



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 1 596 136 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

16.11.2005 Bulletin 2005/46

(51) Int Cl.7: **F24F 1/00**, F04D 33/00

(21) Application number: **05010027.0**

(22) Date of filing: **09.05.2005**

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR**
Designated Extension States:
AL BA HR LV MK YU

• **Chin, Sim Won**

Gwangmyeong-si, Gyeonggi-do (KR)

• **Moon, Dong Soo**

Gwanak-gu, Seoul (KR)

(30) Priority: **12.05.2004 KR 2004033262**

(71) Applicant: **LG ELECTRONICS INC.**
Seoul (KR)

(74) Representative:

TER MEER - STEINMEISTER & PARTNER GbR
Patentanwälte,
Mauerkircherstrasse 45
81679 München (DE)

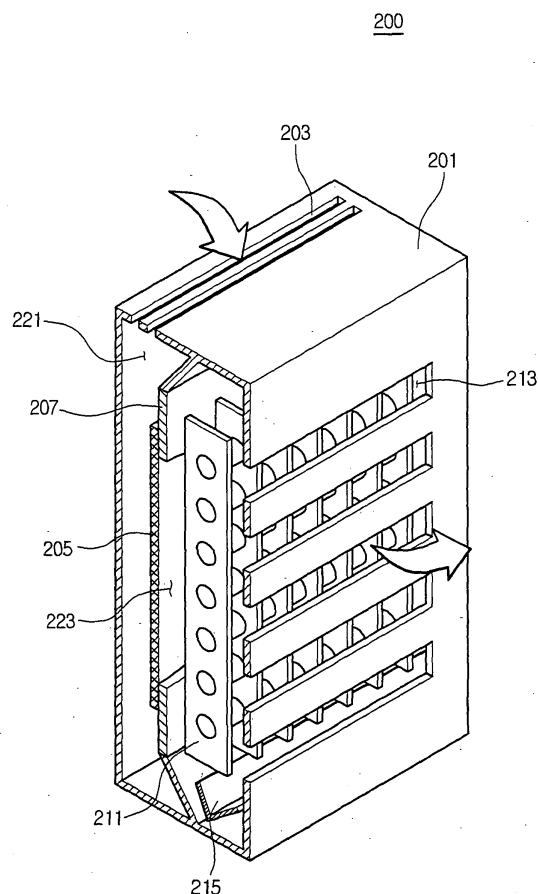
(72) Inventors:

• **Lee, Jung Woo**
Gangseo-gu, Seoul (KR)

(54) **Air conditioner indoor unit with a linearly oscillating blower**

(57) A slim-type air conditioner is provided. The slim-type air conditioner blows air by a plate reciprocating back and forth. Accordingly, the air can be discharged through a wide outlet hole, and the size and thickness of the air conditioner can be reduced. Therefore, the convenience of users and installers can be improved.

FIG.2



EP 1 596 136 A1

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to an air conditioner, and more particularly, to a slim-type air conditioner having an improved structure by which its internal blower can be slimly installed therein and thus it can be installed on a narrow wall surface, thereby making it possible to provide a beautiful external environment.

Description of the Related Art

[0002] An air conditioner is a device for maintaining indoor air at a pleasant state by circulating air in association with a cooling cycle. In general, the air conditioner includes an indoor unit and an outdoor unit, and is classified into a combination-type air conditioner in which the indoor and outdoor units are integrally formed and a separate-type air conditioner in which the indoor and outdoor units are separately formed.

[0003] A typical example of the combination-type air conditioner is a window-type air conditioner, and typical examples of the separate-type air conditioner are a package-type air conditioner and a wall-mounted air conditioner.

[0004] Hereinafter, a structure and operation of a general wall-mounted air conditioner will be described in detail.

[0005] Fig. 1 is a side sectional view of a related art wall-mounted air conditioner.

[0006] Referring to Fig. 1, an indoor unit of the related art wall-mounted air conditioner includes a case 101 forming a receiving space therein, a front panel 110 in which an air inlet hole 112 and an air outlet hole 114 are formed, a cross-flow fan 130 rotatably installed in the case 101, a heat exchanger 140 installed between the cross-flow fan 130 and the air inlet hole 112 to thereby exchange heat with sucked air, a rear guide unit 150 formed in a rear region of the cross-flow fan 130 in such a way to guide an flow of air sucked by the cross-flow fan 130 through the air inlet hole 112, and a stabilizer 160 for dividing inflow air and outflow air of the cross-flow fan 130 and determining the position and strength of a vortex.

[0007] Also, the indoor unit includes a horizontal vane (or louver) 170 and a vertical vane 180 for adjusting a wind direction horizontally and vertically.

[0008] The rear guide unit 150 includes a curved portion 151 curved in such a way to recede from the cross-flow fan 130 as it is directed from the center of the cross-flow fan 130 to the lower front, and a straight portion 152 extended from an end portion of the curved portion 151 to a lower portion of the air outlet hole 114 at a predetermined angle.

[0009] Through this structure, when the cross-flow fan

130 is rotated, external air is sucked through the air inlet hole 112 into the case 101. The sucked air is heat-exchanged with the heat exchanger 140 while passing therethrough. The heat-exchanged air is discharged to an outlet passage 102 by the cross-flow fan 130.

[0010] The discharged air is guided by the rear guide unit 150 and the stabilizer 160, and is adjusted in its direction by the horizontal vane 170 and the vertical vane 180.

[0011] That is, external air is sucked into the indoor unit by a blowing fan (that is, the cross-flow fan 130) and is blown by the blowing fan. The sucked and blown air is heat-exchanged with the heat exchanger 140, and then the heat-exchanged air is discharged outside of the indoor unit.

[0012] The related art indoor unit essentially has the built-in blowing fan and thus has a drawback in that its size and thickness are increased.

[0013] Also, the related art indoor unit discharges air only through the limited air outlet hole and thus does harm to a person near to a position to which the discharged air is directed.

SUMMARY OF THE INVENTION

[0014] Accordingly, the present invention is directed to a slim-type air conditioner that substantially obviates one or more problems due to limitations and disadvantages of the related art.

[0015] An object of the present invention is to provide a slim-type air conditioner capable of cooling or warming indoor air without using a blowing fan that occupies a large space.

[0016] Another object of the present invention is to provide an air conditioner having a reduced thickness and thus occupying a small space.

[0017] A further another object of the present invention is to provide a slim-type air conditioner having a heat exchanger installed on its entire surface and thus increasing an installation area of the heat exchanger.

[0018] A still further another object of the present invention is to provide a slim-type air conditioner that discharges cooled or warmed air uniformly through the entire surface of its indoor unit into an indoor space, thereby providing a more-pleasant indoor environment.

[0019] Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0020] To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a slim-type air conditioner includes: a case; a heat exchanger in-

stalled in the case; an inlet hole, external air being sucked through the inlet hole into the case; an outlet hole provided on a front surface of the case, heat-exchanged air being discharged through the outlet hole; and a blower for blowing air toward the outlet hole by using a plate reciprocating in a straight line.

[0021] In another aspect of the present invention, there is provided a slim-type air conditioner including: a case; a heat exchanger installed in the case; an inlet hole, external air being sucked through the inlet hole into the case; an outlet hole provided on the case, heat-exchanged air being discharged through the outlet hole into an indoor space; at least one or more plates reciprocating in a straight line to thereby blow air toward the outlet hole; and a guide valve for guiding the plates.

[0022] In a further another aspect of the present invention, there is provided a slim-type air conditioner including: a case, a surface thereof being fixed on a wall; a heat exchanger installed in the case, a refrigerant being evaporated in the heat exchanger; an inlet hole, external air being sucked through the inlet hole into the case; an outlet hole, heat-exchanged air being discharged through the outlet hole into an outside of the case; at least one or more plates reciprocating in a straight line to thereby blow air sucked through the inlet hole toward the outlet hole; and a guide valve for guiding the plate and partitioning an inner space of the case by selectively coming into contact with the plate.

[0023] Accordingly, the present invention can reduce an installation space for an air conditioner and provide a more-pleasant indoor environment.

