be a turbofan, an axial fan with a guide, or a cross flow fan.

The first fan 240 is surrounded by the heat exchanger 220, and the inside wall of the cabinet 230, so that the entire air drawn by the first fan 240 is cooled or heated by
5 the heat exchanger 220.

For this, the heat exchanger 220 has one end connected to the inside wall of the cabinet, i.e., a back surface, having the guide wall 238 connected thereto, and the other end connected to the other side inside wall, an inside wall of a side surface, perpendicular to the back surface of the cabinet having the guide wall 238 connected
10 thereto, to form an "L" shape in overall.

Of course, though the heat exchanger 220 may have the one end connected to the guide wall 238, and the other end connected to the inside wall, i.e., the inside wall of the side surface, of the cabinet 230 opposite to the guide wall 238, to form an "I" shape, the "L" shape is advantageous in that an area of heat exchange increases.

15 If the heat exchanger 220 has the "L" shape, it is preferable that a flow guide 239 is provided at a position at a inlet side of the heat exchanger 220, particularly, at a position adjacent to the bent portion, for preventing the air introduced into the heat exchanger 220 from leaning to one side.

Of course, because the flow guide 239 is provided for uniform distribution of
20 the air introduced into the heat exchanger 220 throughout entire surface of the heat

exchanger 220, the flow guide 239 has a relation to a flow direction of the air introduced into the heat exchanger 220 from the suction flow passage deeper than a relation to a shape of the heat exchanger 220.

The operation of the foregoing ventilating and heat exchanging unit of the present invention will be described.

When the user designates the room air circulating mode, and sets a desired room air temperature, the first damper 213 and the second damper close the first opening 211 and the second opening 212.

When the first fan 240 and the second fan 250 are driven by respective motors, room air is introduced into the cabinet 230 through the first inlet 231 connected to the first duct 310. Then, the room air passes through the suction flow passage, and introduced into, and is heat exchanged at, the heat exchanger 220 in the discharge flow passage. Then, the air is drawn into the second fan 250, discharged to the first outlet 232, and guided to the room by the second duct 320, to cool or heat the room.

If the user selects the partial ventilating mode, and sets a desired room temperature, the first damper 213 and the second damper 214 are opened at predetermined angles, and connected to the partitions of the double suction sirocco fans 260 of the first fan 240 and the second fan 250.

When the first fan 240 and the second fan 250 are driven by respective motors, room air is introduced into the cabinet 230 through the first inlet 231 connected to the

first duct 310. A portion of the room air introduced into the cabinet 230 is introduced into the first flow passage of the regenerative heat exchanger 216 in communication with the second opening 212, the rest of portion is introduced into, and heat exchanged at, the heat exchanger 220 in the discharge flow passage.

5 At the same time with this, as the first fan 240 is driven, outdoor air is introduced into the second flow passage of the regenerative heat exchanger 216 through the second inlet 233, makes heat exchange with the room air passing through the first flow passage, is introduced into the heat exchanger 220 through the first opening 211, and heat exchanged at the heat exchanger 220. After heat exchanged with the outdoor
10 air flowing along the second flow passage, the room air introduced into the first flow passage is discharged to an outside of the room through the second outlet 234.

The room air and the outdoor air heat exchanged at the heat exchanger 220 is supplied to the room by the second fan 250, to ventilate, as well as cool or heat the room.

15 In the meantime, if the user selects the total ventilating mode, and sets a desired room temperature, the first damper 213 and the second damper 214 are opened fully, and the first damper 213 is connected to the guide wall 238.

When the first fan 240 and the second fan 250 are driven by respective motors, room air is introduced into the cabinet 230 through the first inlet 231 connected to the
20 first duct 310.

The entire room air introduced into the cabinet 230 is introduced into a first flow passage of the regenerative heat exchanger 216 in communication with the second opening 212 by the second damper 214.

At the same time with this, as the first fan 240 is driven, outdoor air is introduced into a second flow passage of the regenerative heat exchanger 216 through the second inlet 233, makes heat exchange with room air passing through the first flow passage, is introduced into the heat exchanger 220 through the first opening 211, and is heat exchanged at the heat exchanger 220. After heat exchanged with the outdoor air flowing along the second flow passage, the room air introduced into the first flow passage is discharged to an outside of the room through the second outlet 234.

The outdoor air heat exchanged at the heat exchanger 220 is supplied to the room by the first fan 240, to ventilate, as well as cool or heat the room.

The operation mode of the ventilating and heat exchanging unit may be selected manually, or automatically by a controller connected to a predetermined temperature sensor, and a turbidity sensor of the room air.

Meanwhile, the guide wall 238 and the partition 251 of the ventilating and heat exchanging unit in accordance with a first preferred embodiment of the present invention are components for making air flow smoother.

However, if the second fan 250 is mounted in the duct portion 300, on one side of the second outlet 234, or in the regenerative heat exchanger 210, or if the housing of

the fan serves as the guide wall, or the like, the guide wall may not be provided.

Though the partition 251 is omitted from other embodiments of a ventilating and heat exchanging unit of the present invention to be described herein below, if the partition 251 is provided, there is an advantage in that it is effective in maintaining a ratio of ventilating air to circulating air re-supplied to the room.

Other embodiments of the ventilating and heat exchanging unit of the present invention will be described with reference to FIGS. 6 to 9. In describing other embodiments of the ventilating and heat exchanging unit of the present invention, parts identical to the first embodiment ventilating and heat exchanging unit will be given the same names and reference numerals, and repetitive description of which will be omitted.

A second embodiment of the ventilating and heat exchanging unit of the present invention will be described with reference to FIG. 6.

Referring to FIG. 6, the ventilating and heat exchanging unit 200a includes a pipe receiving portion 270 in the cabinet 230.

The pipe receiving portion 270 is between an inside wall of a side surface perpendicular to the other side of the cabinet 230 having the second inlet 233 and the second outlet 234 formed therein and the regenerative heat exchanger portion 210, for housing a condensed water pipe for discharging condensed water formed at the heat exchanger 220, and a refrigerant pipe 272 connected to the heat exchanger.

Accordingly, if the cabinet 230 is mounted at a corner of the ceiling of the

veranda such that the pipe receiving portion 270 faces the wall surface of the veranda, disposal of the condensed water pipe 271 and the refrigerant pipe 272 becomes easy.

Since other configurations of the second embodiment are identical to the first embodiment ventilating and heat exchanging unit 200, description of which will be omitted.

