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Remarks:
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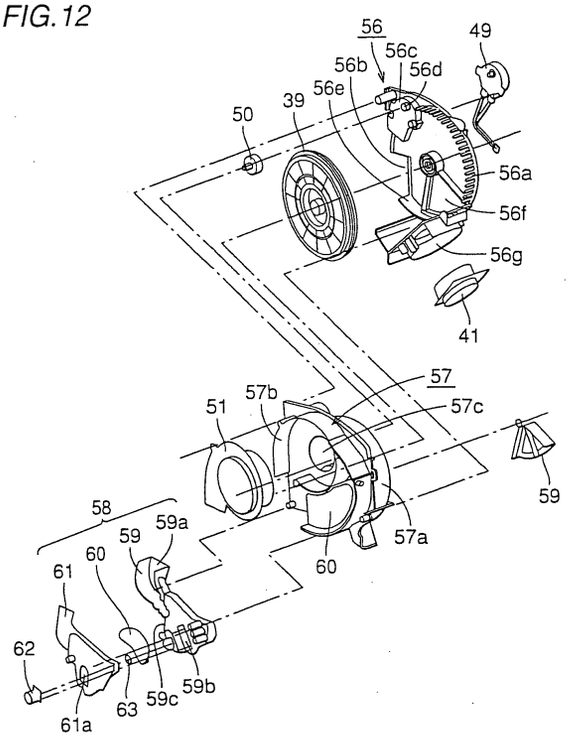
(54) Air conditioner and humidifying/dehumidifing apparatus attached thereto

(57) A humidifying/dehumidifying apparatus (24) contained in an air conditioner has a driving motor (49) for rotating a rotating body (39) of a moisture absorber is provided outside a case (56), on the side of the case (56) in the same plane as the rotating body (39). Therefore, the motor (49) can be mounted at the end, facilitating maintenance. Further, the state of engagement between the rotating body and a driving gear can be easily recognized.

FIG.12



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a humidifying/dehumidifying apparatus attached to an indoor unit of an air conditioner. More specifically, the present invention relates to a humidifying/dehumidifying apparatus of which maintenance is facilitated.

Description of the Background Art

[0002] Some of the indoor units of air conditioners have a display apparatus.

[0003] Referring to Fig. 22, a display apparatus of an indoor unit of a conventional air conditioner disclosed in Japanese Patent Laying-Open No. 11-159846 will be described. A display apparatus 104 is arranged on the right side of an inlet 103 of a body 102 of an indoor unit 101. For display apparatus 104, a liquid crystal display is employed which has an overall display portion enlarged to be easier viewable, on which an operation mode, a state of operation and the like are displayed. :

[0004] In the prior art, as described in Japanese Patent Laying-Open No. 11-159846, the liquid crystal display apparatus is provided on a lower right side of the indoor unit. Though convenience of use is considered, by displaying a state of operation and temperature and moisture inside and outside of the room, it is still necessary to increase the area when the contents to be displayed on the liquid crystal display apparatus are to be added. Therefore, as long as the apparatus is on the present position, the size of the liquid crystal display apparatus is disadvantageously limited or the width of the body must be increased.

[0005] When serious air conditioning is considered, there arises a problem that the space and layout of the display position would be limited when a humidifying/dehumidifying apparatus having the functions of humidifying, dehumidifying and ventilating indoor air to be incorporated.

[0006] Referring to Figs. 23 and 24, a humidifying/dehumidifying apparatus attached to an indoor unit of a conventional air conditioner will be described. In a case L201, a recovery fan 202 and a motor mounting plate on which a motor is fixed are mounted by screws at prescribed positions, and a moisture absorbing rotor 203 is fitted on a shaft portion of case L201, with an outer peripheral gear side facing the case L202. A driving motor 204 and a reduction gear 205 of moisture absorbing rotor 203 are also attached at prescribed positions. A case R208 having a metal cover 207 incorporating a recovery heater 206 incorporated at a prescribed position is combined with case L201 and fixed by a screw. Further, on the side of case R208 facing the metal cover 207, a metal mounting plate, on which a motor for the moisture absorbing fan 209 is mounted, is fixed at a prescribed position by a screw. Finally, a damper unit 212 having a damper 210 and a damper motor 211 mounted thereon is mounted on case R208, whereby the humidifying/dehumidifying apparatus is completed. Moisture absorbing rotor 203 is an absorber consisting of a number of cylindrical ceramic members and having a substance absorbing moisture in the air applied thereon. Moisture absorbing rotor 203 is driven to rotate at a low speed by motor 204 with a speed change gear 205 interposed. Moisture absorbing fan 209 is driven by a moisture absorbing fan motor, which feeds the air sucked from the room to moisture absorbing rotor 203 and thereafter guides the air to an exhaust duct so that the air is exhausted to the outside of the room.

[0007] Here, as the air passes through moisture absorbing rotor 203, most of the water contained in the air is absorbed by the moisture absorbing rotor 203. A recovery fan 202 is driven by a recovery fan motor, which feeds the air sucked from the room to the moisture absorbing rotor 203, guides the air to recovery heater 206 so that the air again passes through moisture absorbing rotor 203 and returns the air to the room through an outlet.

[0008] In the above described prior art, a rotor of an absorber absorbing and desorbing water in the indoor air rotates in a case. Therefore, there is a problem that it is impossible to visually confirm whether the rotor rotates smooth in the case. Further, as a driving motor for the rotor is mounted an the case, there is another problem that it is necessary to disassemble when the motor is to be exchanged.

[0009] The present invention was made in view of the problems of the prior art, and its object is to provide a humidifying/dehumidifying apparatus which can be surely inspected and of which maintenance is improved.

[0010] Though an air conditioner having a ventilating function has been provided conventionally, there has been a problem when an exhaust duct and various pipes are drawn from the room to the outside.

[0011] Figs. 25 to 27 represent an example of how various pipes and the exhaust duct of a conventional air conditioner are drawn out. From an indoor unit A, refrigerant pipes 71 and 72, a drain hose 73, a power line 74 and an exhaust duct 75 are drawn out, bound together by binding means such as an insulating tape, and drawn to the outside through a pipe hole 77 communicating with the indoor side and the outdoor side opened in a wall 76 behind the indoor unit A.

[0012] Among the various pipes drawn out, refrigerant pipes 71 and 72 as well as power line 74 are connected to an outdoor unit placed outside of the room. Exhaust duct 75 is drawn out through pipe hole 77 and extended to a weather cover 81 provided for avoiding the rain, and the air from an outlet of exhaust duct 75 is exhausted to the outside through an air flow outlet provided on the weather cover.

[0013] In the conventional air conditioner, when it is

necessary to bend refrigerant pipes 71 and 72 to cross a longitudinal axis of exhaust duct 75 where the pipes comes out from the room through pipe hole 77, refrigerant pipes 71 and 72 extend traversing between the outlet of exhaust duct 72 and the air flow outlet 82 of weather cover 81. Accordingly, it is possible that refrigerant pipes 71 and 72 hinder air circulation, lowering circulation efficiency.

[0014] When an end surface of the outlet of exhaust duct 75 comes to be in contact with a wall surface of weather cover 81, the outlet of exhaust duct 75 is closed, possibly hindering air circulation from exhaust duct 75 to the air flow outlet of weather cover 81.

SUMMARY OF THE INVENTION

[0015] The above object is according to the invention achieved by a humidifying/dehumidifying apparatus including a rotating body of an absorber absorbing and desorbing water in the air, a moisture absorbing fan sucking in an indoor air, a heater heating air for desorbing water from the moisture absorber, and a recovery fan feeding the heated air, wherein a receiving portion receiving a driving gear transmitting rotational drive to the rotating body of said moisture absorber from said motor for rotating the rotating body of said moisture absorber is provided on a side of a case on the same plane as the rotating body.

[0016] Further, a receiving portion receiving a driving gear transmitting rotational drive to the rotating body of the moisture absorber from the motor is provided on a side of the case on the same plane as the rotating body. Because of this structure, the state of engagement between the rotating body and the gear can be easily confirmed.

[0017] Further, in the apparatus, the moisture absorbing rotating body, the driving gear, the receiving portion for the driving gear and the driving motor are arranged in this order. Because of this structure, the motor can be attached at the end of assembly, and hence, maintenance is facilitated.

[0018] Further, an inlet for sucking air in the room on the side of the case and a cut-out on the opposite side are provided. Because of this configuration, manual inspection through the cut-out is possible.

[0019] Further, all the components including the case are made transparent. Because of this feature, it becomes possible to check inner states without disassembly.

[0020] The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

Fig. 1 is a perspective view showing an appearance of an indoor unit of an air conditioner in accordance with the parent application 00 122 158.9.

Fig. 2 is a schematic view of an in door unit body of the air conditioner in accordance with the parent application 00 122 158.9.

Fig. 3 is a schematic view of the main liquid crystal display apparatus of Fig. 2.

Fig. 4 is a schematic view of a remote controller shown in Fig. 1.

Fig. 5 is a cross section taken along the line A-A showing the structure of the air conditioner of Fig. 1.

Fig. 6 is a cross section taken along the line B-B showing the structure of the indoor unit of Fig. 1.

Fig. 7 shows a state of mounting of the liquid crystal display apparatus of Fig. 2 to the body.

Fig. 8 is a schematic illustration of Fig. 7.

Fig. 9 is a schematic view of an indoor unit body of an air conditioner adapted for containing a humidifying/dehumidifying apparatus in accordance with the embodiment of the present invention.

Fig. 10 is a perspective view of humidifying/dehumidifying apparatus in accordance with the embodiment of the present invention attached to an indoor unit.

Fig. 11 shows a structure of the humidifying/dehumidifying apparatus in accordance with the embodiment of the present invention.

Fig. 12 is an exploded view of the humidifying/dehumidifying apparatus in accordance with the embodiment of the present invention.

Fig. 13 is an exploded view of portions near the case L of Fig. 12.

Fig. 14 is a perspective view of the case L shown in Fig. 12.

Fig. 15 is a perspective view of the case R shown in Fig. 12.

Fig. 16 is an illustration representing a relation between air flow and a moisture absorbing rotor.

Fig. 17 is a vertical cross section representing an example of pipes in an air conditioner

Fig. 18 is a cross sectional view of the examples of pipes of the air conditioner

Fig. 19 is a side view showing an example of auxiliary duct used for an exhaust duct of the air conditioner

Fig. 20 is a front view of the auxiliary duct.