[0024] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

[0026] Fig. 1 is a side sectional view of a related art wall-mounted air conditioner;

[0027] Fig. 2 is a cut-away perspective view of a slim-type air conditioner according to a first embodiment of the present invention;

[0028] Fig. 3 is an exploded perspective view illustrating a blower and a heat exchanger and a drain pan of the slim-type air conditioner according to the first embodiment of the present invention;

[0029] Fig. 4 is a sectional view illustrating an initial state of the slim-type air conditioner according to the second embodiment of the present invention;

[0030] Fig. 5 is a sectional view illustrating a state

where a plate is moved to the rear side according to the first embodiment of the present invention;

[0031] Fig. 6 is a sectional view illustrating a state where a plate is moved to the front side according to the first embodiment of the present invention;

[0032] Fig. 7 is a side view illustrating a state where the slim-type air conditioner according to the first embodiment of the present invention is installed on a wall surface;

[0033] Fig. 8 is a plan view of a plate mounting a driving unit according to the first embodiment of the present invention;

[0034] Fig. 9 is a side view of a plate mounting a driving unit according to the first embodiment of the present invention;

[0035] Fig. 10 is a view illustrating a relationship between a plate and a piezoelectric device according to a second embodiment of the present invention;

[0036] Fig. 11 is a view illustrating a state where a plate is moved to the front side according to a third embodiment of the present invention;

[0037] Fig. 12 is a view illustrating a state where a plate is moved to the rear side according to the third embodiment of the present invention;

[0038] Fig. 13 is a view illustrating a state where external air is sucked into a slim-type air conditioner according to a fourth embodiment of the present invention with the backward movement of the plate;

[0039] Fig. 14 is a view illustrating a state where internal air is discharged from the slim-type air conditioner according to the fourth embodiment of the present invention with the forward movement of the plate;

[0040] Fig. 15 is a view illustrating a state where the plate is positioned between the front side and the rear side in the slim-type air conditioner according to the fourth embodiment of the present invention;

[0041] Fig. 16 is a sectional view of a slim-type air conditioner according to a fifth embodiment of the present invention; and

[0042] Fig. 17 is a sectional view of a slim-type air conditioner according to a sixth embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0043] 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.

[0044] The present invention is mainly focused on an indoor unit of an air conditioner. Also, the present invention can be applied to any type of air conditioner having a mechanism where air is forcibly blown toward a heat exchanger so as to provide cooled or warmed air into an indoor space. Particularly, the present invention can be applied to a wall-mounted air conditioner.

First Embodiment

[0045] Fig. 2 is a cut-away perspective view of a slim-type air conditioner according to a first embodiment of the present invention.

[0046] Referring to Fig. 2, a slim-type air conditioner 200 includes an indoor unit case 201, a heat exchanger 211 disposed at the inner front of the case 201, a blower 209 reciprocating in a straight line behind the heat exchanger 211 to thereby suck external air and discharge the sucked air through the heat exchanger 211, and an outlet grill 213 disposed on a front surface of the case 201.

[0047] An inlet grill 203 is formed on a side surface of the case 201 so as to communicate with a space in which the blower 209 is installed.

[0048] The blower 209 includes a plate 205 reciprocating in a straight line behind the heat exchanger 211, and a guide valve 207 forming a closed space in association with the plate 205 having moved to the front side.

[0049] Fig. 3 is an exploded perspective view illustrating a blower and a heat exchanger and a drain pan of the slim-type air conditioner according to the first embodiment of the present invention.

[0050] Referring to Fig. 3, a blower 209 includes a plate 205 and a guide valve 207. A heat exchanger 211 is formed in front of the blower 209. A drain pan 215 collects condensed waterdrops that form on and drop from the heat exchanger 211.

[0051] A structure of the inventive slim-type air conditioner will now be described in detail with reference to Figs. 2 and 3.

[0052] Referring to Figs. 2 and 3, in a slim-type air conditioner 200, an inlet grill 203 is formed on an outer surface of a case 201, and an outlet grill 213 is formed on a front surface of the case 201. Preferably, the inlet grill 203 is formed on at least one or more side surfaces of the case 201, and the outlet grill 213 is formed on the case 201's front surface perpendicular to the inlet grill 203 so that air flowing in through the inlet grill 203 may not be mixed.

[0053] A blower 209 is disposed at the inner rear of the case 201, and a heat exchanger 211 is disposed at the inner front of the case 201. The blower 209 and the heat exchanger 211 is installed to face each other and to be spaced apart from each other by a predetermined interval.

[0054] The blower 209 includes a plate 205 and a guide valve 207. The plate 205 is disk-shaped, is installed at the inner rear of an indoor unit, and reciprocates in a straight line by a driving source such as a motor or a piezoelectric device. The guide valve 207 is donut-shaped and guides the plate 205 so that an air blowing operation is possible by the reciprocating straight-line motion of the plate 205. The inner and outer peripheries of the guide valve 207 may be formed to have a square shape instead of a circular shape.

[0055] For this purpose, the guide valve 207 is made

of elastic material and its outer end is connected to a rear cover 202 (See Fig. 4) for supporting the heat exchanger 211, whereby it guides the back-and-forth motion of the plate 205 by its elasticity.

[0056] The guide valve 207 has a vent hole 208 formed therein, and the vent hole 208 has a diameter smaller than that of the plate 205. An inlet space 221 communicates with an outlet space 223 through the vent hole 208, whereby an airflow therebetween is possible.

[0057] That is, when the plate 205 moves forward, air sucked through the inlet grill 203 is propelled forward by a thrust force of the plate 205 and thus flows toward the heat exchanger 211 through a space closed by the plate 205 and the guide valve 207. Thereafter, the air is heat-exchanged with the heat exchanger and then flows outside the case 201.

[0058] Here, the heat exchanger 211 is preferably a fin-tube heat exchanger. The heat exchanger 211 is installed on the whole front surface of the case 201 and faces the outlet grill 213. The heat exchanger 211 is positioned in the outlet space 223 and the outlet space 223 is closed from the outside and the inlet space 221 with the exception that the outlet grill 213 communicates with a flow passage that the plate 205 moves along, whereby a heat exchange amount can be increased.

[0059] A drain pan 215 is formed below the heat exchanger 211 and thus collects condensed waterdrops dropping from the heat exchanger 211. The drain pan 215 may be connected to or integrally formed with the outlet grill 213 or the case 201.

[0060] An operation of the inventive slim-type air conditioner will now be described in detail with reference to Figs. 4 to 6.

[0061] Fig. 4 illustrates an initial state of the slim-type air conditioner according to the second embodiment of the present invention, Fig. 5 illustrates a state where the plate is moved to the rear side in the slim-type air conditioner, and Fig. 6 illustrates a state where the plate is moved to the front side.

[0062] Referring to Figs. 4 to 6, when no power is supplied from the outside, the plate 205 and the guide valve 207 are maintained at their initial states. On the contrary, when power is supplied from the outside, the plate 205 is driven by a driving unit (not shown). As shown in Fig. 4, the plate 205 contacts with a rear surface of the guide valve 207 in its initial state.

[0063] The plate 205 of the blower 209 is moved backward as shown in Fig. 5 and is moved forward as shown in Fig. 6 by the driving unit. Through this reciprocating straight-line motion of plate 205, a blowing operation of the air conditioner is initiated.

[0064] Referring to Figs. 5 and 6, when the plate 205 is moved to the rear side, a flow passage is formed between the plate 205 and the guide valve 207. Upon the formation of the flow passage, external air is sucked through the inlet grill 203 into the flow passage. Thereafter, when the plate 205 is moved forward, the formed flow passage is closed. Accordingly, the sucked air is

moved forward by the plate 205, is heat-exchanged with the heat exchanger 211, and is then discharged through the outlet grill to the outside.

[0065] That is, the plate 205 reciprocates in a straight line between the inlet space 221 (that is, a space where the plate is positioned between the guide valve 207 and a rear surface of the case 201) and the outlet space 223 (that is, a space where the heat exchanger 211 is installed), whereby the inlet and outlet spaces 221 and 223 communicate with each other or are closed by the plate 205 and thus the sucked internal air is propelled forward.

[0066] At this time, the elasticity of the guide valve 207 causes the plate 205 to sufficiently push air in the outlet space 223. Preferably, a guider for guiding the reciprocating straight-line motion of the plate 205 may be further formed between the plate 205 and the guide valve 207. Here, the guider may be a protrusion protruded from a portion where the plate 205 contacts with the guide valve 207.

[0067] The blowing operation of the blower 209 causes the sucked air to be heat-exchanged with the heat exchanger 211 and then be discharged through the outlet grill 213 to the outside.

[0068] Thereafter, when the power supply is cut off, the plate 205 and the guide valve 207 return to their initial states.

[0069] Fig. 7 is a side view illustrating a state where the slim-type air conditioner according to the first embodiment of the present invention is installed on a wall surface.

[0070] Referring to Fig. 7, since there is no rotating fan in the case 201, the inventive slim-type air conditioner can be manufactured to have a thickness of several tens mm. An inlet grill 203 for sucking external air is provided on a side surface of the case 201, and an outlet grill 213 for discharging conditioned air is provided on a front surface of the case 201. Accordingly, air sucked through the inlet grill is heat-exchanged with a heat exchanger and is then discharged through the outlet grill 213 to the outside.

[0071] As described above, the inventive slim-type air conditioner does not need a fan occupying a large space and thus can have a thickness considerably smaller than that of the related art air conditioner. Accordingly, the inventive slim-type air conditioner can have a reduced occupation volume in an indoor space, a reduced weight, and a beautiful appearance, and can be simply installed in the indoor space.

[0072] Hereinafter, a driving unit for causing the plate 205 to reciprocate in a straight line will be described in detail with reference to Figs. 8 and 9.

[0073] Fig. 8 is a plan view of a plate mounting a driving unit according to the first embodiment of the present invention, and Fig. 9 is a side view of the plate mounting the driving unit.