Next, third and fourth embodiments of the ventilating and heat exchanging unit of the present invention having a first fan 240 and a second fan 250 driven by one motor will be described, with reference to FIGS. 7 and 8.

Referring to FIG. 7, in the third embodiment ventilating and heat exchanging unit 200b of the present invention, the first fan 240 and the second fan 250 are coupled to a rotation shaft of a motor 280 mounted passed through the guide wall 238.

However, a case causes a problem, when the first fan 240 and the second fan 250 have the same structure, for an example, if the fans 240 and 250 are the double suction sirocco fan 260.

In other words, if the double suction sirocco fan of the first fan 240 and the double suction sirocco fan of the second fan 250 are mounted in a state the first fan 240 and the second fan 250 are turned by 180° around an axis vertical to a bottom of the cabinet 230 such that air discharge directions thereof are opposite, one of the double suction sirocco fans can not perform the air blowing properly, if the blades 262 rotate in the same direction.

In order prevent this, there are gears 281 and 282 engaged with each other between the second fan 250 and the motor 280 for changing a rotation direction, which are coupled to a rotation shaft of the motor 280 and the rotation shaft of the second fan 250, respectively.

5 Of course, it is apparent that the gears 281, and 282 can be provided between the first fan 240 and the motor 280.

In the embodiment, the heat exchanger 200a has one end connected to the guide wall 238 and the other end connected to an inside wall of the cabinet 230 opposite to the guide wall 238, for form an “I” shape.

10 Next, referring to FIG. 8, in the fourth embodiment ventilating and heat exchanging unit 200c of the present invention, a first fan 240 and a second fan 250 are coupled to a rotation shaft of a motor 280 mounted passed through a guide wall 238.

However, a double suction sirocco fan of the first fan 240 and a double suction sirocco fan of the second fan 250 are mounted in a state symmetry with reference to a point. Therefore, unlike the third embodiment ventilating and heat exchanging unit 200b,
15 no gears are required.

Since other configurations are identical to the first embodiment ventilating and heat exchanging unit 200, description of which will be omitted.

Next, a fifth embodiment ventilating and heat exchanging unit of the present
20 invention will be described, with reference to FIGS. 9, 10A, and 10B.

Referring to FIG. 9, the fifth embodiment ventilating and heat exchanging unit of the present invention includes a first fan 240a having at least one X-fan, and a second fan 250a having at least on X-fan.

In this instance, functions and positions of the first fan 240a and the second fan
5 250a are identical to the first embodiment ventilating and heat exchanging unit.

Referring to FIGS. 10A and 10B, the first fan 240a and the second fan 250a each includes an X-fan assembly having at least one X-fan 280.

In the embodiment, the X-fan assembly has a multi-staged structure in which a plurality of fans air coupled in an axial direction.

10 In more detail, the X-fan 280 includes a rotation shaft 281 rotatably coupled to a driving motor (not shown), a cylindrical hub 282, a cylindrical hub fixedly secured to end portions of the rotating shaft 281, and blades 283 formed on an outside circumferential surface of the hub 282 in a helix. When seen from a side, the X-fan assembly has a shape of 'X'.

15 The hub 282 is hollow, and has opened inlet and outlet, and four arms 284 in the hollow of the hub 282 at 90° intervals in a circumferential direction for joining with a rotating shaft 281 and securing supporting strength.

Alternatively, instead of the arms 284 in the hub 282, helical supplementary blades may be formed, for blowing air through the inside of the hub 282, too.

20 The blades 283 have a semicircular section, substantially. When seen in a

rotation shaft direction, the blades 283 have no area overlapped with each other, for permitting injection molding with upper, and lower molds.

Accordingly, in injection molding of the fan of the present invention, a partition line 285 is formed on an outside circumferential surface of the hub 282 by the upper, and lower molds, which connects an inlet of a blade 283 to an outlet of an adjacent blade 283.

It is favorable that the blade 283 has a thickness, not constant, but thicker than an outer tip in a radial direction as the blade is the nearer to the hub, because gravity center of the blade 283 can be induced inwardly, to reduce moment generated when the fan rotates, which reduces vibration.

Moreover, when the blade 283 is curved with a predetermined radius of curvature, it is preferable that the radius of curvature at the inlet is greater than the radius of curvature at the outlet, because air entrance at the inlet becomes smooth, and the air is accumulated before discharged at the outlet to raise a static pressure of the air being discharged.

In the meantime, taking small spaces for mounting the first fan 240a and the second fan 250a into account, while an axial direction length of the hub 282 of the X-fan assembly is made shorter, a number of the blades on the outside circumference of the hub 282 may be increased to two or more than two. That is, it is preferable that use of a multi-blade X-fan is preferable, which has a plurality of blades on the outside

circumferential surface of the hub 282.

In the meantime, there may be a supplementary fan 250b in the second outlet 234, for enhancing air flowing power of the air discharged to an outside of the room.

The supplementary fan 250b may be provided between the first flow passage and the
5 second damper 214.

Though not shown, there may be an additional supplementary fan 250b on one side of the second inlet 233, or between the second flow passage and the first damper too, for enhancing air blowing power of the air introduced into the room.

It will be apparent to those skilled in the art that various modifications and
10 variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

Industrial Applicability

15 As has been described, the ventilating and heat exchanging unit of the present invention has the following advantages.

First, the ventilating and heat exchanging unit can provide a comfortable environment to a room resident, because, as described before, the ventilating and heat exchanging unit has, not only room cooling and heating function, but also a room
20 ventilating function.

Second, the regenerative heat exchanger for minimizing a heat loss during ventilation and the heat exchanger for room cooling and heating mounted in one cabinet of the ventilating and heat exchanging unit permits easy installation compared to a case when the regenerative heat exchanger is mounted separately.

5 Third, the ventilating and heat exchanging unit can maintain a room environment in an optimum state as the ventilating and heat exchanging unit can be operated in a room air circulating mode, a partial ventilating mode, and a total ventilating mode.

 Fourth, the first fan and the second fan, of which air discharge static pressure
10 maximized, in the ventilating and heat exchanging unit improve air blowing performance.

 Fifth, the partition in the fan for splitting air re-circulating to the room, and air discharged to an outside of the room at a predetermined ratio permits to maintain a level of ventilation appropriately in the ventilation of the room, to prevent excessive heat loss.

15 Sixth, the first fan and the second fan driven by one motor permits to simplify a structure, improve productivity, and a degree of an inside space utilization of the cabinet.