Fig. 21 is a plan view of the auxiliary duct.

Fig. 22 is a schematic illustration of an indoor unit of a conventional air conditioner.

Fig. 23 is an exploded view of a conventional humidifying/dehumidifying apparatus.

Fig. 24 is an exploded view of portions near the case L in the conventional humidifying/dehumidifying ap-

paratus.

Fig. 25 is a perspective back view showing an example of pipes in the conventional air conditioner.

Fig. 26 is a vertical sectional view showing an example of pipes in the conventional air conditioner.

Fig. 27 is a cross sectional view showing an example of pipes in the conventional air conditioner.

[0022] The configuration of the indoor unit of an air conditioner in accordance with the parent application 00 122 158.9 will be described.

[0023] Fig. 1 is a schematic front perspective of the indoor unit of the air conditioner in accordance with the present embodiment, and Fig. 2 is a front perspective with the front panel of Fig. 1 opened. As can be seen from Fig. 1, indoor unit 1 includes a body casing 2 in which a heat exchanger and an indoor fan are in provided, a front panel 3 which can be opened for visually inspecting the inside of the body to check dirt on the filter, an outlet 4 letting out cooled/heated air, an inlet 5 sucking in indoor air, a main liquid crystal display apparatus 6 displaying a state of operation, and an outlet 7 letting out air from a humidifying/dehumidifying apparatus. A remote controller 8 is for remote-controlling power on/off or for changing the state of operation.

[0024] With the front panel 3 opened as shown in Fig. 2, it can be seen that a right filter 9 and a left filter 10 are arranged at a lattice-like inlet of body casing 2 facing inlet 5 of front panel (see Fig. 1), and air cleaning filters 11 and 12 are mounted approximately at the central portions of right filter 9 and left filter 10, respectively. Further, a filter 13 for an inlet for the humidifying/dehumidifying apparatus to suck in the indoor air is provided at a left end portion of the body casing 2.

[0025] As can be seen from Fig. 3, a main liquid crystal display apparatus 6 is provided at the central portion of indoor unit 1. Main liquid crystal display apparatus 6 includes a moisture lamp 14 which is turned on in accordance with the moisture in the room, a purity lamp 15 of which color changes in accordance with the degree of contamination of the room, a display unit 16 displaying indoor environment and the state of operation in accordance with a signal from an operation button of a remote controller 8, and a light receiving portion 17 receiving a signal from remote controller 8.

[0026] Remote controller 8 shown in Fig. 4 includes a remote controller display unit 18 displaying the state of operation, a transmission display 19 which is turned on when a signal is transmitted to indoor unit 1, an operation on/off switch 20 for turning on/off the operation of the air conditioner, a temperature switch 21 for setting the indoor temperature, an operation selecting switch 22 for selecting an operation mode, and flow rate switch 23 for switching the flow rate.

[0027] Fig. 5 is a cross sectional view taken along the line A-A of Fig. 2 of the body of indoor unit 1. Indoor unit 1 includes a body casing 2 as a base of indoor unit 1, an indoor heat exchanger 25 through which a heating/cooling medium (refrigerant) is passed for heat-exchanging between the indoor and outdoor air, an indoor fan 26 sucking in the indoor air and blowing out the air heat-exchanged by the indoor heat exchanger 25, a vertical louver 27 for changing air flow in the left and right directions at the outlet 4 of body casing 2, and a horizontal louver 28 for changing the air flow in the upward and downward directions. Further, air cleaning filters 11 and 12 for removing dust in the air sucked in through the inlet are provided on the left and right portions. As can be seen from Fig. 2, air cleaning filters 11 and 12 are inserted through filter guides 29 of body casing 2. Right filter 11 has such a shape that is branched at the portion of the liquid crystal display apparatus in order to remove dust in the air from the room also in the space behind the main liquid crystal apparatus 6. Further, a drain pan 30 is arranged below indoor heat exchanger 25 to receive drainage generated when heat-exchange with the indoor air takes place. Above the main liquid crystal display apparatus 6 of front panel 3, an inlet 31 for sucking in the indoor air is formed, and an inlet 32 for sucking in the indoor air is also provided at an upper surface of body casing 2.

[0028] Fig. 6 is a cross sectional view taken along the line B-B of Fig. 2 of indoor unit 1. Different from the cross section of Fig. 5 taken along the line A-A, there is not the main liquid crystal display apparatus 6, and therefore, the shape of the front panel 3 is relatively flat, as it does not have the projected portion covering the main liquid crystal display apparatus 6, and an inlet 5 is formed at the front surface.

[0029] Main liquid crystal display apparatus 6 includes a liquid crystal display 33 displaying the indoor environment and the state of operation in accordance with a signal from an operation button of the remote controller, a display substrate 35 on which an LED 34 for illuminating the liquid crystal display 33 is mounted, and a liquid crystal holder 36 holding the liquid crystal display 33, as shown in Fig. 7. Liquid crystal holder 36 includes a portion receiving liquid crystal display 33 and a portion for fixing on the body casing 2, and there are a plurality of partition walls 37, on the right side of which a fixing portion 38 for fixing on the body casing 2 is formed. Main liquid crystal display apparatus 6 is mounted on body casing 2 in the manner as shown in Fig. 8. More specifically, main liquid crystal display apparatus 6 is mounted on body casing 2 by fixing the fixing portion 38 of partition wall 37 of the liquid crystal holder 36 by means of a screw.

[0030] The operation procedure will be described in the following. Operation mode of the air conditioner is switched every time the "operation selection" switch 22 on the control panel of remote controller 8 is pressed, in the order of "automatic" - "heating" - "cooling" - "dry" - "automatic"-, the operation mode is displayed on display unit 18 of remote controller 8, and the user selects the operation mode accordingly.

[0031] When "operation on/off" switch 20 on the con-

trol panel of remote controller 8 is pressed, the contents of operation, set temperature and the room temperature are displayed in order on main liquid crystal display apparatus 6 of indoor unit 1, and during the operation, the room temperature is constantly displayed.

[0032] When the operation is to be stopped, "operation on/off" switch 20 on the control panel of remote controller 8 is pressed, then the display on main liquid crystal display apparatus 6 of indoor unit 1 disappears and the operation is stopped. When the temperature is to be changed, for example, when the temperature is to be increased by 1°, "Δ" switch of "temperature" switch on the control panel of remote controller 8 is pressed once, then the set temperature is increased by 1°. In the heating or cooling operation mode, the set temperature is displayed on the remote controller display unit 18 on the control panel of remote controller 8 and on the main liquid crystal display apparatus 6 of the indoor unit 1. In the automatic or dry operation mode, the amount of temperature to be increased is displayed on remote controller display unit 18 on the control panel of remote controller 8, while the set temperature is displayed on the main liquid crystal display apparatus 6 of indoor unit 1. At this time, the display of the set temperature on the main liquid crystal display apparatus 6 of indoor unit 1 returns to the display of the room temperature after approximately 4 seconds. When the flow rate is to be changed, "flow rate" switch 23 on the control panel of remote controller 8 is pressed. Every time the switch 23 is pressed, the flow rate changes and the display "flow rate automatic" - "flow rate Δ" - "flow rate ΔΔ" - "flow rate ΔΔΔ" - "flow rate automatic" is given at display unit 18 on control panel of remote controller 8, and the display "flow rate automatic" - "flow rate minimum" - "flow rate medium" - "flow rate maximum" - "flow rate automatic" is displayed on main liquid crystal display apparatus 6 of indoor unit 1.

[0033] The operation will be described in the following with reference to Figs. 5 and 6. In a cooling operation, a heat exchange medium at a high temperature condensed by a compressor is fed to an outdoor heat exchanger of an outdoor unit. At the outdoor heat exchanger, outdoor air deprives the heat exchange medium of heat as it passes through the outdoor heat exchanger by the operation of an outdoor fan, and the heat exchange medium is cooled. The heat exchange medium passes through a decompressor, evaporated at an indoor heat exchanger 25 of indoor unit 1, and deprives the air in the room of heat as the air in the room is passed by the indoor fan 26 through the indoor heat exchanger 25. In this manner, the air in the room is cooled, and the room is cold. Heating of the room is performed by reverse-circulating the heat exchange medium in the direction reverse to the cooling operation. Condensed heat exchange medium is fed to the indoor heat exchanger 25 of indoor unit 1, so as to warm up the air in the room passing through indoor heat exchanger 25. The heat exchange medium is further passed through the decompresser, evaporated at the outdoor heat exchanger of the outdoor unit, and after the outdoor air is passed through the outdoor heat exchanger by the outdoor fan and heat-exchange takes place, deprives the outdoor air of heat, and returns to the compressor.

[0034] As to the air flow caused by indoor fan 26 for feeding the indoor air through the indoor heat exchanger 25 so as to deprive the indoor air of heat, the indoor air is sucked in through the inlet 12 positioned above the humidifying/dehumidifying apparatus and inlet 5 of the front panel 3 of in door unit 1, passes through the left filter 10 and enters to the indoor heat exchanger 25, on one hand, and the indoor air entering through inlet 31 above main liquid crystal display apparatus 6 passes through right filter 9, enters to the space between main liquid crystal display apparatus 6 and indoor heat exchanger 25 and enters the indoor heat exchanger 25 through a passage between partition walls 37 of liquid crystal holder 36 on the other hand. Namely, the indoor air is sucked in, fully utilizing the surface of indoor heat exchanger 25. Therefore, heat exchange effectiveness at the indoor heat exchanger 25 is improved, and COP is also improved.

[0035] The humidifying/dehumidifying apparatus (not shown) arranged on the right side of the body 2 of indoor unit 1 sucks in the indoor air to be humidified/dehumidified through inlet 13 of body 2 through a filter 13. In a humidifying operation, for example, the humidifying/dehumidifying apparatus absorbs moisture in the indoor air and discharges the dry air to the outside of the room, and discharges moist air to the room. The apparatus is also capable of a dehumidifying operation in which moist air is discharged to the outside of the room and the dry air is discharged to the room. As an outlet 4 for heating/cooling by a compressor and an outlet 7 for the humidifying/dehumidifying apparatus are provided separately on the left and light, the positions of arrangement of the inlet and outlet of the indoor air are not mixed. Therefore, even when these operations are performed together, there would be no short-circuit caused by the airflow.