[0074] Referring to Figs. 8 and 9, a piezoelectric device 230 for use as the driving unit is mounted on one

surface of the plate 205. Electric wires are connected to the piezoelectric device 230. When a voltage is applied to the electric wires, the piezoelectric device generates a mechanical vibration. The generated vibration causes the plate 205 to vibrate, and the vibration of the plate 205 results in the blowing operation of the blower 209.

[0075] The piezoelectric device 230 may be mounted on a rear surface of the plate 205. At this time, the piezoelectric device 230 may be directly connected or indirectly connected through a separate vibration transmitting member to the plate 205 so that the mechanical vibration of the piezoelectric device 230 can be perpendicular to a surface of the plate 205. Here, the piezoelectric device 230 may be a piezoelectric translator (PZT) made of ferroelectrics PbTiO₃ and antiferroelectric PbZrO₃. An operation of the piezoelectric device is well known in the art and thus a detailed description thereof will be omitted for simplicity.

[0076] Meanwhile, the piezoelectric device 230 is preferably configured to be longer than a specific length so that it can generate a vibration of the maximum possible width.

Second Embodiment

[0077] A second embodiment is identical to the first embodiment with the exception of an installation structure of the piezoelectric device.

[0078] Fig. 10 is a view illustrating a relationship between a plate and a piezoelectric device according to the second embodiment of the present invention.

[0079] Referring to Fig. 10, the second embodiment is characterized in that two or more piezoelectric devices 231 reciprocate the plate 205 in a straight line.

[0080] In detail, an electrode 232 is installed at an end portion of the piezoelectric device 231. When power is supplied to the electrode 232, the piezoelectric device 232 vibrates. Here, one end portion of the piezoelectric device 232 is fixed to a specific portion (for example, the rear cover 202) in the slim-type air conditioner, and the other end portion thereof is fixed to an outer end portion of the plate 205. When power is applied to the piezoelectric device 231, the piezoelectric device 231 vibrates back and forth, whereby the plate 205 reciprocates in a straight line.

[0081] Preferably, a pair of the piezoelectric devices 231 are symmetrically fixed to the plate 20 in such a way to be spaced apart from each other by the maximum distance possible so that the plate 20 can be accurately reciprocated in a straight line by the piezoelectric devices 231. Also, any type of device capable of amplifying and adjusting the vibration amount of the piezoelectric device 231 may be added between the plate 205 and the piezoelectric device 231.

[0082] The piezoelectric device 231 generates a mechanical vibration of a specific frequency, and the amplitude of the mechanical vibration is determined according to its frequency and the length of the piezoelec-

tric device 231. Accordingly, the piezoelectric device 231 may be suitably selected according to the shapes and sizes of the plate 205. Also, the piezoelectric device 231 does not generate a harmful electromagnetic wave, whereby electromagnetic interference can be minimized.

Third Embodiment

[0083] A third embodiment is identical to the first embodiment with the exception of a vibration structure of the plate.

[0084] Figs. 11 and 12 schematically illustrate a driving unit for the plate according to a third embodiment of the present invention. In detail, Fig. 11 illustrates a state where the plate is moved to the front side by the driving unit, and Fig. 12 illustrates a state where the plate is moved to the rear side by the driving unit.

[0085] Referring to Figs. 11 and 12, the inventive driving unit for the plate 205 includes a short L-shaped link 331, a long L-shaped link 332, and a link axis 333.

[0086] The short link 331 is connected to a motor so as to be able to reciprocate in a circular line of a specific radius. Also, a crank axis may be further provided between the motor and the short link 331. In this case, the motor need not rotate clockwise and counterclockwise. That is, the crank axis reciprocates in a straight line by the unidirectional (clockwise or counterclockwise) rotation of the motor, and the reciprocating straight-line motion of the crank axis causes the short link 331 to move back and forth.

[0087] The long link 332 is installed to extend from an outer portion of the plate 205 to a rear surface thereof, and thus reciprocates in a circular line of a specific radius together with the short link 331. Here, the short link 331 and the long link 332 may be integrally formed or may be connected by a separate link connecting unit.

[0088] When the short link 331 reciprocates in a circular line clockwise, the long link 332 reciprocates in a circular line counterclockwise. Accordingly, the plate 205 reciprocates in a straight line. At this time, the long link 332 is preferably configured to be longer than the short link 331 so that the plate 205 can reciprocate in a longer straight line. Also, a guide member or a slide member for supporting the reciprocating straight-line motion of the plate 205 at an end portion of the long link 332 may be further connected to the plate 205.

[0089] By the above structure, the long link 332 connected on a rear surface of the plate 205 repeatedly pushes forward or pulls back the plate 205 according to the reciprocating motion of the short link 331. This back-and-forth straight-line reciprocating motion of the plate 205 causes internal air to pass through the heat exchanger. Accordingly, the internal air is heat-exchanged with the heat exchanger and is then discharged into the indoor space.

Fourth Embodiment

[0090] A fourth embodiment is identical to the above-mentioned embodiments with the exception of a structure and operation of a plate.

[0091] Figs. 13 to 15 are sectional views of a slim-type air conditioner according to the fourth embodiment of the present invention. In detail, Fig. 13 illustrates a state where external air is sucked into the slim-type air conditioner with the backward movement of a plate, Fig. 14 illustrates a state where internal air is discharge from the slim-type air conditioner with the forward movement of the plate, and Fig. 15 illustrates a state where the plate is positioned between the front side and the rear side in the slim-type air conditioner.

[0092] Referring to Figs. 13 to 15, an inventive blower 259 includes a plate assembly 255 and a guide valve 257. The plate assembly 255 includes a first (or rear) plate 261, a second (or front) plate 262, and a connecting member 263 for connecting the first plate 261 and the second plate 262, and thus has a H-shaped section.

[0093] The plate assembly 255 is arranged in such a way that the guide valve 257 is positioned between the first plate 261 and the second plate 262. Accordingly, the plate assembly 255 can be moved between the rear-most position and the frontmost position without being detached outside.

[0094] An operation of the fourth embodiment will now be described.

[0095] When power is supplied, the plate assembly 255 is repeatedly moved between the rear-most position and the frontmost position as shown in Figs. 13 and 14. When moved to the frontmost position, the first plate 261 pushes against the guide valve 257. At this time, external air sucked through the inlet grill 203 into the inlet space 221 is forcibly blown forward and is then discharged through the outlet grill 213 to the outside.

[0096] At this point, the sucked external air flows into the outlet space 223 containing the heat exchanger 211 through a flow passage 264 formed between the first plate 261 and the second plate 262 as shown in Fig. 15. Thereafter, the sucked air is heat-exchanged with the heat exchanger 211 and is then discharged through the outlet grill 213 to the outside.

[0097] Preferably, the second plate 262 is configured to have a plurality of vent holes formed thereon, and flowing air pushed by the first plate 261 is directly transferred through the vent holes to the heat exchanger 211 without experiencing a flow resistance by the second plate 262.

Fifth Embodiment

[0098] A fifth embodiment is similar to the above-mentioned embodiments with the exception that a slim-type air conditioner is mounted on a ceiling 340 of a room.

[0099] Fig. 16 is a sectional view of a ceiling-mounted slim-type air conditioner according to the fifth embodi-

ment of the present invention.

[0100] Referring to Fig. 16, in the ceiling-mounted slim-type air conditioner, a gently-sloped-V shaped heat exchanger 311 is installed at the inner front of a case 301, and a blower 309 including a plate 305 and a guide valve 307 is provided at the inner rear of the case 301. Condensed water dropping from the heat exchanger 311 is collected into a drain pan 350 that is installed below a center portion of the heat exchanger 311.

[0101] Here, the drain pan 350 is arranged along a center line of the heat exchanger 311 and a center line of an outlet grill 313 formed in a front surface of the case 301. A rear surface 304 of the case 301 is connected to the ceiling 304.

[0102] An operation of the ceiling-mounted slim-type air conditioner will now be described with reference to Fig. 16. [00108] Referring to Fig. 16, when power is supplied from the outside, the plate 305 on a rear surface of the guide valve 307 is moved back and forth. During the back-and-forth movement of the plate 305, external air is sucked through an inlet grill 303 formed on a side rear portion of the case 301 and the sucked air is transferred to the heat exchanger 311. Thereafter, the sucked air is heat-exchanged with the heat exchanger 311 and is then discharged through the outlet grill 313 to the outside.

[0103] Here, an operation of the blower 309 may be any one of the aforementioned embodiments.

Sixth Embodiment

[0104] A sixth embodiment is identical to the first embodiment with the exception of a position of a heat exchanger.

[0105] Fig. 17 is a sectional view of a slim-type air conditioner according to the sixth embodiment of the present invention.

[0106] Referring to Fig. 17, a case 401 is installed on a wall surface 440. A heat exchanger 411 is installed at the inner rear of the case 401. A blower 409 is disposed in front of the heat exchanger 411. The blower 409 includes a plate 405 moving back and forth, and a guide valve 407 for guiding the plate 405.

[0107] As stated above, the sixth embodiment is characterized in that the heat exchanger 411 is installed behind the blower 409, that is, in an inlet space into which external air is sucked by the blower 409. Accordingly, a larger installation space for the heat exchanger can be obtained.