 Seventh, the possibility of installation of the ventilating and heat exchanging unit of the present invention on a ceiling of a veranda improves a degree of room space utilization, and simple to install without requirement for burying in a ceiling of room.

What is Claimed is:

1. A ventilating and heat exchanging unit comprising:

a regenerative heat exchanger portion for making outdoor air supplied to a room

5 and room air discharged to an outside of the room for ventilation to heat exchange with each other;

a heat exchanger for controlling a temperature of air supplied to the room; and

a cabinet for housing the regenerative heat exchanger portion on one side of inside thereof and the heat exchanger on the other side of the inside thereof.

10

2. The unit as claimed in claim 1, wherein the cabinet includes;

a first inlet for introduction of the room air thereto,

a first outlet for discharging air from the heat exchanger to the room;

a second inlet for supplying the outdoor air to the regenerative heat exchanger

15 portion; and

a second outlet for discharging the room air heat exchanged at the regenerative heat exchanger.

3. The unit as claimed in claim 2, wherein the first inlet is in communication

20 with the second outlet selectively, and the second inlet is in communication with the

first outlet selectively.

4. The unit as claimed in claim 2, wherein the regenerative heat exchanger includes;

5 a first opening for discharging the outdoor air drawn through the second inlet to the heat exchanger,

a second opening for drawing the room air introduced into the cabinet through the first inlet,

a first damper on the first opening for opening/closing the first opening, and

10 a second damper on the second opening for opening/closing the second opening.

5. The unit as claimed in claim 4, wherein the first damper and the second damper are opened/closed by rotation of the first damper and the second damper, respectively.

15

6. The unit as claimed in claim 5, wherein the second damper guides the room air introduced into the cabinet through the first inlet to the second opening in a total ventilating mode, and guides a portion of the room air introduced into the cabinet through the first inlet to the second opening in a partial ventilating mode.

7. The unit as claimed in claim 6, wherein the cabinet further includes a guide wall which forms a suction flow passage of the room air introduced thereto through the first inlet, and a discharge flow passage of the air discharged through the first outlet.

5 8. The unit as claimed in claim 7, wherein the guide wall includes;
one end connected to an inside wall of the cabinet between the first inlet and the first outlet, and
the other end spaced a distance from the regenerative heat exchanger portion, for making the suction flow passage and the discharge flow passage in communication,
10 and
connected to the second damper in the total ventilating mode.

9. The unit as claimed in claim 8, further comprising:
a first fan between the heat exchanger and the first outlet for forcing air to flow
15 from the heat exchanger to the first outlet, and
a second fan for forcing air to flow from the first inlet to the second outlet when the first inlet and the second outlet are in communication.

10. The unit as claimed in claim 9, wherein the second fan is mounted on one
20 side of the second outlet.

11. The unit as claimed in claim 9, wherein the second fan is mounted in the suction flow passage.

5 12. The unit as claimed in claim 11, wherein the first fan and the second fan are driven by the same motor.

13. The unit as claimed in claim 12, wherein the first fan and the second fan are sirocco fans.

10

14. The unit as claimed in claim 13, further comprising gears mounted on shafts of motors for making the first fan and the second fan rotated in directions opposite to each other.

15 15. The unit as claimed in claim 11, wherein the second fan includes a discharge portion split by a partition at a predetermined ratio, the partition being extended toward the regenerative heat exchanger portion such that the partition is connected to the second damper opened at a predetermined angle in the partial ventilating mode.

20

16. The unit as claimed in claim 11, wherein at least one of the first fan and the second fan is a sirocco fan.

17. The unit as claimed in claim 16, wherein the cabinet further includes a flow
5 guide at an inlet side of the heat exchanger for preventing air being introduced into the heat exchanger from leaning to one side.

18. The unit as claimed in claim 16, wherein the sirocco fan is a double suction
sirocco fan having suctions in opposite side surfaces, respectively.
10

19. The unit as claimed in claim 18, wherein the double suction sirocco fan
includes a partition splitting an inside thereof such that a ratio of outdoor air drawn
through one side suction to room air drawn through the other side suction has a
predetermined ratio.
15

20. The unit as claimed in claim 19, wherein the partition is mounted in the
sirocco fan of the first fan, passed through the heat exchanger, and extended toward the
regenerative heat exchanger portion, so that the partition is connected to the first damper
opened at a predetermined angle in the partial ventilating mode.
20

21. The unit as claimed in claim 19, wherein the partition is mounted in the sirocco fan of the second fan, passed through the heat exchanger, and extended toward the regenerative heat exchanger portion, so that the partition is connected to the second damper opened at a predetermined angle in the partial ventilating mode.

5

22. The unit as claimed in claim 9, wherein at least one of the first fan and the second fan includes at least one X-fan having a helical blade.

23. The unit as claimed in claim 4, wherein the regenerative heat exchanger
10 includes a partition wall having a first opening and a second opening, and forming a space for accommodating the heat exchanger.

24. The unit as claimed in claim 2, wherein the regenerative heat exchanger
portion includes a regenerative heat exchanger of a substantially hexahedron shape,
15 including;

a first flow passage for flow of the room air being discharged to an outside of the room, and

a second flow passage perpendicular to the first flow passage for flow of the outdoor air being supplied to the room.

20

25. The unit as claimed in claim 24, wherein the regenerative heat exchanger has one side surface adjoining to one side of an inside of the cabinet.

26. The unit as claimed in claim 24, wherein the cabinet has an inspection
5 opening under the regenerative heat exchanger for maintenance of the regenerative heat exchanger, and

a door mounted on the inspection opening for opening/closing the inspection opening.

10 27. The unit as claimed in claim 26, wherein the regenerative heat exchanger includes a bottom formed of metal, and the door includes a magnet for attaching the regenerative heat exchanger thereto.

28. The unit as claimed in claim 26, wherein the cabinet further includes
15 supporting bars for supporting edges of the regenerative heat exchanger.