Preferred Embodiment of the Invention

[0036] The embodiment of the present invention will be described with reference to Figs. 9 to 16. Fig. 9 is a perspective view showing an appearance of the indoor unit of the air conditioner in accordance with the embodiment, Fig. 10 is a perspective view showing the humidifying/dehumidifying apparatus attached to the indoor unit, and Fig. 11 shows a configuration of the humidifying/dehumidifying apparatus of Fig. 10.

[0037] As shown in Figs. 9 and 10, the humidifying/dehumidifying apparatus is attached to a right end portion when viewed from the front side, of the indoor unit 1. An inlet 5 sucking in the indoor air is provided at a front panel 3 of indoor unit 1. Behind the inlet 5 of front panel 3, a body casing 2 is formed. At a right portion of body casing 2, an inlet 5a for sucking in the indoor air

of humidifying/dehumidifying apparatus 24 is arranged. On the back surface of body casing 2, an exhaust outlet 43 for discharging air from the humidifying/dehumidifying apparatus 24 to the outside of the room is provided, to which an exhaust duct 12 is connected. The humidifying/dehumidifying apparatus 24 contained in the indoor unit 1 will be described with reference to Fig. 3. In the figure, a moisture absorbing rotor 39 is an absorber including a number of cylindrical ceramic members, on which a substance absorbing water in the air is applied. Moisture absorbing rotor 39 is driven to rotate at a low speed by a motor 49 with a speed change gear 50 inserted therebetween. A moisture absorbing fan 51 is driven by a moisture absorbing fan motor, which sucks in the indoor air, passes the air to the moisture absorbing rotor 39, and thereafter guides the air to the exhaust duct 52 to be exhausted to the outside of the room. Here, most of the water contained in the air is absorbed by moisture absorbing rotor 39 as it passes through moisture absorbing rotor 39. A recovery fan 41 is driven by a recovery fan motor, and it serves to pass the air sucked in from the room through moisture absorbing rotor 39, to guide the air to the recovery heater 42 so that the air is again passed through moisture absorbing rotor 39, and to return the resulting air to the room through the outlet 7. Here, in the dehumidifying operation, for example, some of the water in the air is absorbed by moisture absorbing rotor 39, as the indoor air passes through moisture absorbing rotor 39. On the other hand, the water which has been absorbed by moisture absorbing rotor 39 is desorbed by the heat of recovery heater 42, and much moisture of the air passed therethrough is absorbed. By discharging the dried air to the room and discharging the moist air to the outside of the room in this manner, the air in the room is dehumidified. In a humidifying operation, the dried air is discharged to the outside, and moist air is fed to the inside of the room, so that the moisture contained in the indoor air is accumulated, the moisture in the room is increased, and the room is humidified.

[0038] Moisture absorbing rotor 39 having a moisture absorbing substance applied thereon is provided at the center of humidifying/dehumidifying apparatus 24, and zeolite powder with an adhesive mixed is used as the moisture absorbing substance. A moisture absorbing fan 51 of a sirocco fan and a moisture absorbing motor are arranged on an upper right side of moisture absorbing rotor 39, and recovery heater 42 is arranged at a lower portion. Behind moisture absorbing fan 51, exhaustion duct 52 is connected. Exhaustion duct 52 has such a structure that accommodates various extension ducts having different lengths and shapes, in accordance with positional correlation of connecting pipe holes of the indoor and outdoor units, when the air conditioner is installed. In front of the lower left side of moisture absorbing rotor 39, recovery fan 41, that is the sirocco fan, and the recovery fan motor are provided. Behind moisture absorbing rotor 39, a synchronous motor 49 for rotating moisture absorbing rotor 39, and a reduction gear 50 for reducing the speed of rotation of moisture absorbing rotor 39 are provided.

[0039] Humidifying/dehumidifying apparatus 24 is formed by a combination of a plurality of resin cases as shown in Fig. 12, and an inlet 56a, which has a number of aligned rectangular holes for sucking in the indoor air, is provided at a case R56. At a position opposite to inlet 56a, there is a cut-out 56b. Near the cut-out 56b, there is a mounting portion 56c in which motor 49 is placed. Mounting portion 56c has a gear receiving portion 56d receiving the reduction gear 50 for rotating moisture absorbing rotor 39 at a reduced speed, and the receiving portion 56d has a through hole. Cut-out 56b may have a structure that is sealed by a detachable cover. At the central portion of case R56, there is a bearing portion for the rotation shaft of moisture absorbing rotor 39. At a tip end portion of case R56, there is a wall 56e in the form of an involute curve, for mounting the recovery fan 41, and a casing formed of a boss for fixing the motor continuous to the wall 56e. There is a chamber 56f through which the recovered air is passed, and a passage passing through the chamber 56f to enter recovery fan 41. There is a receiving portion of a concave shape, accommodating motor 49, outside the case R56, and near this portion, there are two bosses on each of the left and right portions, that is, a positioning boss for fixing motor 49 and a boss with a hole provided at the center.

[0040] On the other hand, a case L57 has a bearing boss for the moisture absorbing rotor 39 at the central portion of a surface opposing to case R56, and a wall 57a at a small distance away from the outer periphery of moisture absorbing rotor 39, and holes are provided in approximately one half (about 180°) the bottom surface, so as to pass the recovered air therethrough. At the side opposing to the holes, there are holes 57c of about 60 mm, for passing the air that has passed through the moisture absorbing rotor 39. At a surface opposing to the mounting surface of moisture absorbing rotor 39, there is a wall 57b of the casing for moisture absorbing fan 51, sucking in the indoor air through moisture absorbing rotor 39. On the downstream side of the passage, there is a passage to a damper unit 58 for switching passages, and there is a plurality of holes for mounting a metal cover in which recovery heater 42 for heating the recovering air is placed.

[0041] On the left side of case L57, there is the damper unit 58 which is formed by combining two transparent resin cases, in which a damper 60 is contained. On the case L59 of damper unit 58 on the side of case L57, an inlet 59a for the dried air from moisture absorbing fan 51, an inlet 59b of moist air with moisture desorbed by moisture absorbing rotor 39, and a duct connecting hole 59c for discharging to the outside of the room, are provided. Further, there is a bearing boss for damper 60 at the central portion, and in the vicinity thereof, there is a receiving portion for the reduction gear 63 from a damper driving motor 62. On the other case R61 of damper

unit 58, there is an indoor outlet 61a for feeding the air back into the room, and in the vicinity thereof, there is a hole for mounting a motor for driving damper 60. As to the shape of damper 60, there is a bearing boss at the central portion, gears are arranged at approximately 1/4 of the outer periphery, and there is a wall for switching air passage.

[0042] The procedure for assembling humidifying/dehumidifying apparatus 24 is as follows. The motor mounting plate on which recovery fan 41 and the motor are fixed is mounted on a prescribed portion of case L56 by means of a screw, and moisture absorbing rotor 39 is fitted to the shaft of case L56, with the outer peripheral gear side facing the side of case L56. Further, reduction gear 50 is also mounted on a prescribed position. Case R57 with the metal cover 60 incorporating recovery heater 42 therein at a prescribed position is combined and fixed to case L56 by means of a screw. At this time, moisture absorbing rotor 39 is manually rotated through the cut-out 56b of case L56, whereby manual inspection by touching is possible to check any deviation or contact at the time of rotation. Further, on the side of metal cover 60 of case R57, a metal mounting plate on which the motor of moisture absorbing fan 51 is mounted is fixed at a prescribed position, by means of a screw. Finally, damper unit 58 having damper 60 and damper motor 62 mounted thereon is mounted on case L56, whereby humidifying/dehumidifying apparatus 24 is finished.

[0043] The function and the structure of the humidifying/dehumidifying apparatus as well as the air flow will be described, with reference to a humidifying operation. The air sucked in from the room is sucked through inlet 5 on the front surface of front panel 3 and inlet at an upper portion of body casing 2, and the air is guided to a left side surface of moisture absorbing rotor 39 through filter 13. On both sides of moisture absorbing rotor 39, air flow paths are formed respectively at the angles as shown in Fig. 16, and a rubber packing having such a shape that slides over the rotor surface is provided for sealing, so as to prevent leakage of air at a portion that is in contact with the rotor. The air sucked in by moisture absorbing rotor 51 passes through the area A having the area of 1/2 (180°) of the rotor side surface shown in Fig. 16 and, at this time, the water in the air is absorbed by the moisture absorbing substance applied on the rotor, so that after the passage through moisture absorbing rotor 39, the air is dry. The dried air is passed through exhaustion duct 52 and discharged to the outside of the room, by the function of the sirocco fan, operated by the motor of moisture absorbing fan 51. The air sucked in by the motor of recovery fan 41 passes through the areas B and D of Fig. 16, each having the area of 1/8 (45°) of the side surface of moisture absorbing rotor 8, exits from the right side surface of moisture absorbing rotor 39, returns and again is guided to recovery heater 42. When the air passes through the area B, the moisture in the air is absorbed by the moisture absorbing substance of the rotor, in the similar manner as described above. It is noted, however, that moisture absorbing rotor 39 rotates at a slow speed, and the area B follows the area A. Therefore, moisture absorbing efficiency at the area B is not so high as in area A. When the air passes through the area D, the moisture absorbing function of area D is small, as the area D follows the area C of moisture absorbing rotor 39 and the temperature of the ceramics as the material of the moisture absorbing rotor 39 is not yet sufficiently low. The air which has passed through areas B and D is heated to a high temperature as it passes through recovery heater 42, and thereafter, the air passes from the right side surface of moisture absorbing rotor 39 through an area of 1/4 (90°) of the side surface of moisture absorbing rotor 39 of area C shown in Fig. 5, to the left side surface. At this time, as the water absorbed in the moisture absorbing substance on moisture absorbing rotor 39 is heated, and emitted from the moisture absorbing substance. As a result, the air containing much moisture enters from the right side surface of moisture absorbing rotor 39 to the recovery fan 42, and blown out to the inside of the room through outlet 7.

[0044] By the function and structure described above, the dried air is discharged to the outside of the room, and the moist is accumulated in the room, so that room is humidified.

[0045] The humidifying/dehumidifying apparatus 24 assembled in this manner allows manual inspection by touching the moisture absorbing rotor 39 through the cut-out 56b of case R56 in the process of assembly. Therefore, any problem can be found at an earlier stage, and if there should be a trouble, the time necessary for disassembly can significantly be reduced.

[0046] Further, as the driving motor 49 for moisture absorbing rotor 39 is mounted on the outside of the case, maintenance is possible without disassembly, and therefore, the loss of time is avoided.