[0108] An operation of the slim-type air conditioner according to the sixth embodiment will now be described with reference to Fig. 17.

[0109] Referring to Fig. 17, when power is supplied to the blower 409, an airflow is generated in the air conditioner. That is, external air is sucked into the inlet space through an inlet grill 403 formed on a side surface of the case 401. The sucked air is heat-exchanged with the heat exchanger 411. Thereafter, through the reciprocating

straight-line motion of the plate 405 and the guiding operation of the guide valve 407, the heat-exchanged air is discharged through an outlet grill 413 formed on a front surface or the case 401 to the outside.

[0110] This embodiment is characterized in that the sucked external air is first heat-exchanged with the heat exchanger and then discharged through the outlet grill 413.

[0111] Here, at least one or more blowers may be provided in the case 401, and the heat exchanger may be formed in various shapes at a facing position with respect to the blowers.

[0112] As described above, the inventive slim-type air conditioner uses a small-sized blower reciprocating in a straight line, instead of the related art rotation-type blower having a relatively large thickness and volume. Accordingly, the inventive slim-type air conditioner can be reduced in thickness and size.

[0113] Also, the inventive heat exchanger is disposed over the whole body surface of the air conditioner and cooled or warmed air is discharged through the whole outlet surface into an indoor space, whereby a more-pleasant indoor environment can be provided.

[0114] Further, the inventive air conditioner has a reduced thickness and size and thus can enhance indoor space efficiency and its installation convenience.

[0115] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

Claims

1. A slim-type air conditioner comprising:

a case;
a heat exchanger installed in the case;
an inlet hole, external air being sucked through the inlet hole into the case;
an outlet hole provided on a front surface of the case, heat-exchanged air being discharged through the outlet hole; and
a blower for blowing air toward the outlet hole by using a plate reciprocating in a straight line.

2. The slim-type air conditioner according to claim 1, wherein the inlet hole is provided in a side surface of the case.

3. The slim-type air conditioner according to claim 1 or 2, wherein a rear surface of the case is fixed on a wall surface or a ceiling.

4. The slim-type air conditioner according to claim 1, wherein the heat exchanger is provided in front of

the blower or at a rear of the blower.

5. The slim-type air conditioner according to any one of the proceeding claims, wherein a formation surface of the outlet hole is parallel to a formation surface of the plate. 5
6. The slim-type air conditioner according to any one of the proceeding claims, wherein the plate is moved by a piezoelectric device. 10
7. The slim-type air conditioner according to claim 6, wherein one piezoelectric device is provided at a center portion of the plate. 15
8. The slim-type air conditioner according to claim 6, wherein at least two or more piezoelectric devices are provided at an edge of the plate.
9. The slim-type air conditioner according to any one of claims 1 to 5, wherein the plate is rotated by: 20
 - a rotary motor; and
 - a link connected to the rotary motor and the plate. 25
10. The slim-type air conditioner according to any one of the proceeding claims, further comprising a guide valve for guiding a reciprocating straight-line motion of the plate. 30
11. The slim-type air conditioner according to claim 10, wherein the guide valve has a vent hole formed a center thereof and is made of elastic material. 35
12. The slim-type air conditioner according to claim 10, wherein the guide valve is made of elastic material and air is blown by an pushing operation of the plates against the guide valve. 40
13. The slim-type air conditioner according to any one of claims 10 to 12, wherein plates are respectively provided in front of and at a rear of the guide valve and are connected by a connecting member. 45
14. The slim-type air conditioner according to any one of claims 10 to 12, wherein the plate is a single round-shaped plate. 50

55

FIG.1

(BACKGROUND ART)