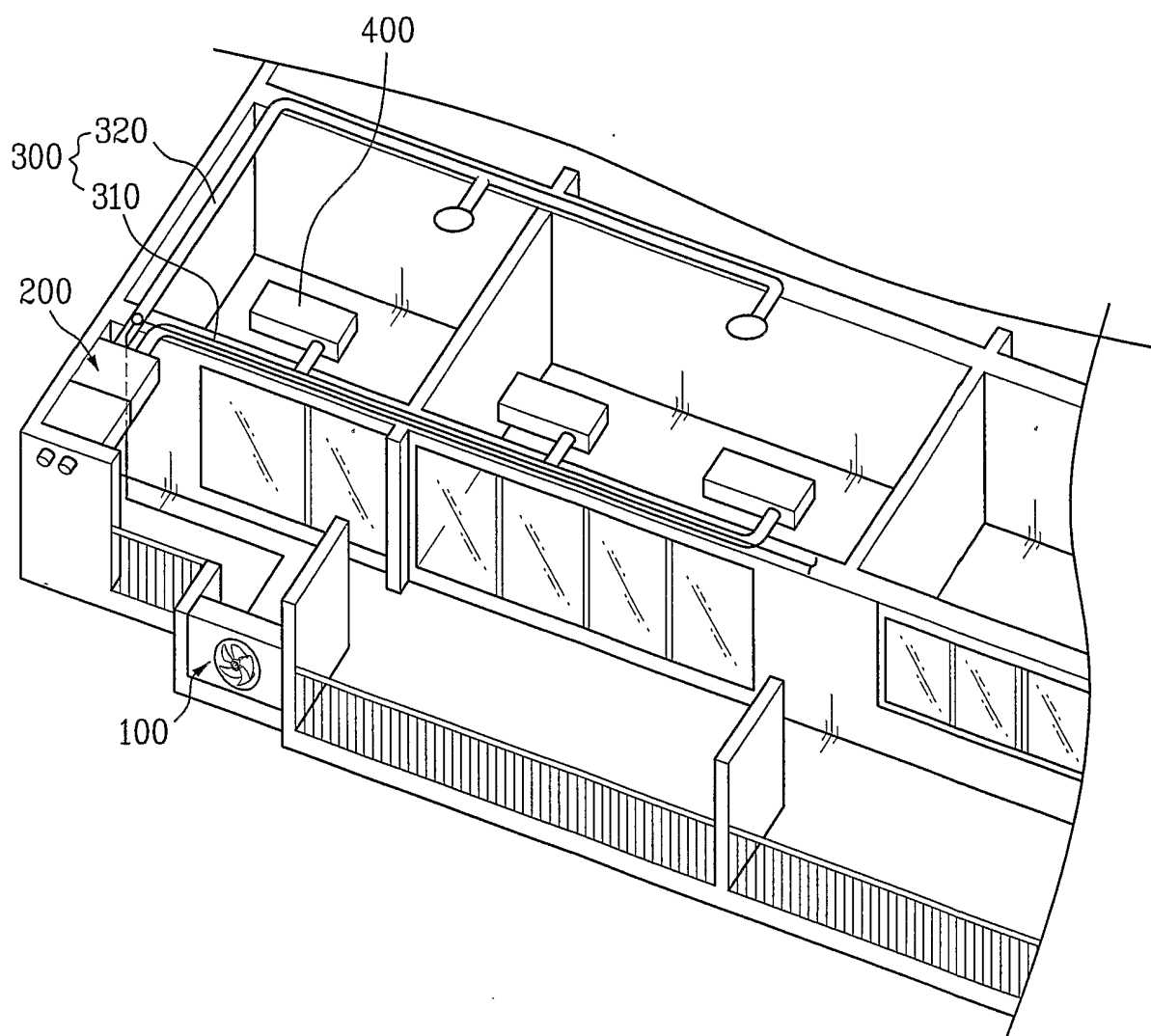
29. The unit as claimed in claim 2, wherein the cabinet has one side surface with the first inlet and the first outlet formed therein, and the other side surface opposite to the one side with the second inlet and the second outlet formed therein, the cabinet
20 has a hexahedron shape, substantially.

30. The unit as claimed in claim 29, wherein the cabinet is mounted on a ceiling of a veranda such that the first inlet and the first outlet face the room.

5 31. The unit as claimed in claim 29, wherein the cabinet further includes a pipe receiving portion between the other side surface and the regenerative heat exchanger portion, for receiving a condensed water pipe for discharging condensed water formed at the heat exchanger, and a refrigerant pipe connected to the heat exchanger.

10 32. The unit as claimed in claim 2, wherein the cabinet further includes a preheater for heating outdoor air being supplied to the regenerative heat exchanger through the second inlet.