[0047] As is apparent from the foregoing description, the present invention provides a humidifying/dehumidifying apparatus which contains a rotating body of a moisture absorber absorbing and desorbing water in the air, a moisture absorbing fan sucking in the indoor air, a heater heating the air for desorbing water from the moisture absorber, and a recovery fan for feeding the heated air, in which the driving motor for rotating the rotating body of the moisture absorber is provided outside the case, and a cut-out is provided so that manual inspection by touching through the cut-out is possible, whereby any trouble can be found at an earlier stage, and even if there should be a trouble, the time for disassembly can significantly be reduced. Further, as the driving motor for the moisture absorbing rotor is mounted on the outside of the case, maintenance is possible without disassembly, and thus loss of time can be avoided.

[0048] Further, a receiving portion receiving a driving gear transmitting rotational drive to the rotating body of the moisture absorber from the motor is provided on the side of the case on the same plane as the rotating body.

Therefore, the state of engagement between the rotating body and the driving gear can be easily confirmed.

[0049] As shown in Figs. 17 and 18, refrigerant pipes 71 and 72, a drain hose 73, a power line 74 and a ventilation duct 75 are drawn out from an indoor unit A (see Fig. 25) to the outside of the room through a pipe hole 77 provided in a wall 76 behind the indoor unit. Particularly, an auxiliary duct 78 such as shown in Figs. 17 and 18 is coupled to an outdoor side end of ventilation duct 75.

[0050] Auxiliary duct 78 is molded by a hard resin, for example, and has a coupling portion 79 to be coupled to ventilation duct 75, and an outlet side end 80 having an approximately semicircular shape. As is apparent from Fig. 20, outlet side end 80 is molded, twisted by about 90° from the coupling portion 79.

[0051] Though coupling portion 79 has an approximately semicircular shape as the cross sectional shape of ventilation duct 75 is approximately semicircular, the shape is not limited to semicircular, and the shape may be adapted in accordance with the cross sectional shape of ventilation duct 75.

[0052] A weather cover 81 for avoiding rain is mounted on an outdoor surface of wall 76, and various pipes, ventilation duct 75 and auxiliary duct 78 are guided to weather cover 81. The air discharged from indoor unit A through ventilation duct 75 and auxiliary duct 78 are exhausted to the outside of the room through an outlet 82 of weather cover 81.

[0053] When pipes such as refrigerant pipes 71, 72, drain hose 73 and power line 74 are to be drawn out bent to cross the longitudinal axis of ventilation duct 75, the various pipes can be drawn out bent to cross ventilation duct 75 not passing between the outlet side end opening 83 of auxiliary duct 78 and the weather cover 81, if the pipes are bent along the twisted portion below the approximately semicircular outlet side end 80 twisted by about 90° of auxiliary duct 78. Therefore, decrease in air circulation efficiency circulating the ventilation duct can be prevented.

[0054] The coupling portion 79 of auxiliary duct 78 is adapted to be a coupling portion 79 of different diameters, having stepwise large diameter portion 79a and a small diameter portion 79b, so as to cope with a case where the pipe hole 77 is small and a ventilation duct 5 of small diameter must be used. Therefore, when the ventilation duct 75 to be coupled has a small diameter, it is possible to couple the auxiliary duct directly to the ventilation duct 75 by simply cutting the large diameter portion 79a.

[0055] Further, the outlet side end opening 83 of auxiliary duct 78 is cut obliquely, and therefore, when the duct is guided to weather cover 81 and brought into contact with the wall surface of weather cover 81, circulation of the air is not hindered, and good state of ventilation is ensured. Though the outlet side end opening 83 is cut obliquely upward in the shown example, the direction is not limited as long as the opening is cut obliquely.

[0056] As described in detail above, an auxiliary duct having an approximately semicircular outlet side end twisted by about 90° with respect to a coupling portion of the ventilating duct is coupled to an outdoor side end of the ventilation duct. Therefore, even when it is necessary to bend various pipes to cross the longitudinal axis of the ventilation duct, it becomes possible to bend the pipes not passing between an outlet end surface of the ventilation duct and the weather cover. Therefore, decrease in circulation efficiency of the air passing through the ventilation duct can be prevented.

[0057] When the coupling portion for coupling the auxiliary duct to the ventilation duct is adapted to be a coupling portion having cross sections of different diameters, it is unnecessary to prepare a separate auxiliary duct even when a pipe hole through which the ventilation duct is passed is small and a ventilation duct of a small size is necessary.

[0058] Further, when the outlet side opening of the auxiliary duct is cut obliquely, it is advantageous in that air circulation is not hindered even when the duct is guided to a weather cover provided to avoid rain and the outlet side end of the ventilation duct comes into contact with the wall surface of the weather cover.

[0059] Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation

Claims

1. A humidifying/dehumidifying apparatus including a rotating body (39) of an absorber absorbing and desorbing water in the air, a moisture absorbing fan (51) sucking in an indoor air, a heater (42) heating air for desorbing water from the moisture absorber, and a recovery fan (41) feeding the heated air, wherein

   a receiving portion receiving a driving gear transmitting rotational drive to the rotating body (39) of said moisture absorber from said motor (49) for rotating the rotating body of said moisture absorber is provided on a side of a case (56) on the same plane as the rotating body.

2. The humidifying/dehumidifying apparatus according to claim 1, wherein the moisture absorbing rotating body (39), the driving gear, the receiving portion for the driving gear and the driving motor (49) are arranged in this order.

3. The humidifying/dehumidifying apparatus according to any one of claims 1 or 2, wherein a cut-out (56b) is provided at a side opposing to an inlet (56a) sucking in the indoor air on the side of said case (56).

4. The humidifying/dehumidifying apparatus according to any one of claims 1 to 3, wherein all components including said case (56) are made transparent.