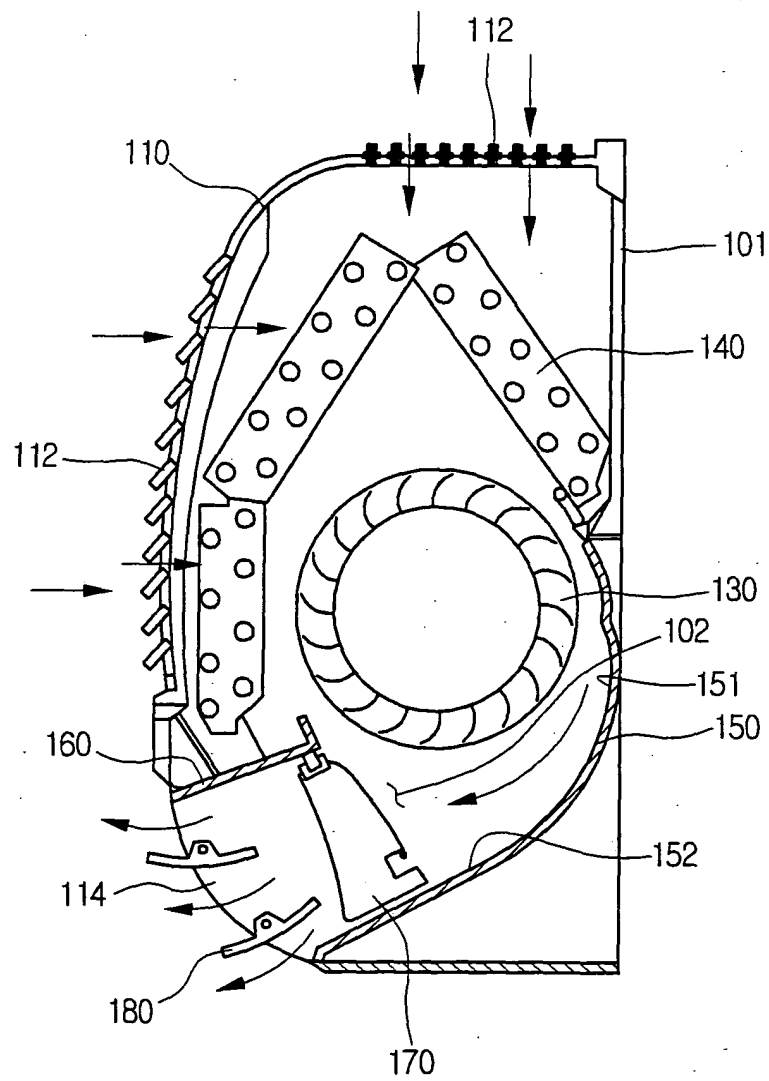


FIG.2

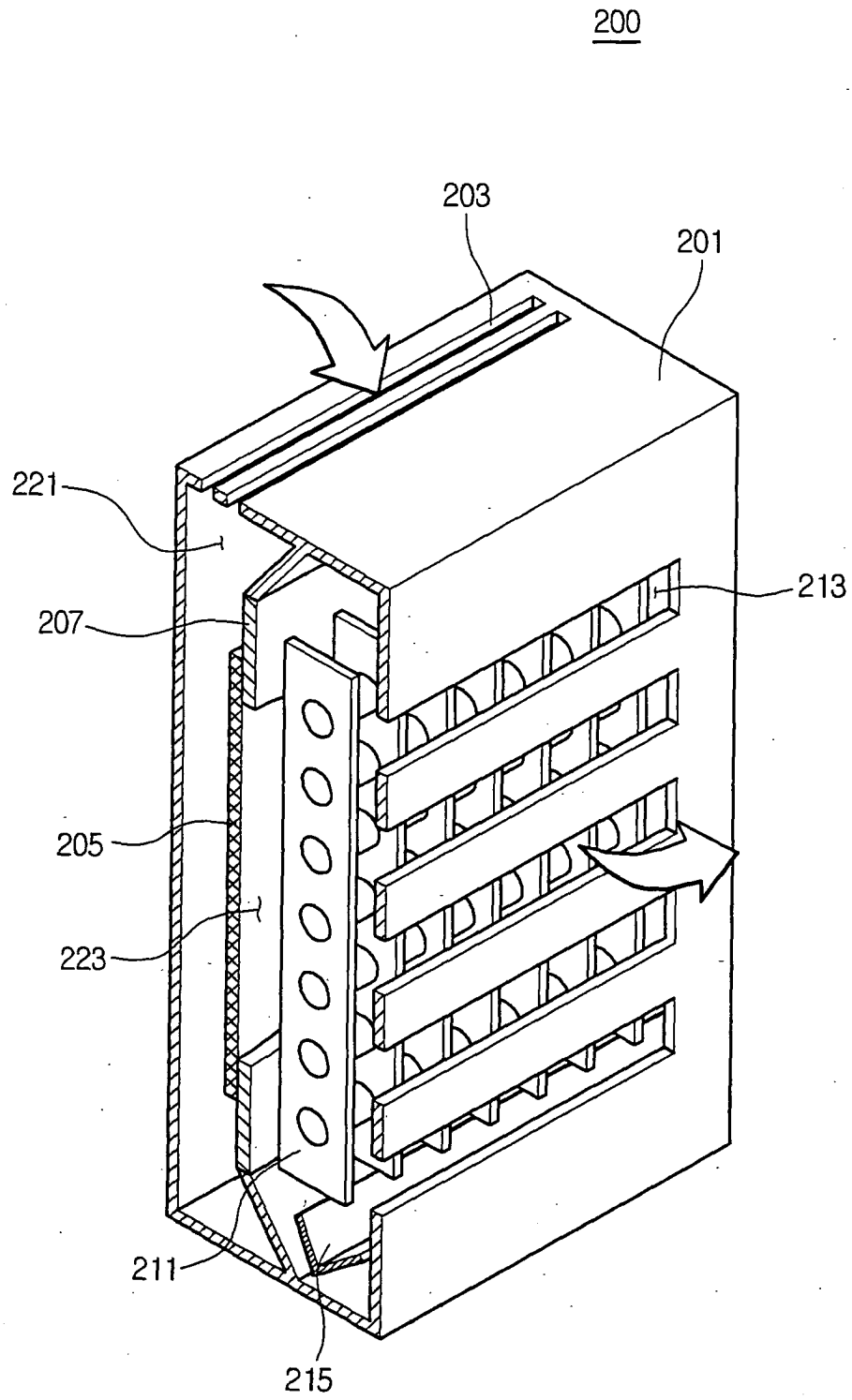


FIG.3

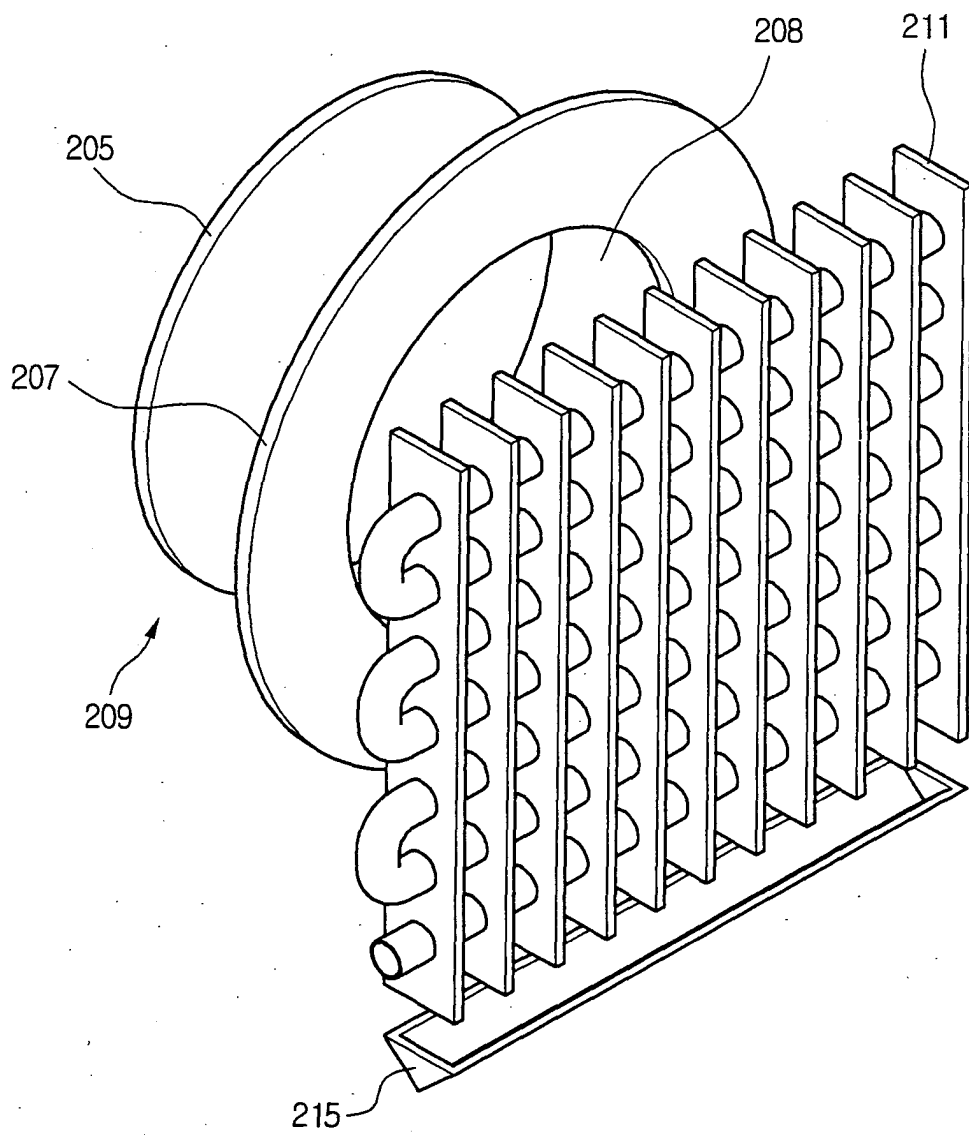


FIG.4

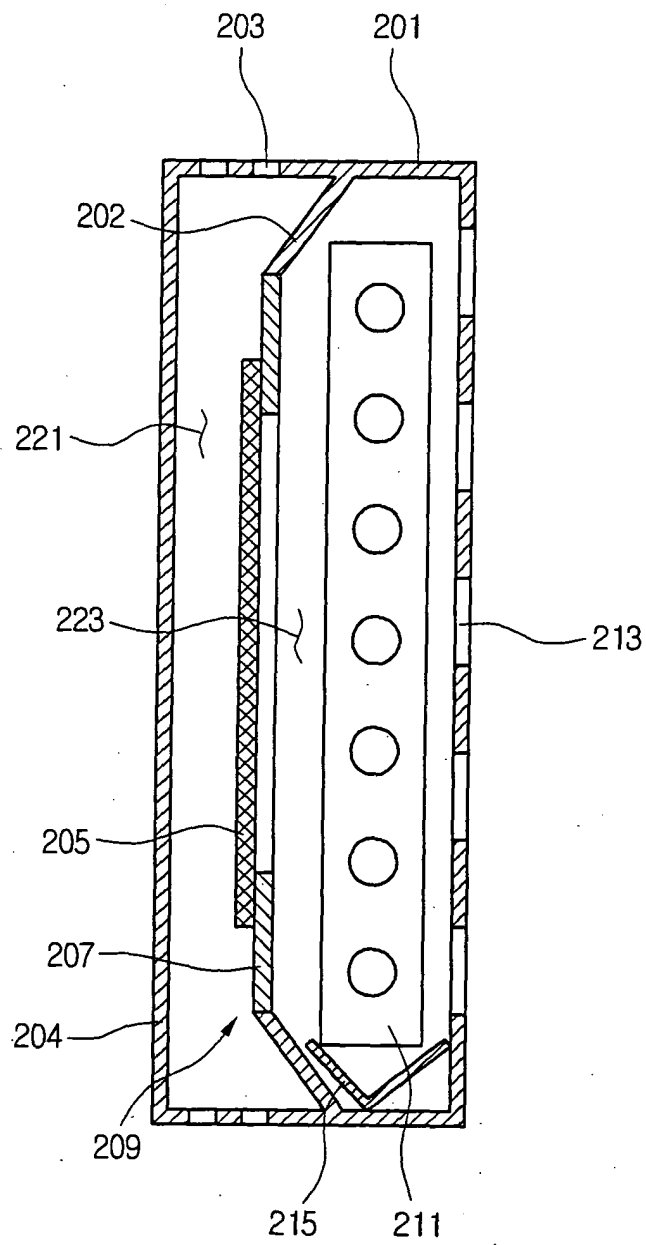


FIG.5

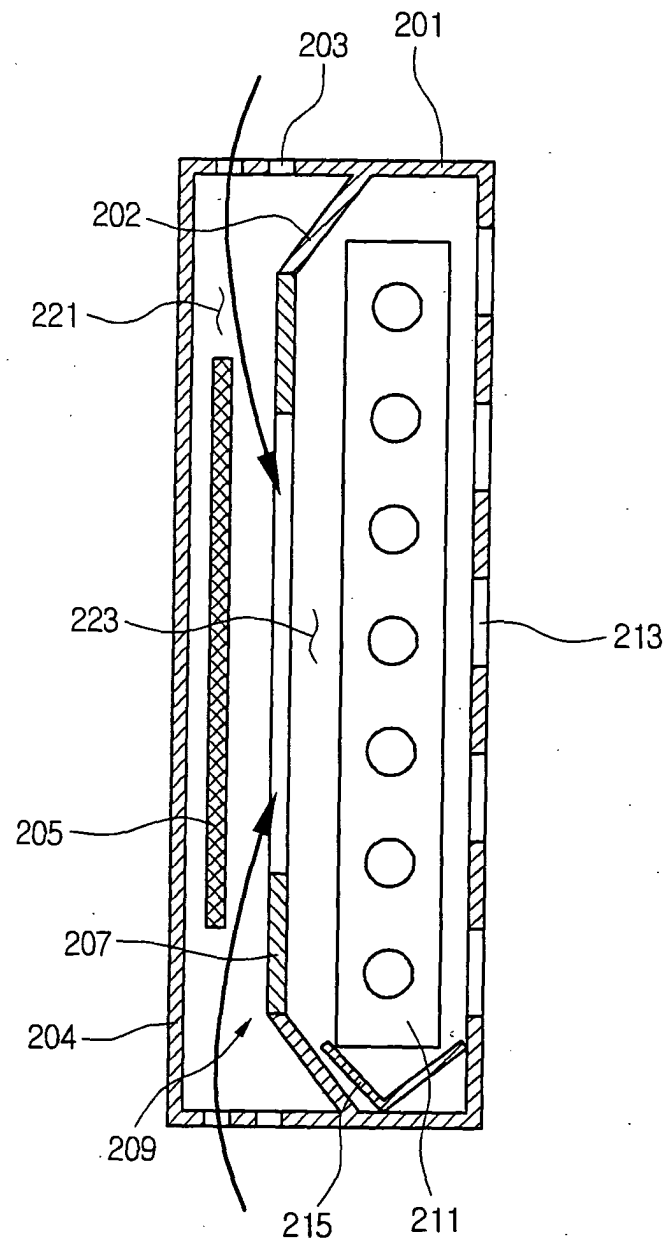


FIG.6

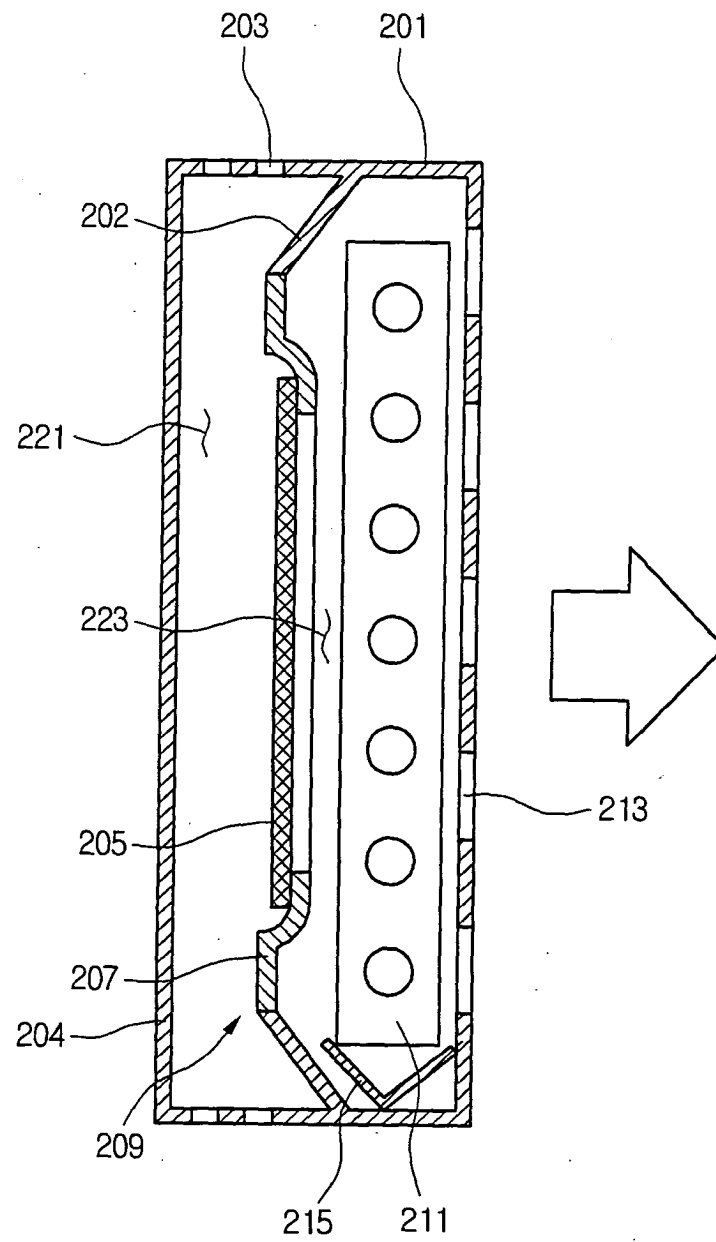


FIG.7

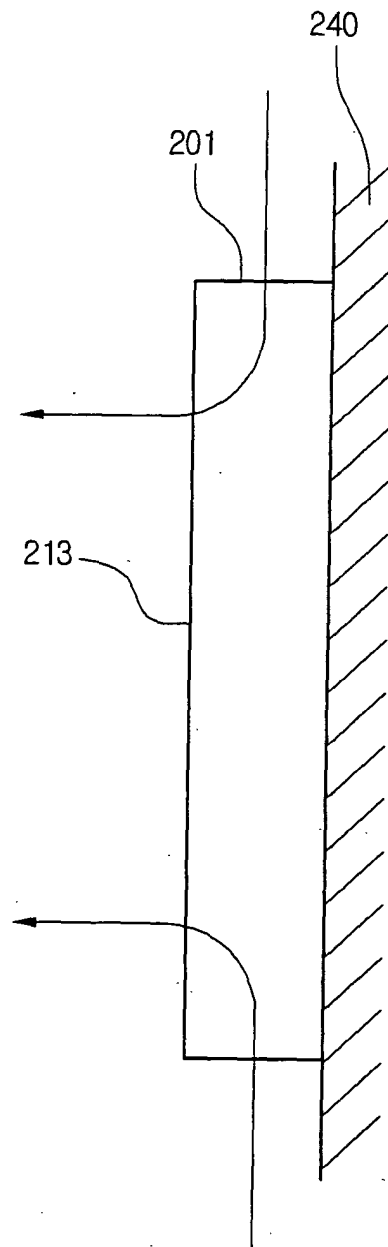


FIG.8

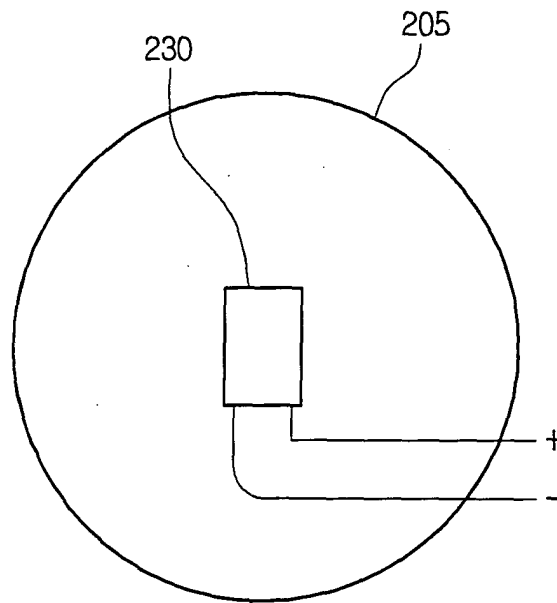


FIG.9

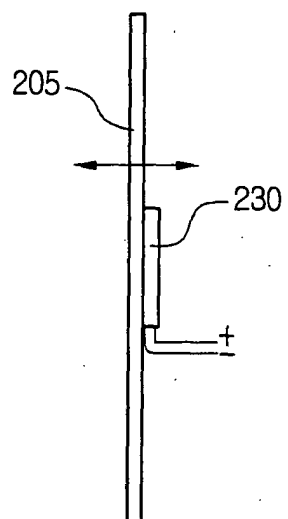


FIG.10

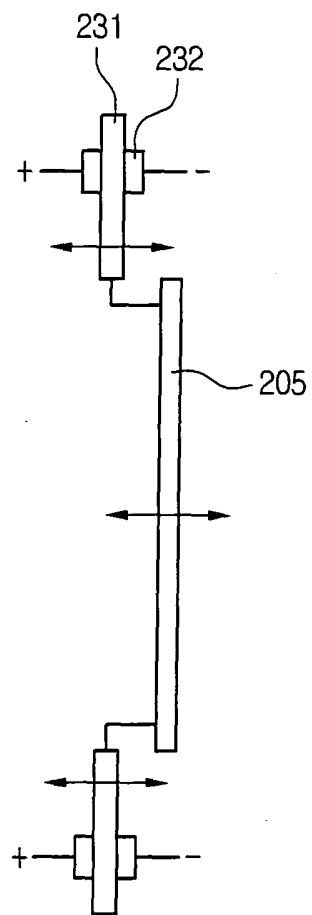


FIG.11

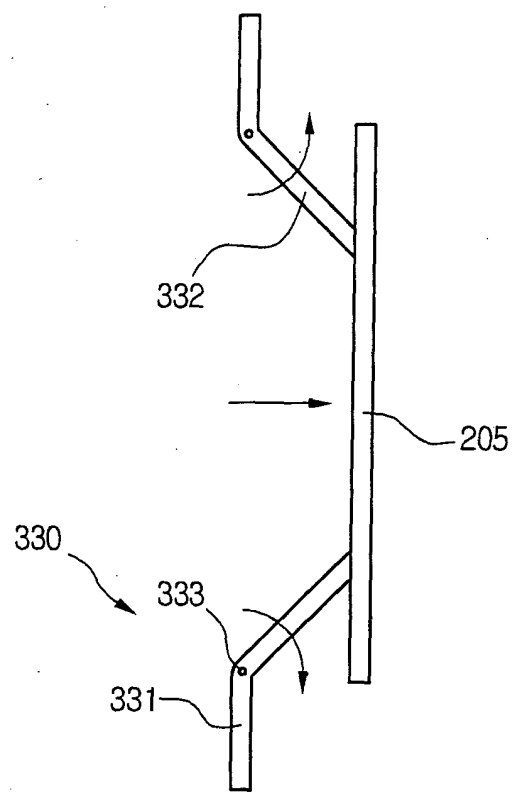