FIG. 1



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FIG. 2

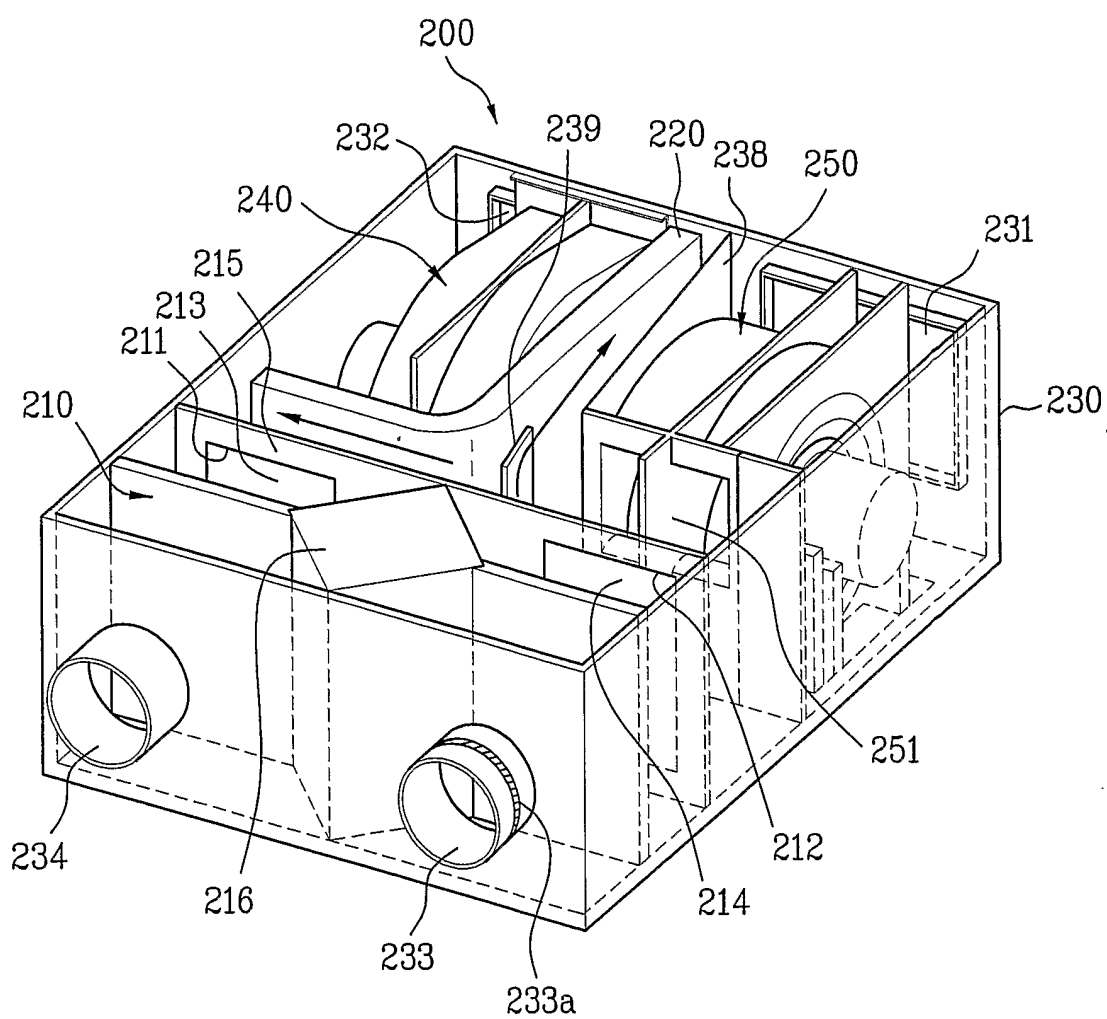
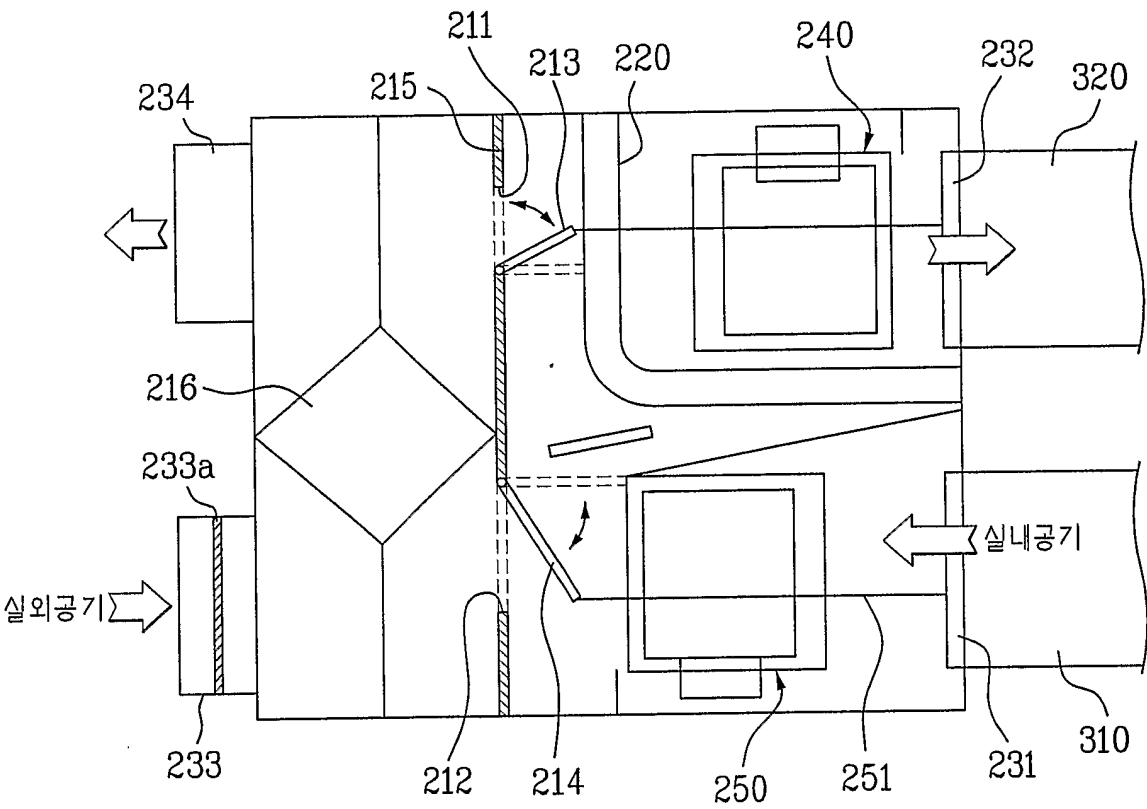
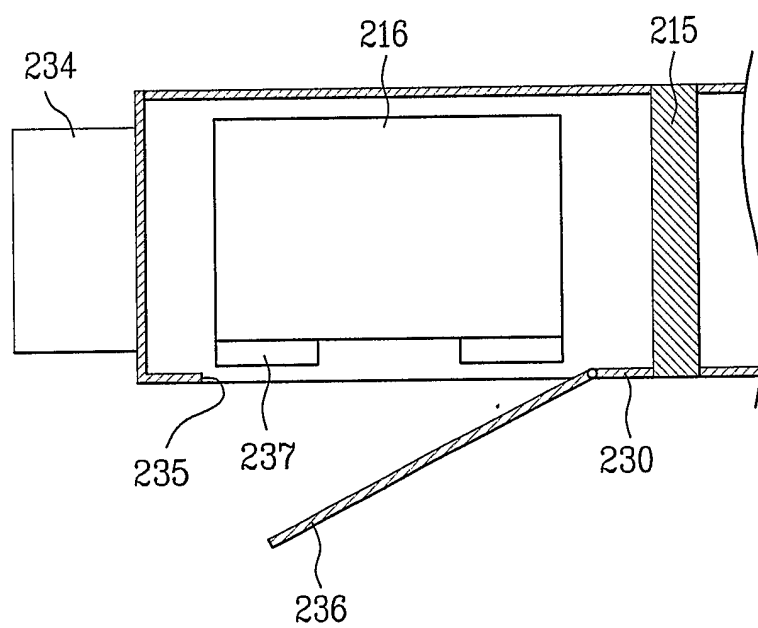