FIG.1

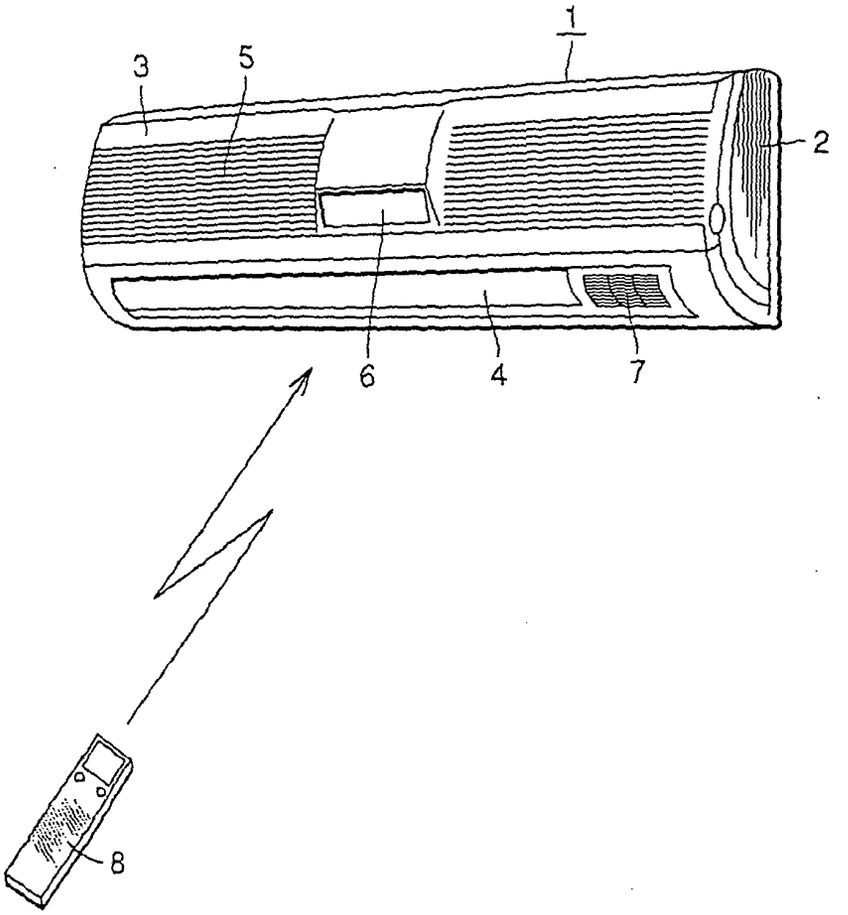


FIG.2

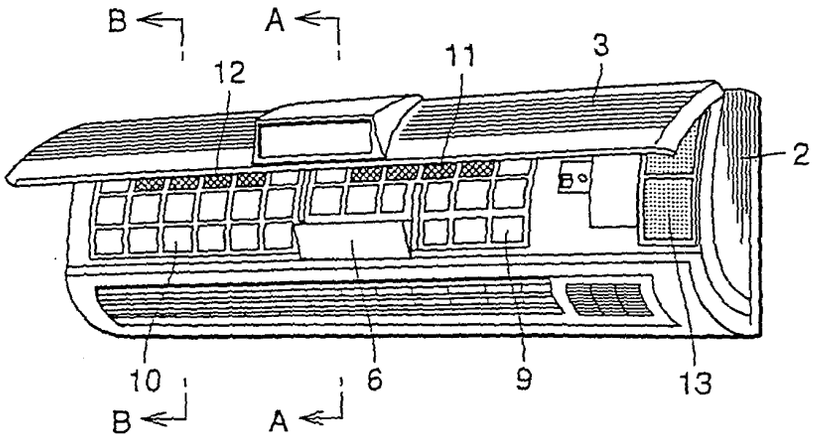


FIG.3

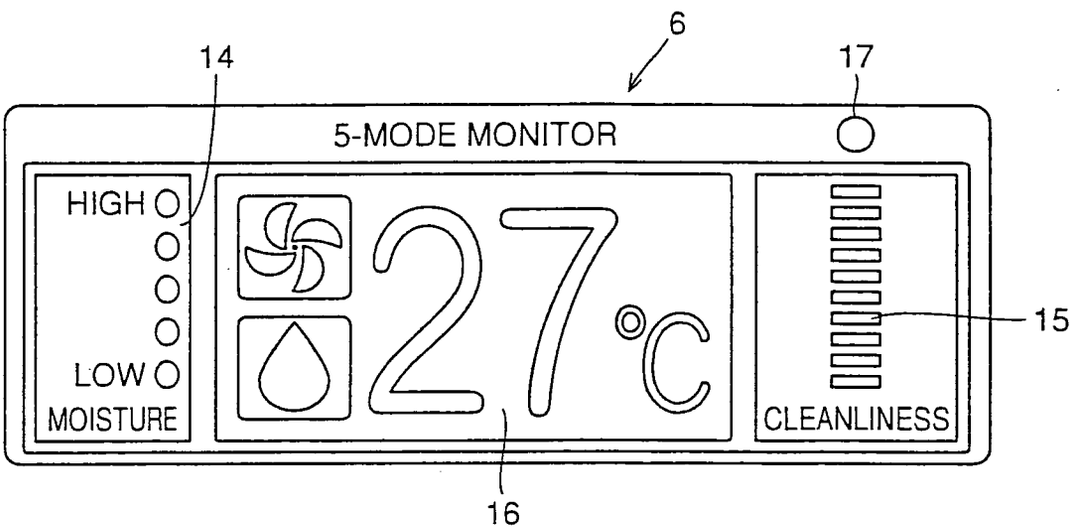

6
14
17
5-MODE MONITOR
HIGH
LOW
MOISTURE
27°C
CLEANLINESS
15
16

FIG.4

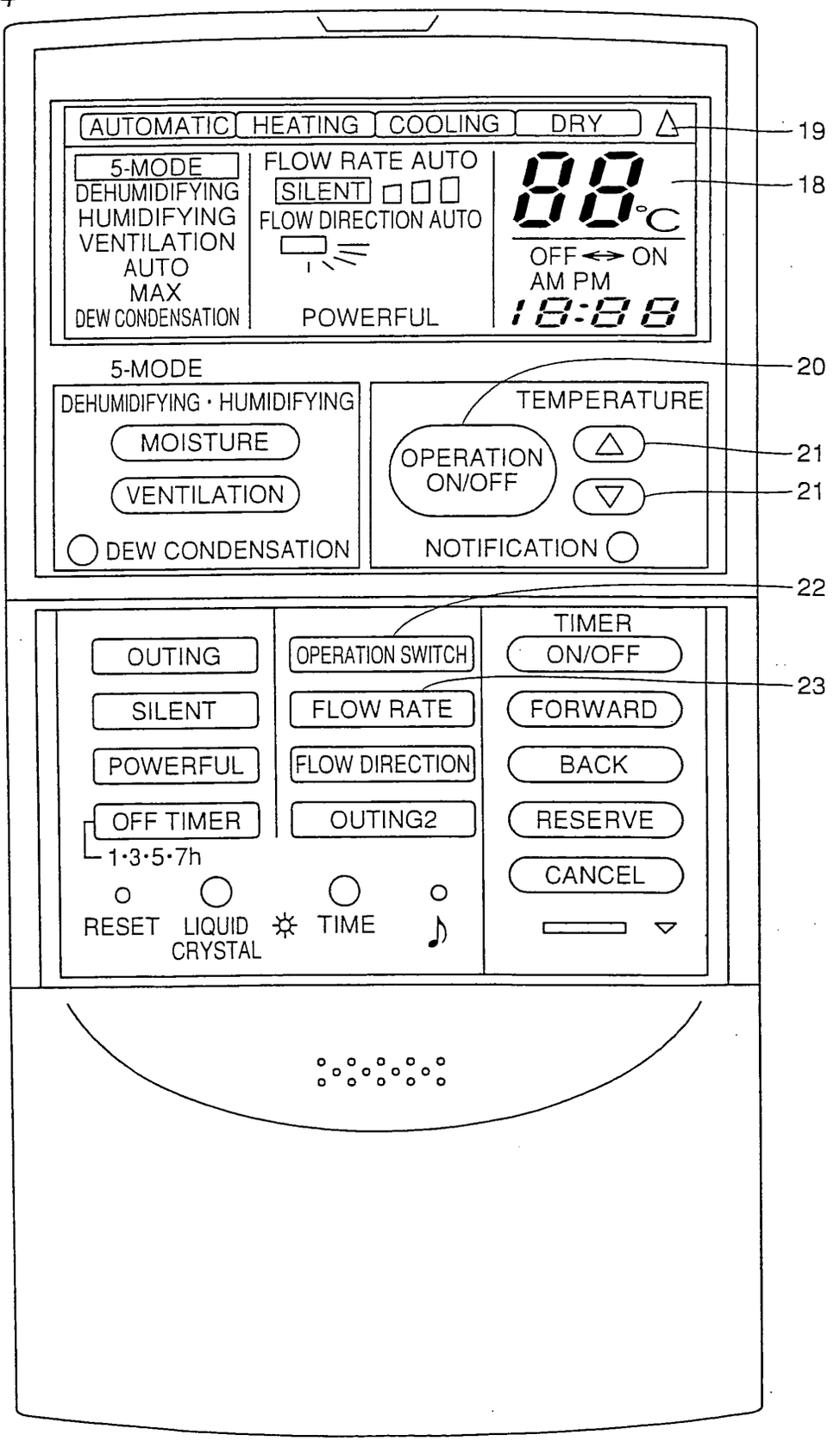

AUTOMATIC
HEATING
COOLING
DRY
19
5-MODE
DEHUMIDIFYING
HUMIDIFYING
VENTILATION
AUTO
MAX
DEW CONDENSATION
FLOW RATE AUTO
SILENT
FLOW DIRECTION AUTO
POWERFUL
88°C
18
OFF ↔ ON
AM PM
18:88
5-MODE
DEHUMIDIFYING · HUMIDIFYING
MOISTURE
VENTILATION
DEW CONDENSATION
20
TEMPERATURE
OPERATION ON/OFF
21
21
NOTIFICATION
22
TIMER
OUTING
SILENT
POWERFUL
OFF TIMER
1·3·5·7h
OPERATION SWITCH
FLOW RATE
FLOW DIRECTION
OUTING2
ON/OFF
23
FORWARD
BACK
RESERVE
CANCEL
RESET
LIQUID CRYSTAL
TIME