FIG.12

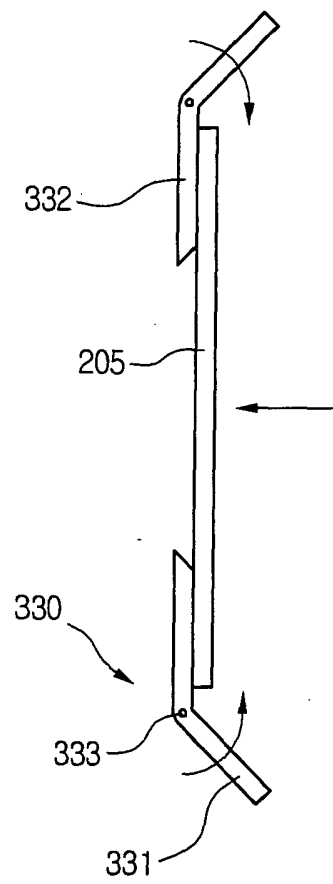


FIG.13

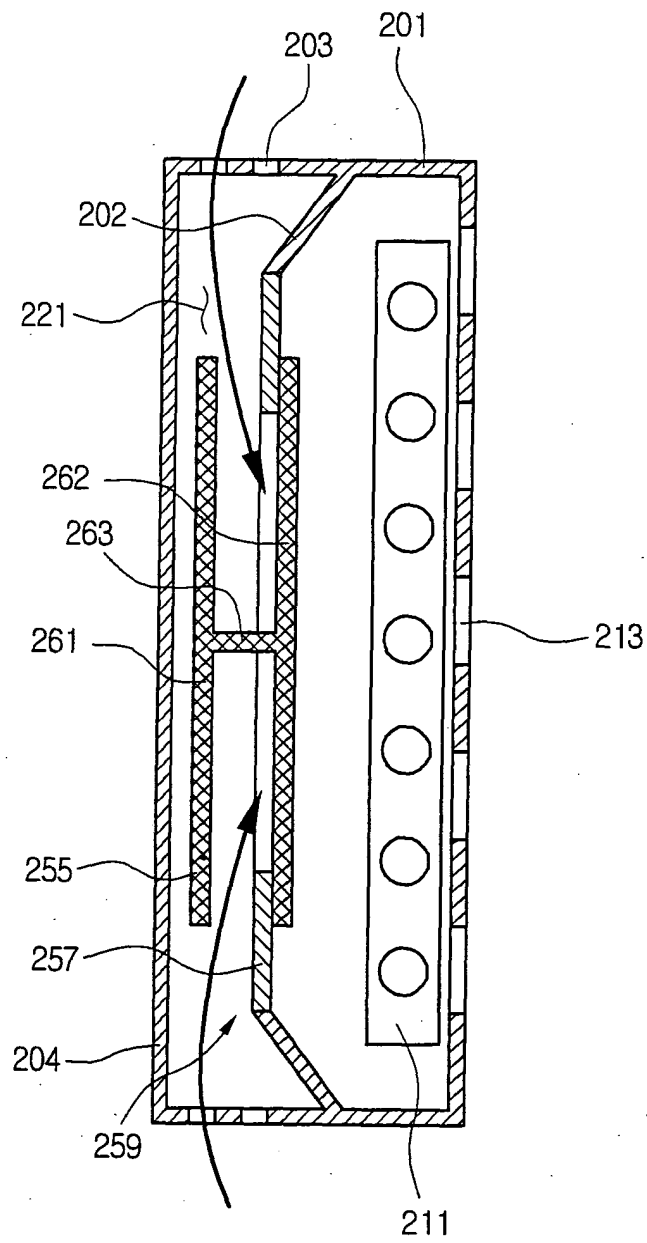


FIG.14

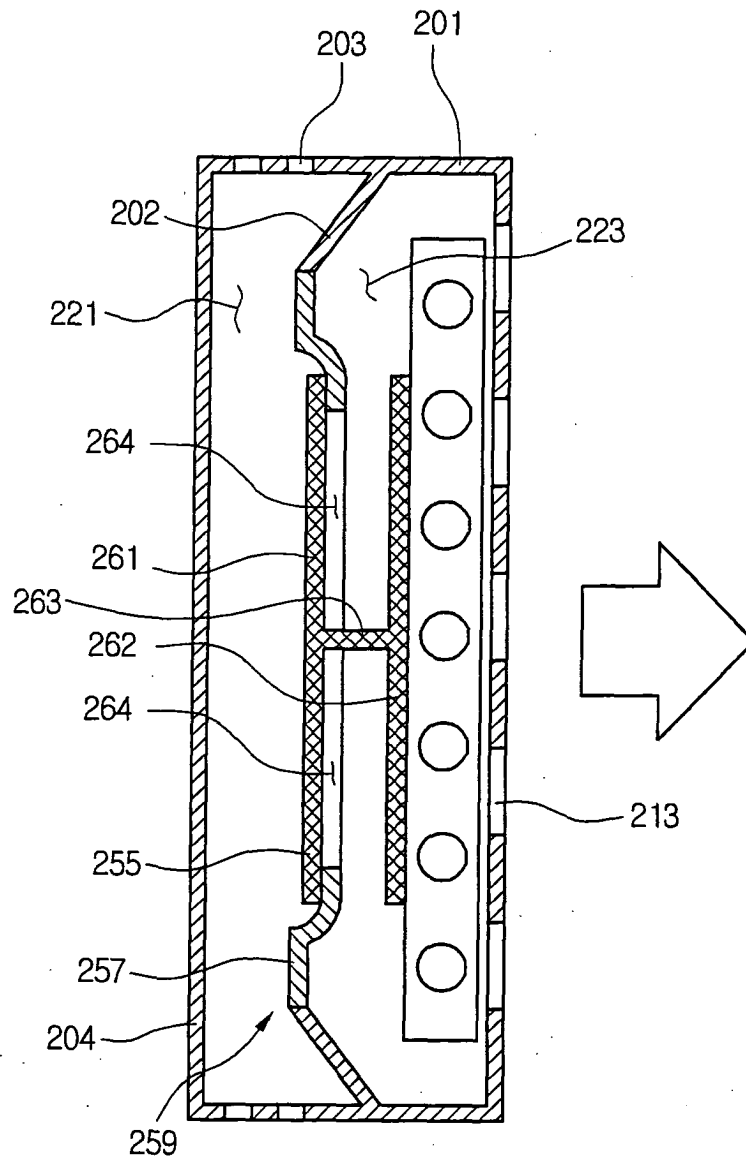


FIG.15

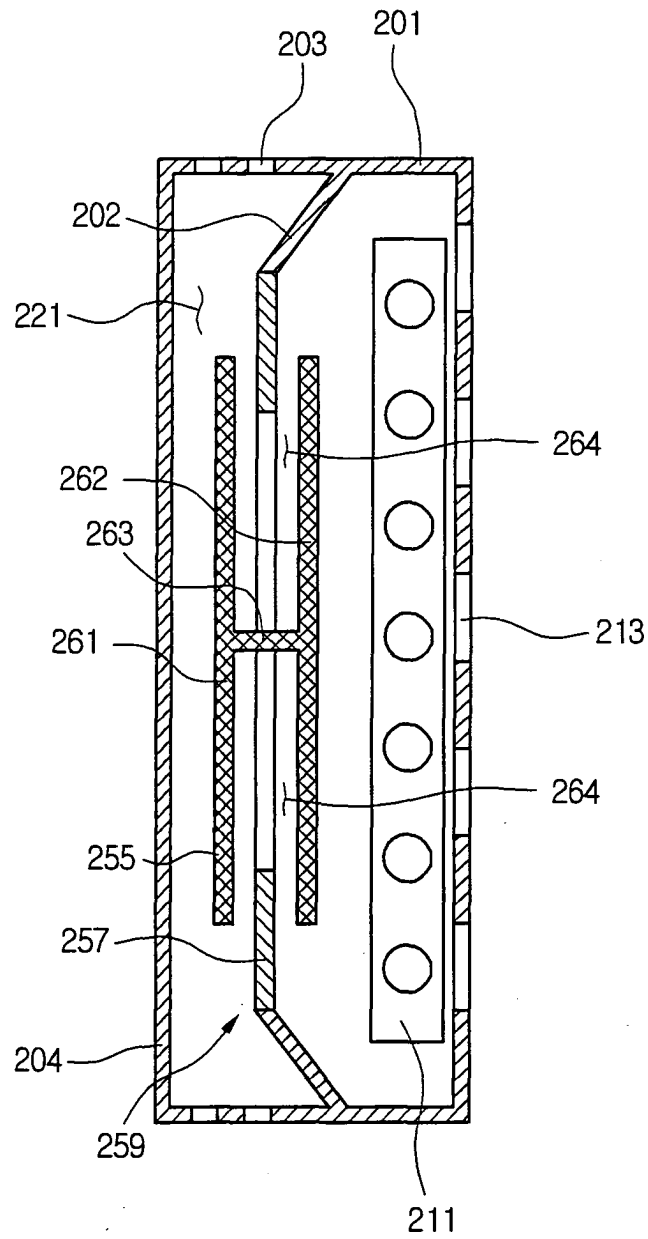


FIG.16

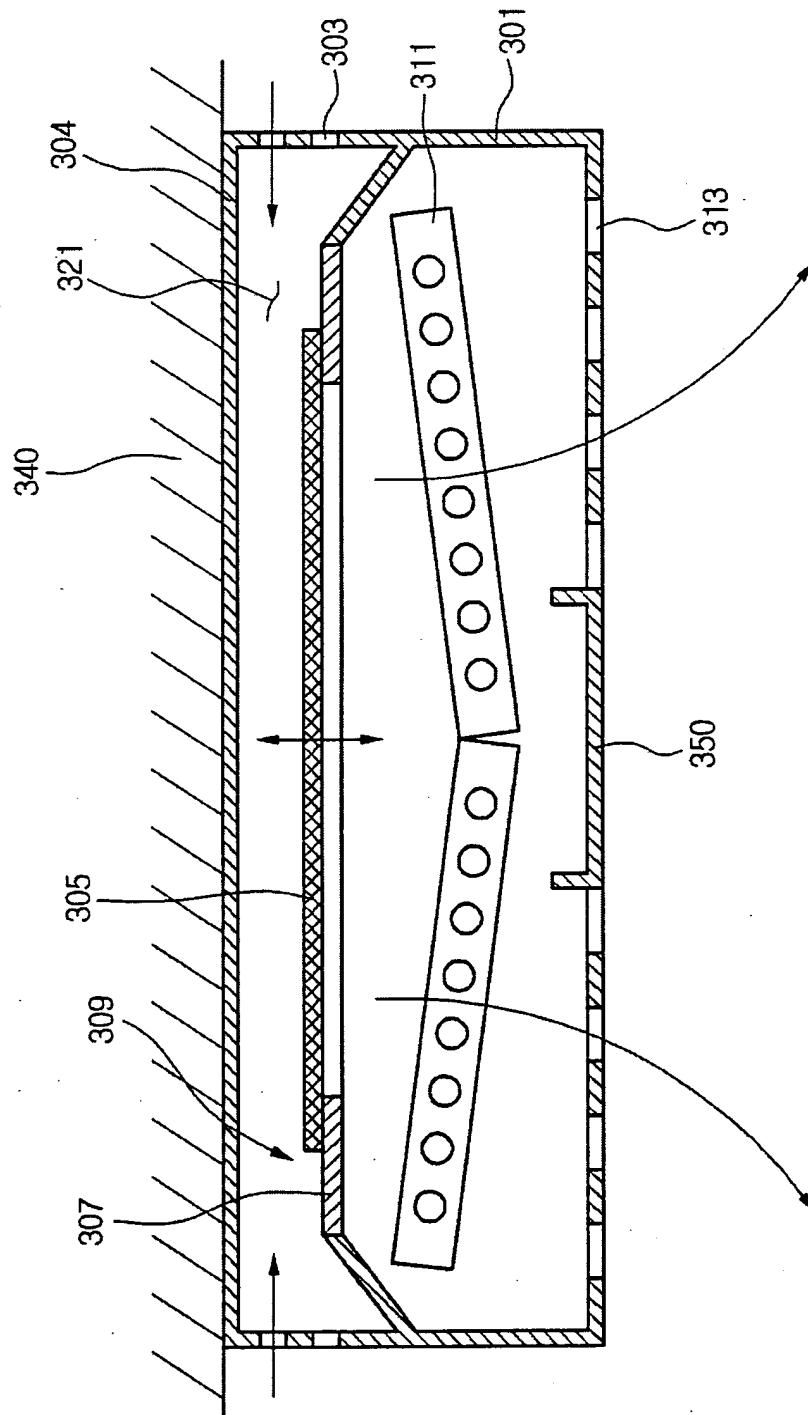
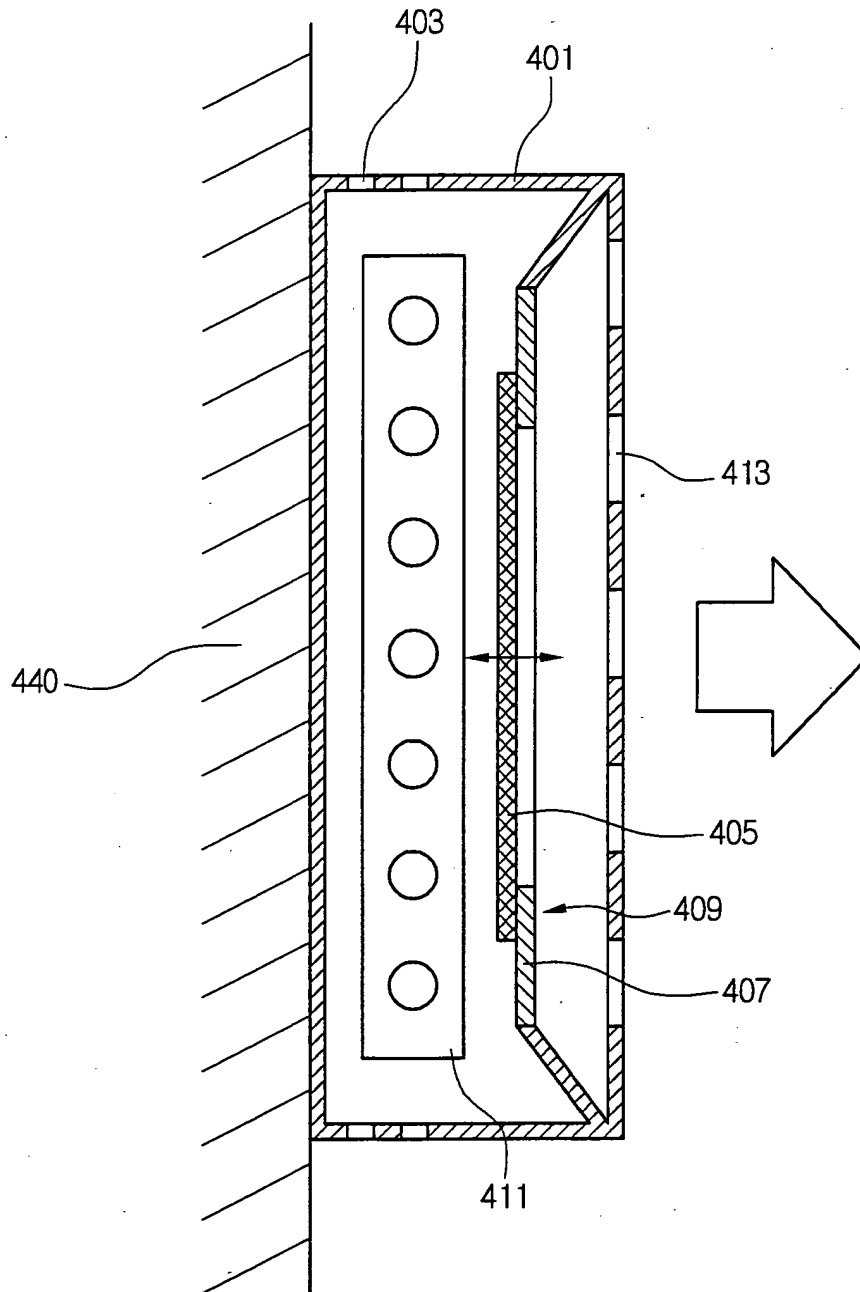


FIG.17





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 01 0027

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	PATENT ABSTRACTS OF JAPAN vol. 010, no. 253 (M-512), 29 August 1986 (1986-08-29) & JP 61 079937 A (TOSHIBA CORP), 23 April 1986 (1986-04-23) * abstract; figure 7 *	1-14	F24F1/00 F04D33/00
A	GB 2 376 720 A (* 1... LIMITED) 24 December 2002 (2002-12-24) * figure 12a.12b *	1-14	
A	US 5 941 694 A (TSUTSUI ET AL) 24 August 1999 (1999-08-24) * abstract *	1-14	
A	PATENT ABSTRACTS OF JAPAN vol. 012, no. 052 (M-668), 17 February 1988 (1988-02-17) & JP 62 199999 A (NIPPON DENSO CO LTD), 3 September 1987 (1987-09-03) * abstract; figures 1,2,4-6 *	1-14	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			F24F F04D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 August 2005	Examiner Valenza, D
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

3
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 05 01 0027

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

04-08-2005

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 61079937	A	23-04-1986	NONE	
GB 2376720	A	24-12-2002	GB 2405256 A	23-02-2005
US 5941694	A	24-08-1999	JP 10141300 A	26-05-1998
JP 62199999	A	03-09-1987	JP 1882130 C	10-11-1994
			JP 6006960 B	26-01-1994