FIG. 3



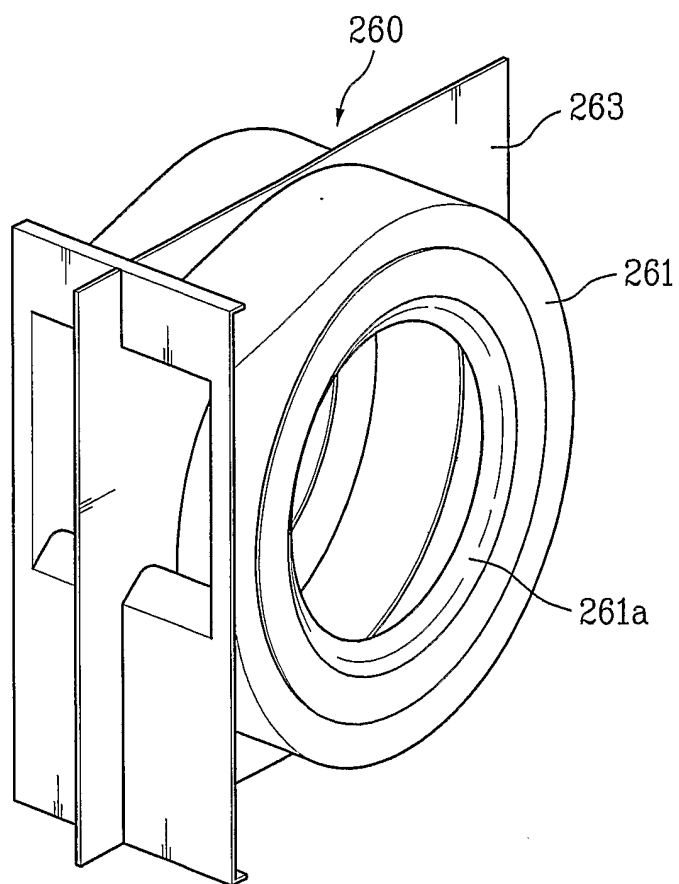
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FIG. 4



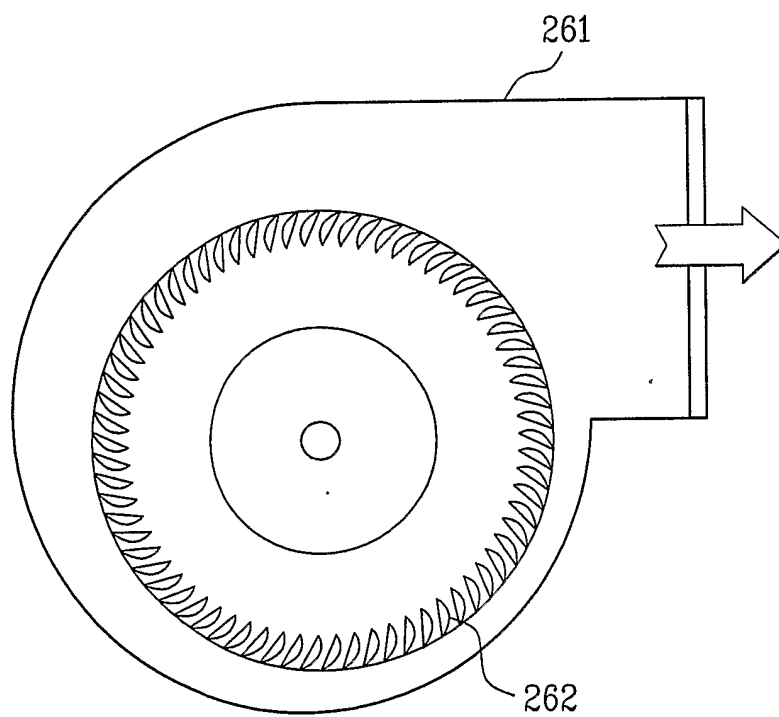
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FIG. 5A



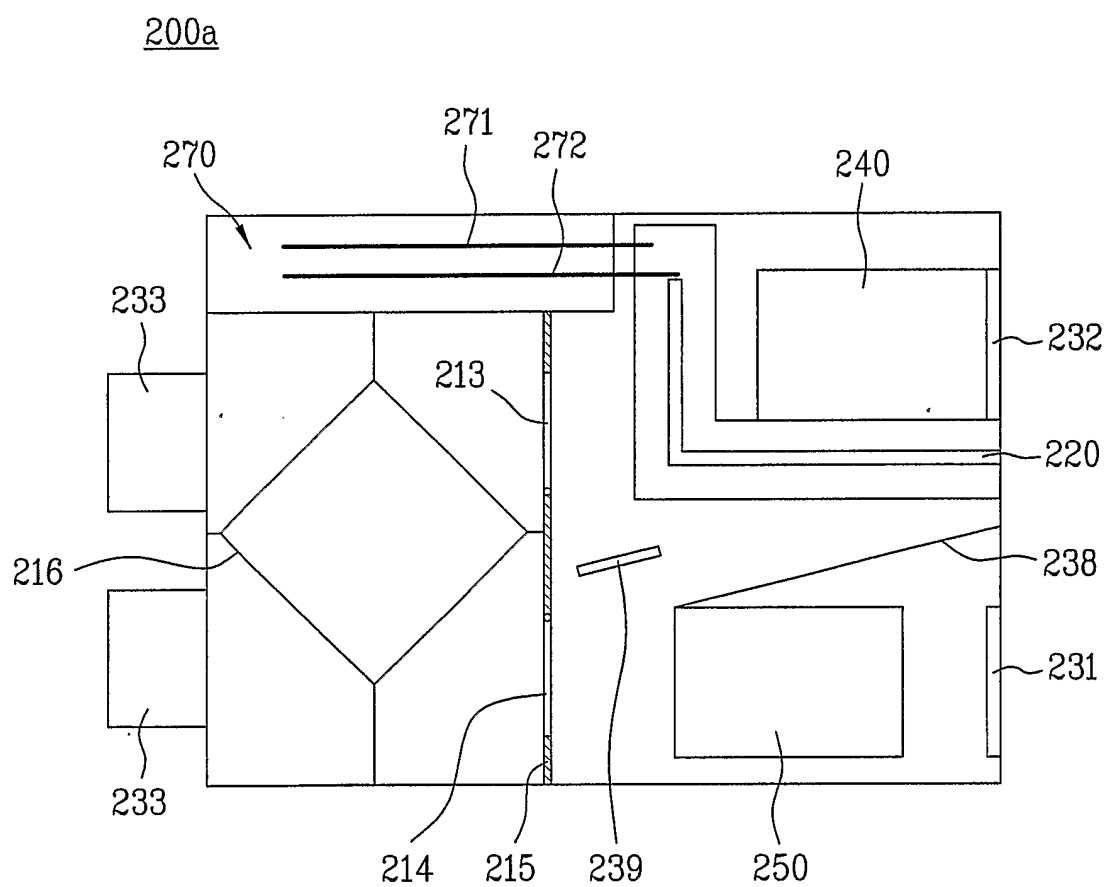
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FIG. 5B