FIG.5

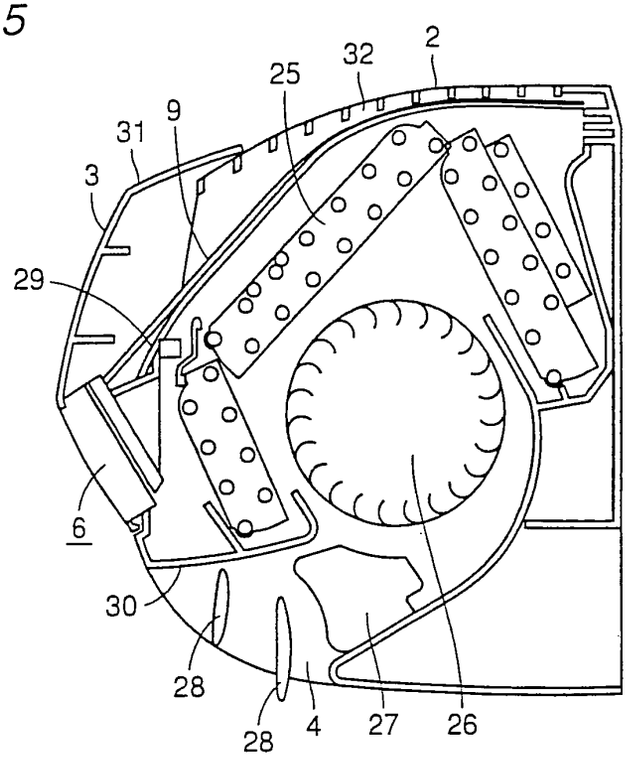


FIG.6

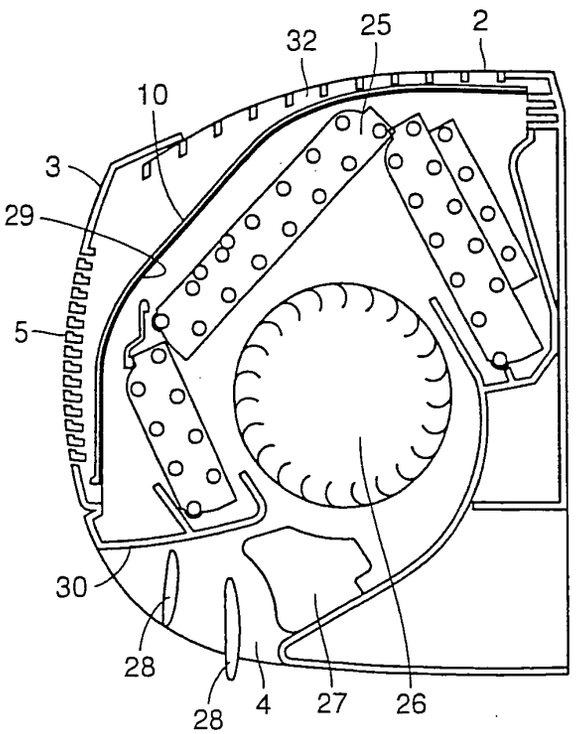


FIG.7

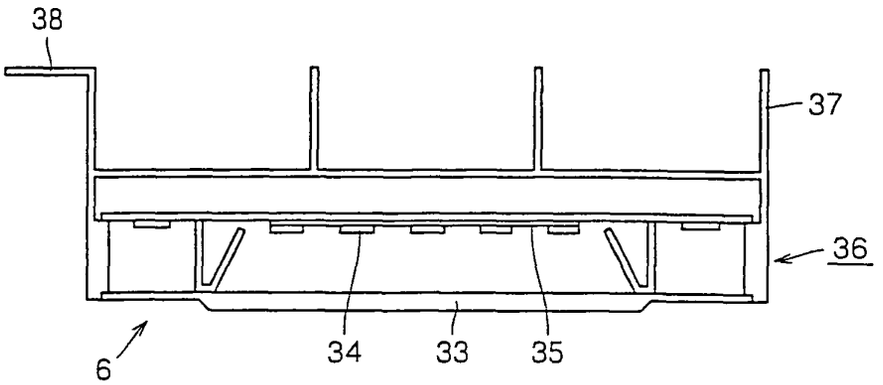


FIG.8

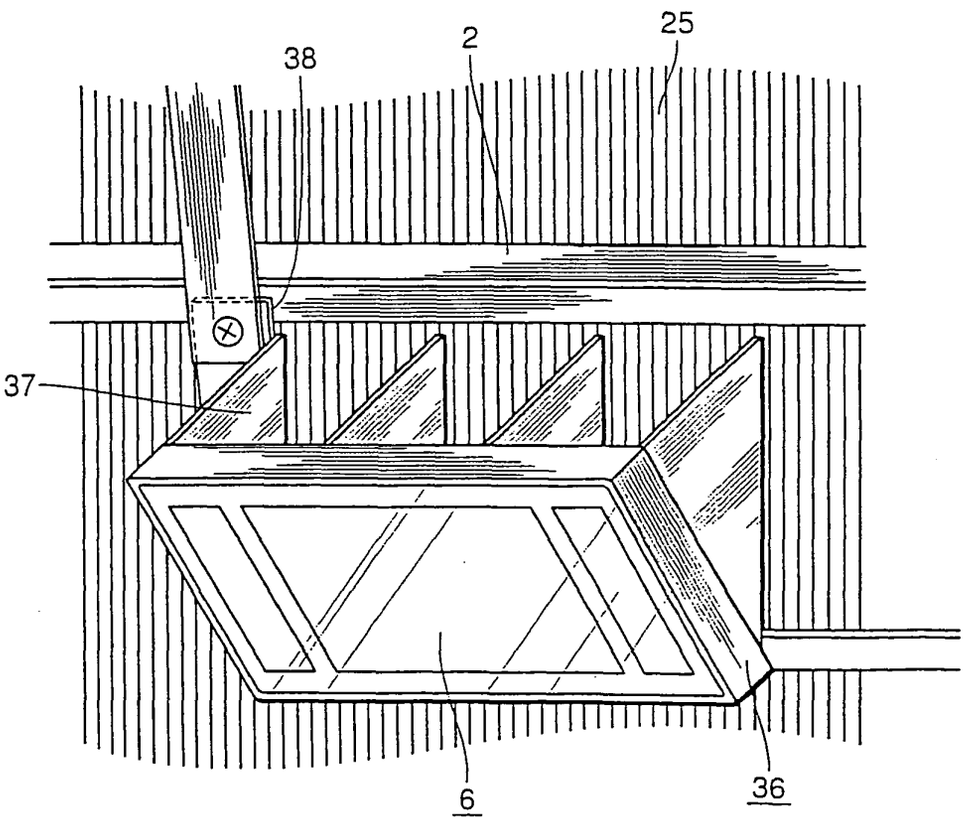


FIG.9

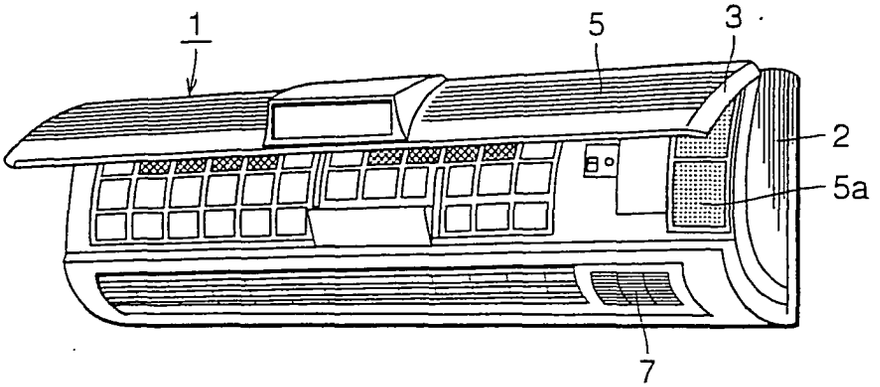


FIG.10

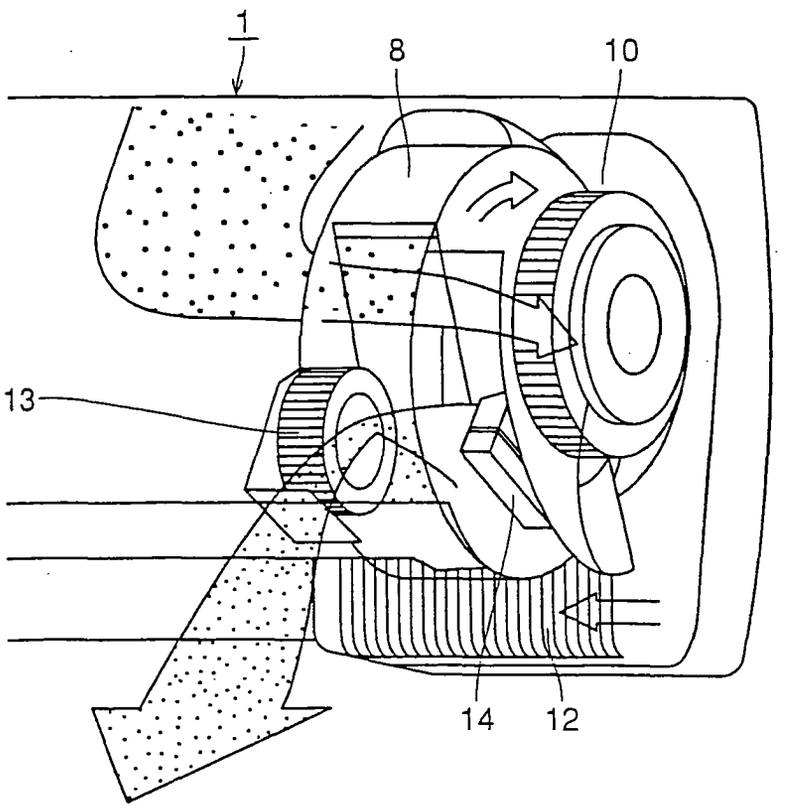


FIG.11

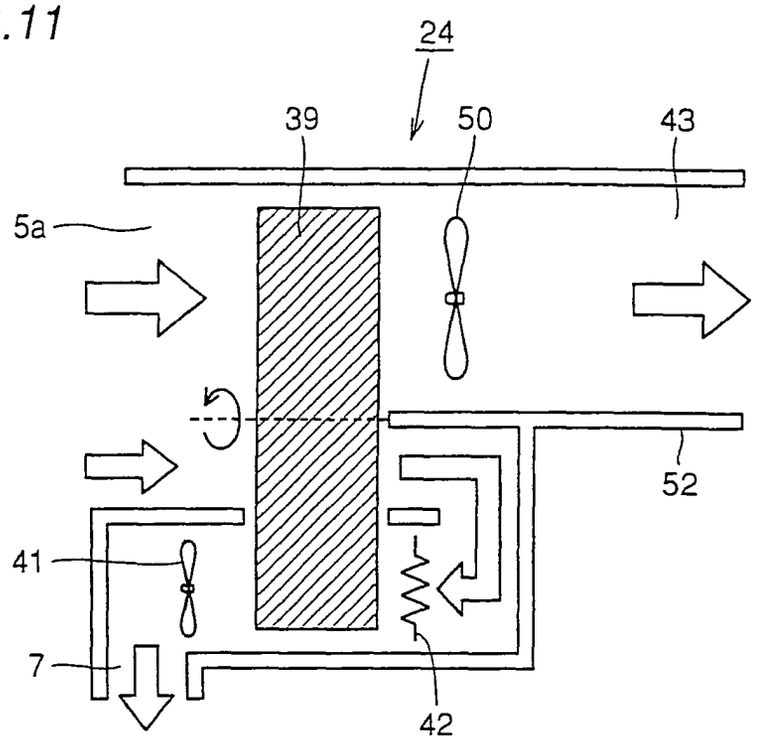
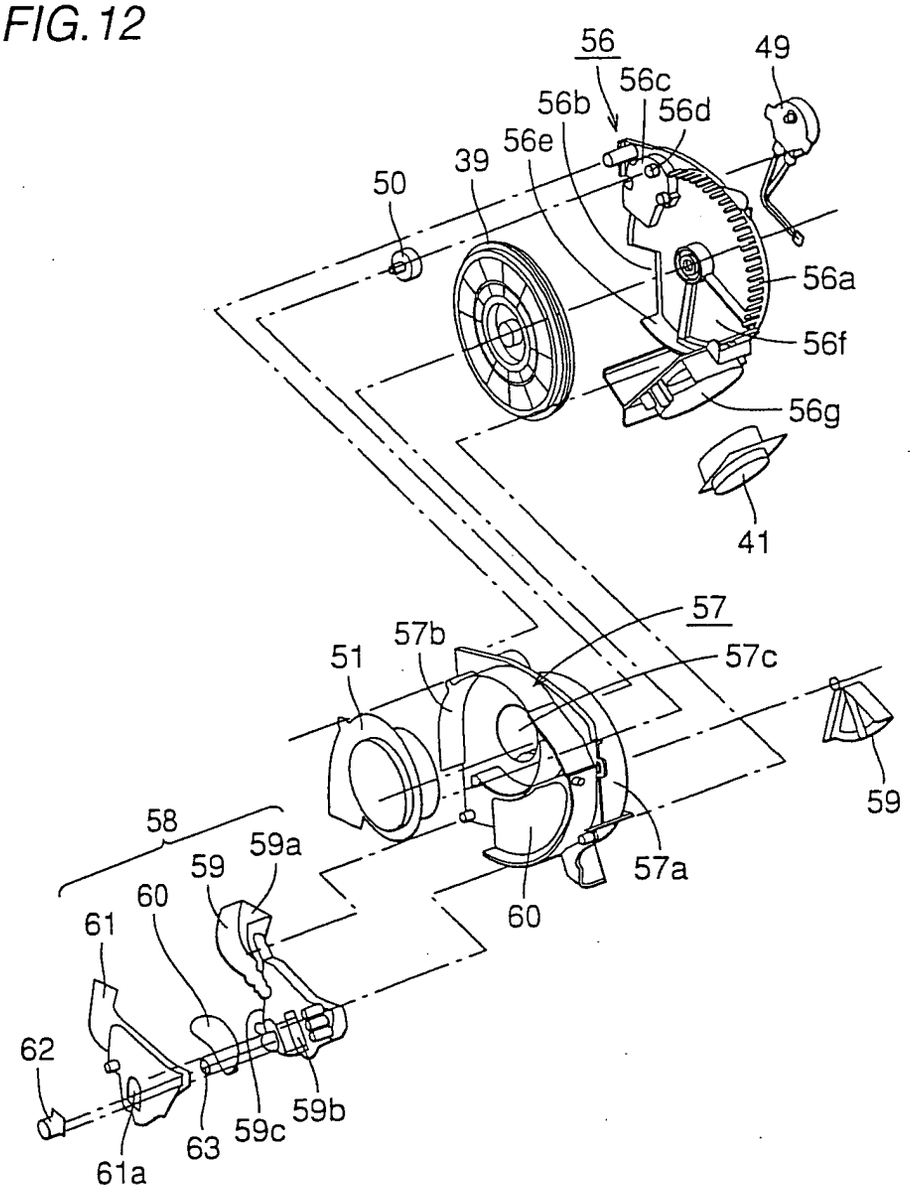