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FIG. 6



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FIG. 7

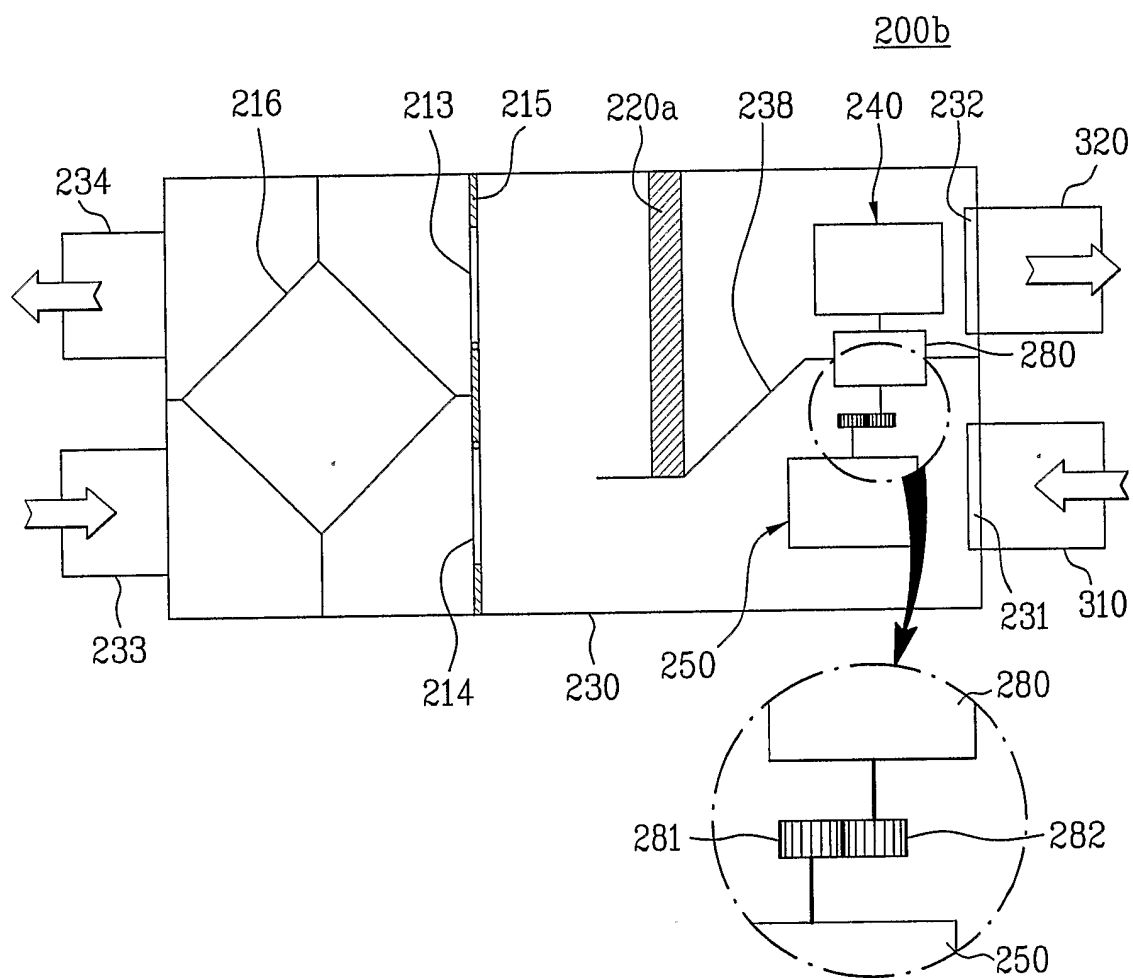
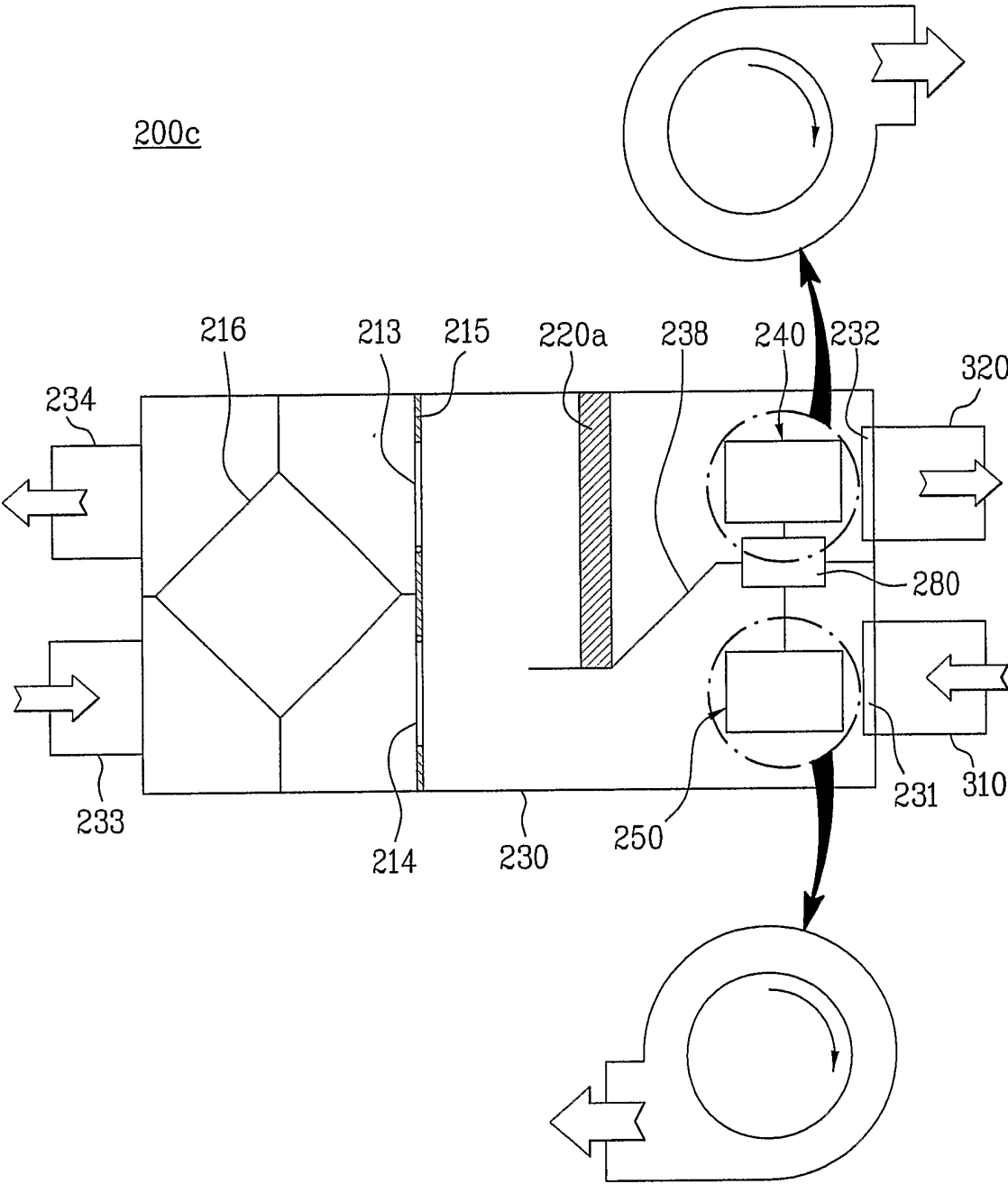
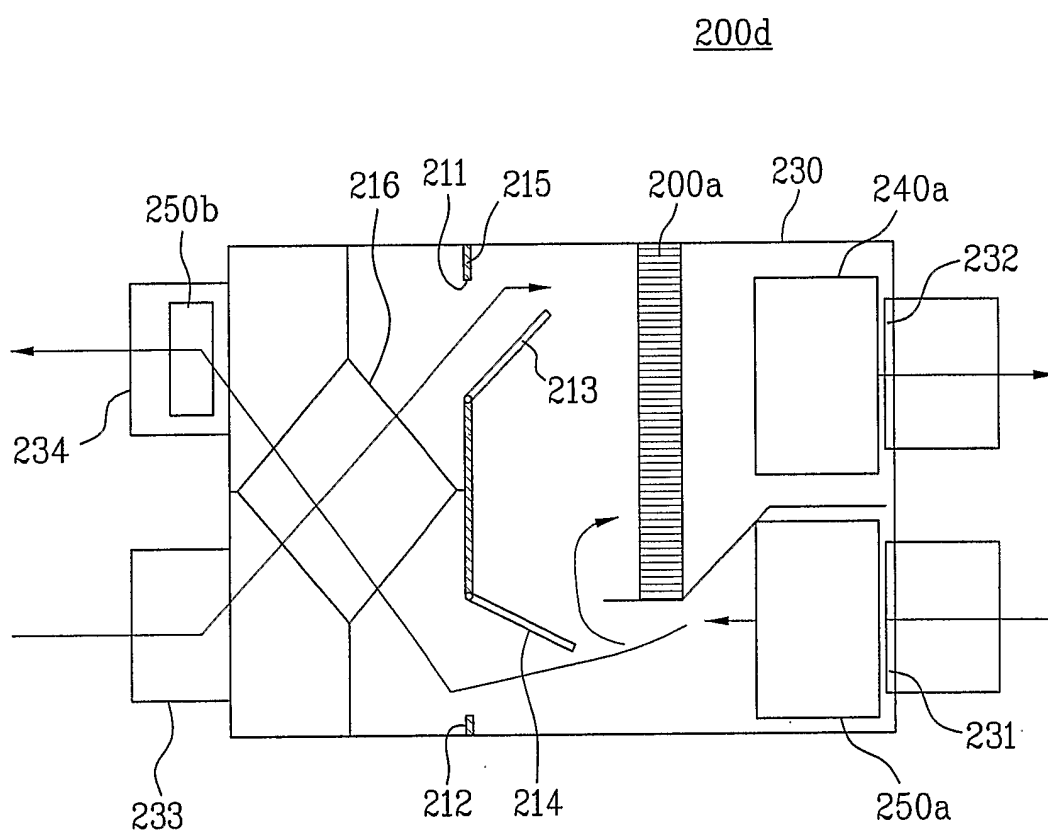


FIG. 8



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FIG. 9



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FIG. 10A

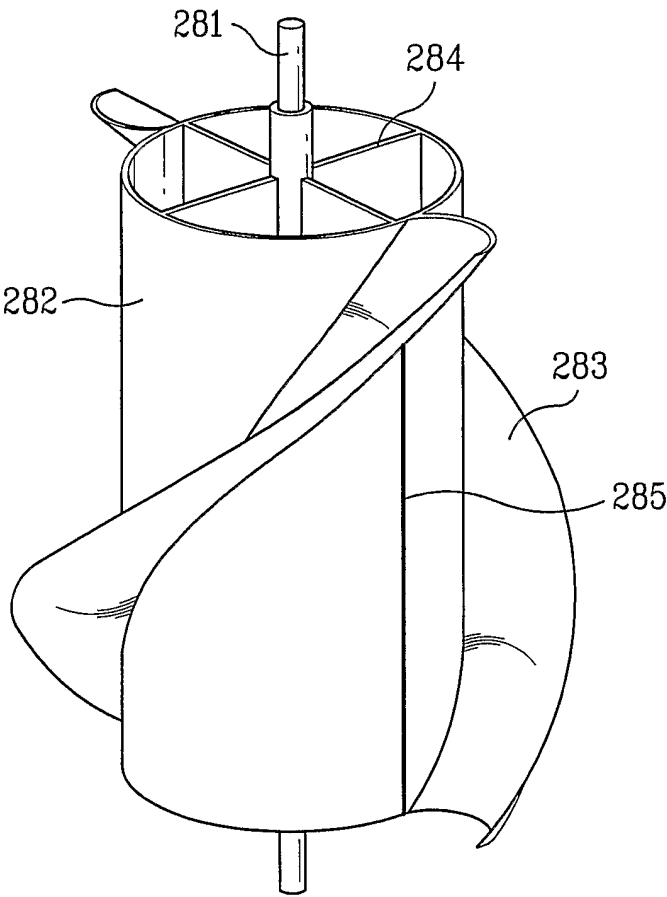


FIG. 10B