FIG. 12


56
49
56c
56b
56d
56e
39
50
56a
56f
56g
41
57
57b
51
57c
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57a
60
62
63
59c
59b
61a

FIG.13

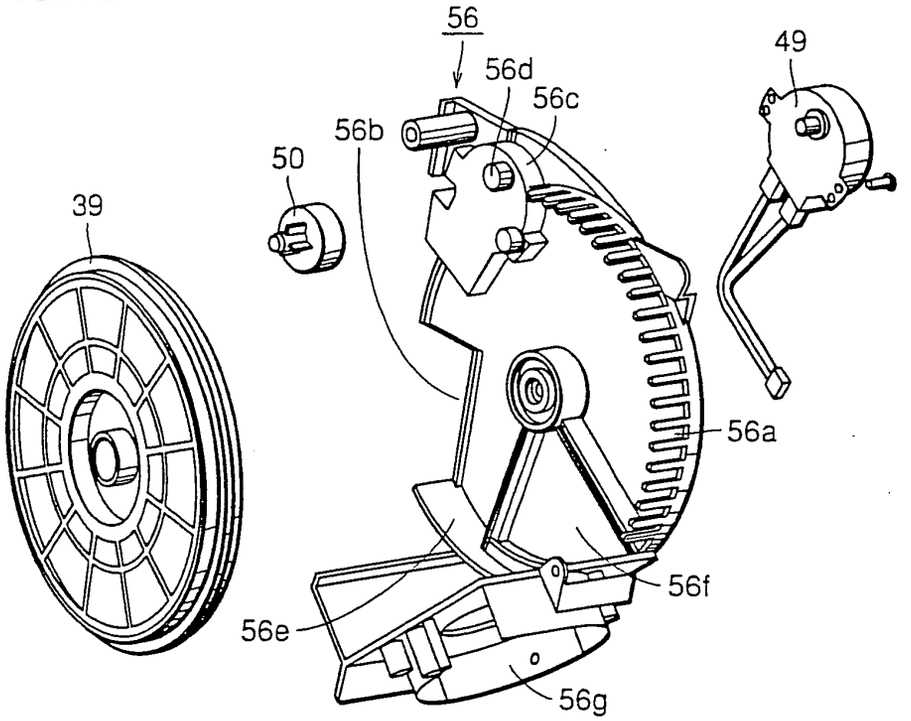


FIG.14

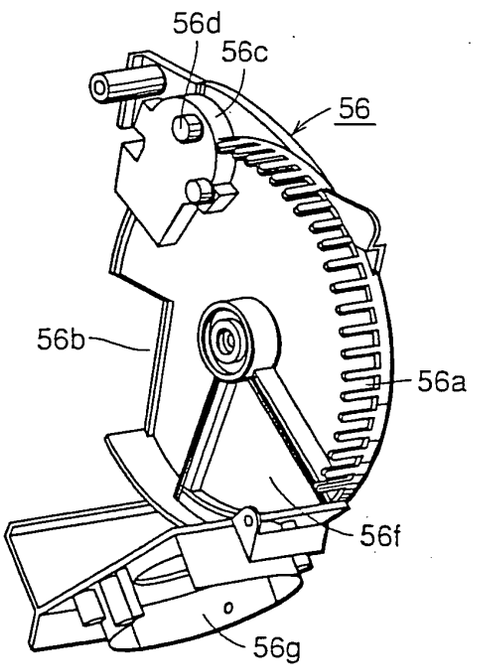


FIG.15

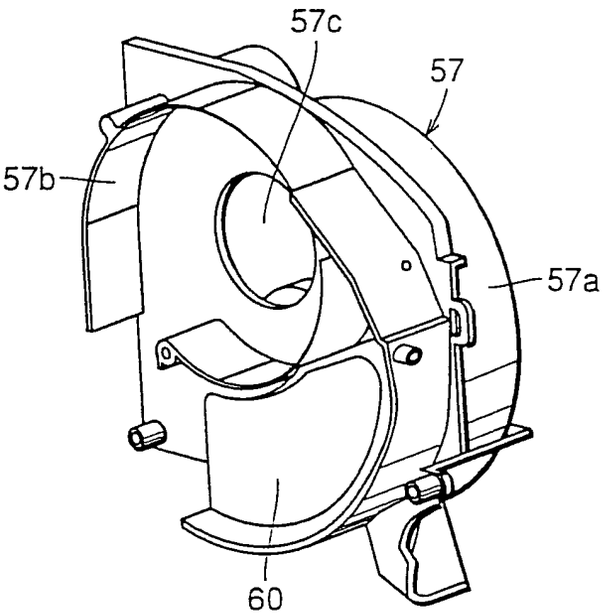


FIG.16

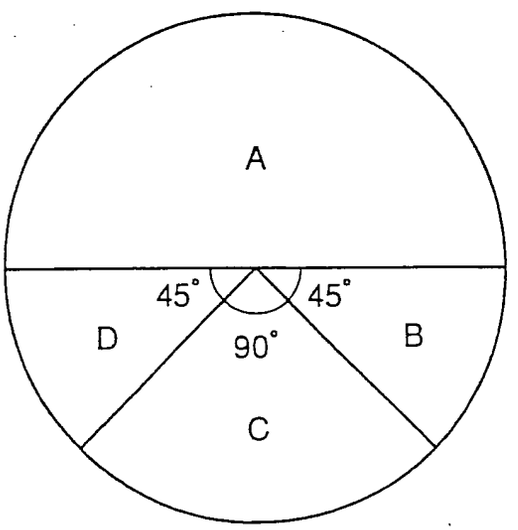
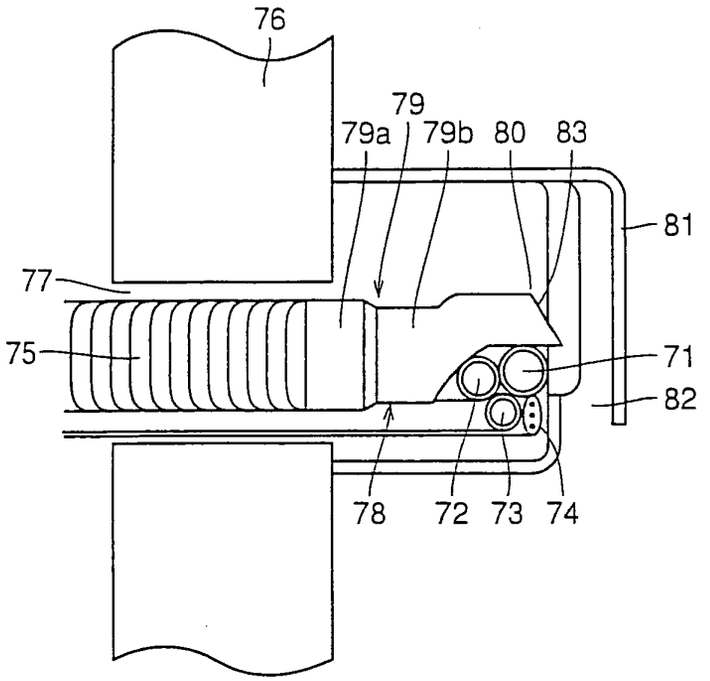


FIG.17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79a
79b
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83
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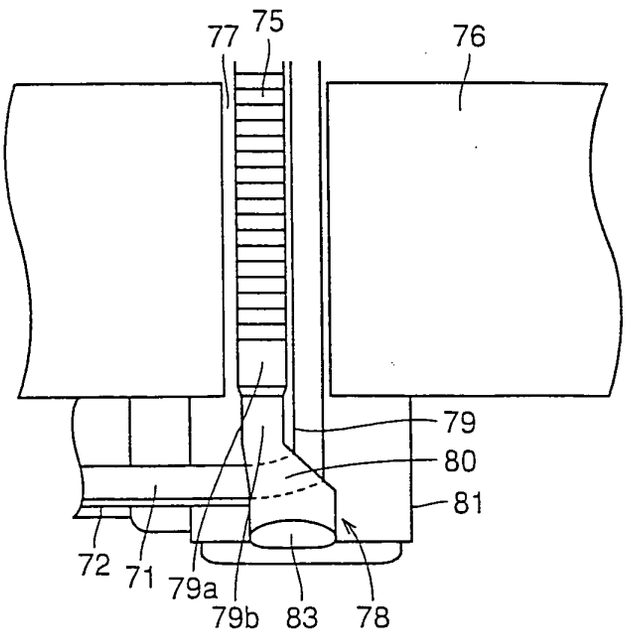
77
75
71
82
78
72
73
74

FIG.18


77
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79a
79b
83
78

FIG.19

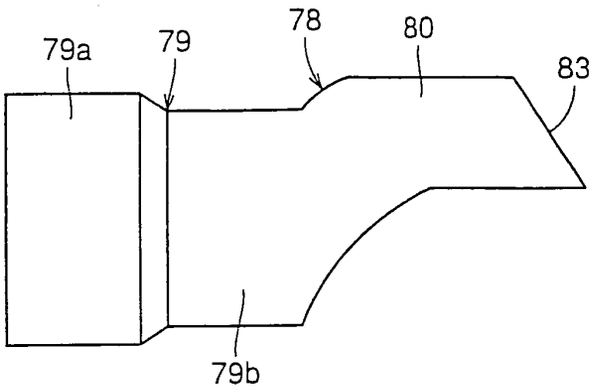


FIG.20

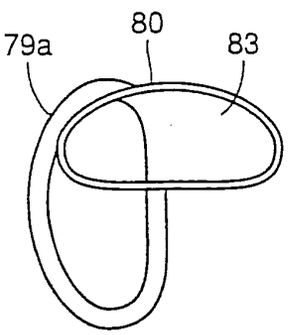


FIG.21

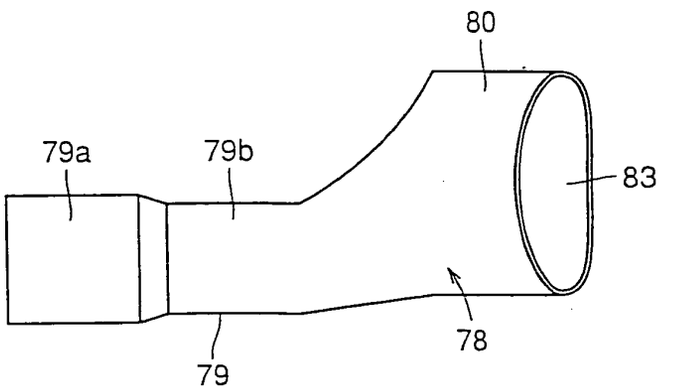


FIG.22

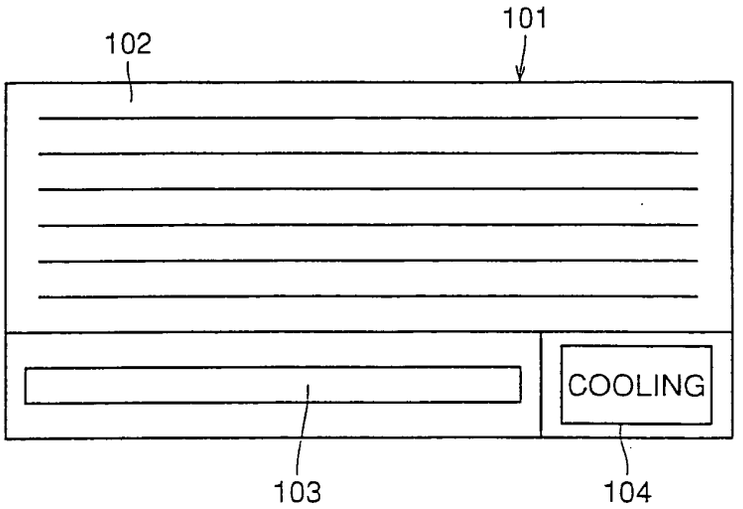
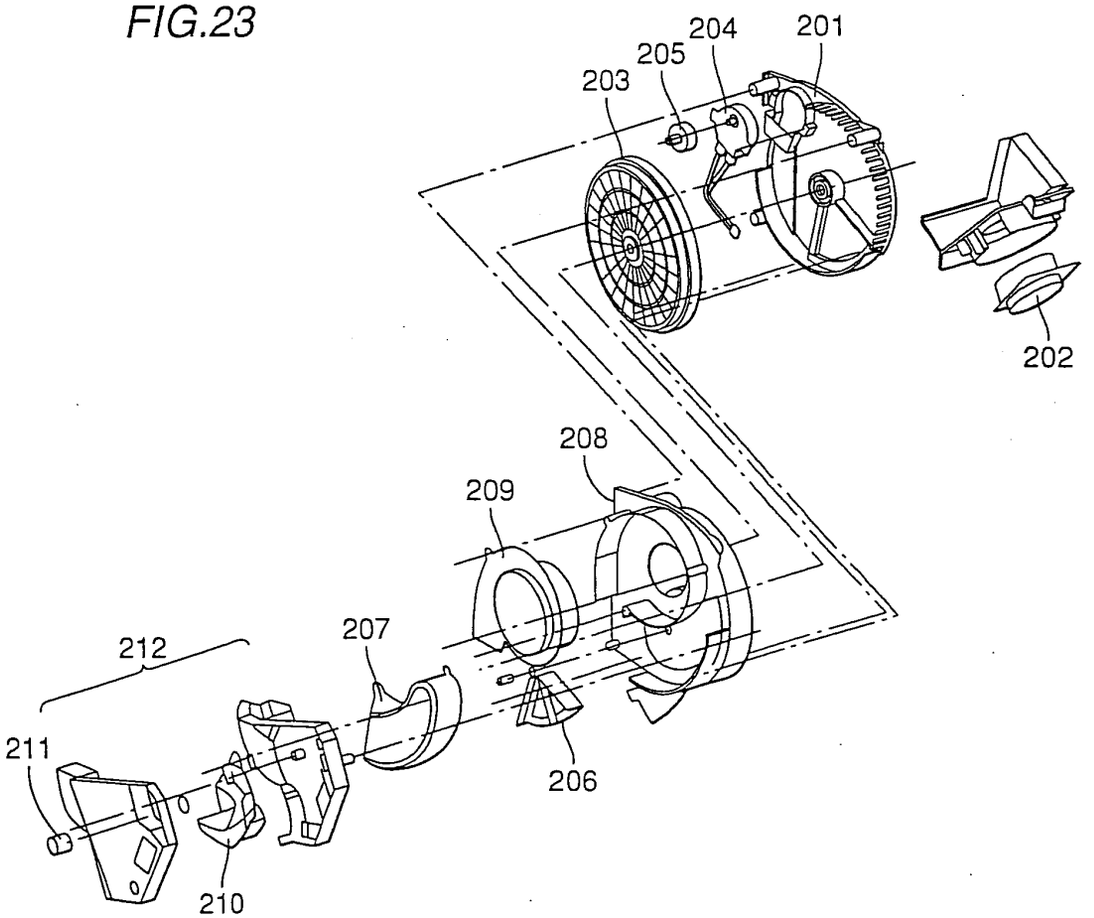

101
102
COOLING
103
104

FIG.23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210

FIG.24

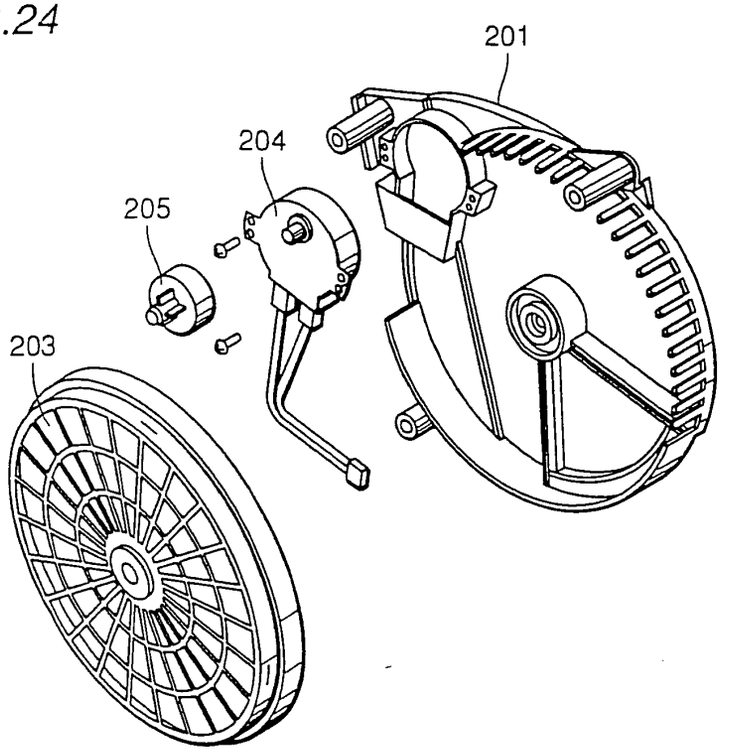

FIG.25

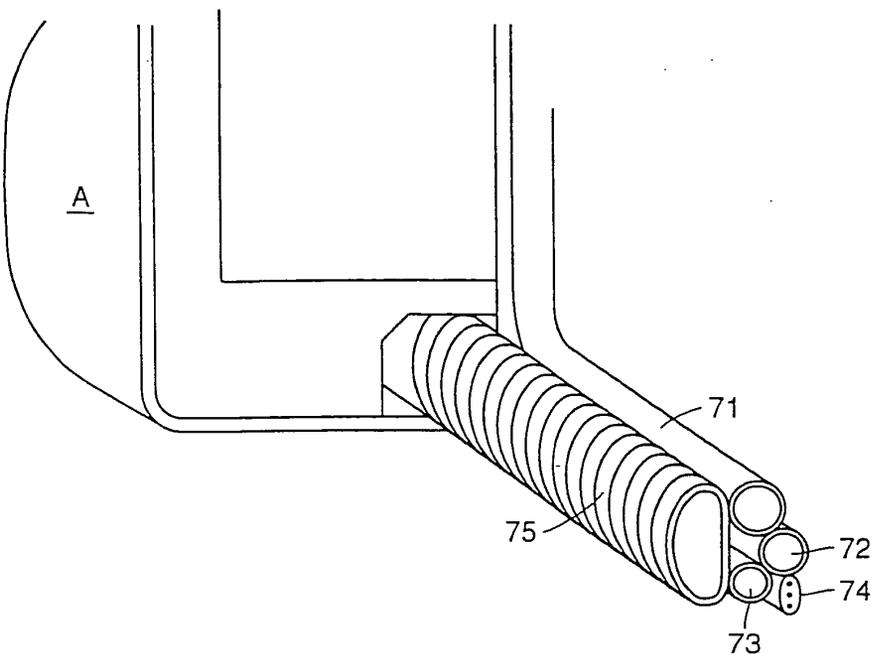

FIG.26

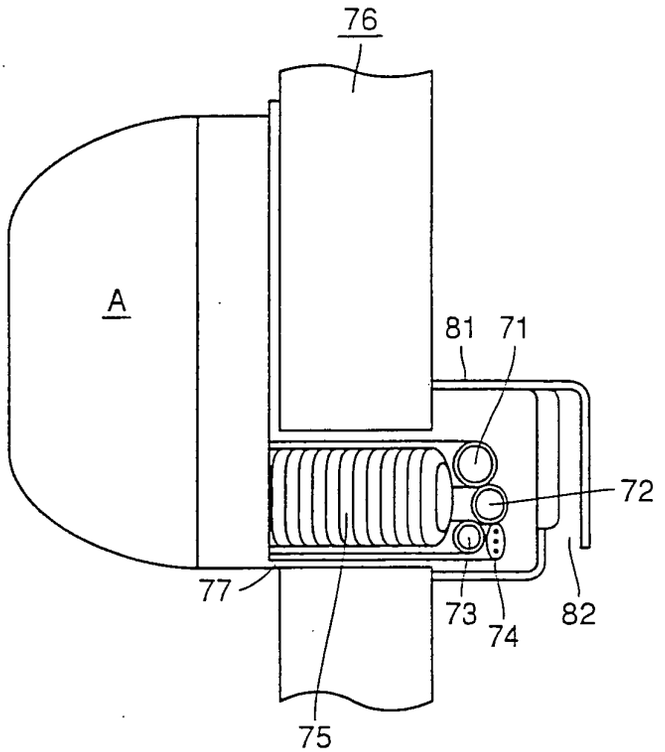

FIG.27