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(54) **INDOOR UNIT OF AIR CONDITIONER**

(57) Disclosed is an indoor unit of an air conditioner which comprises a panel body (2) enclosing lateral parts of the air conditioner and used for installing a front panel (1), a back casing, and the front panel (1) closely jointed with the panel body (2). The back casing, the panel body (2) and the front panel (1) define an inner chamber of the air conditioner, in which a heat exchanger (5), control

components and ventilation parts (4) are all installed. The lower part of the front panel (1) is provided with an air outlet which is opened or closed by an air guide plate (3) installed in the front panel (1) or located on the panel body (2). A vortex forming device, which is a serrated face including many concave grooves, is located at the bottom of the air outlet.

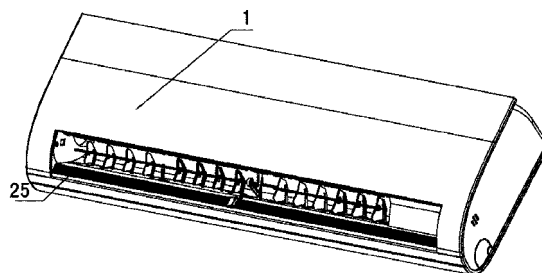


Fig. 4

Description

FIELD OF THE INVENTION

5 **[0001]** The present application relates to an indoor unit of an air conditioner, and particularly, to an indoor unit of an air conditioner with optimized performance and distinct effects.

BACKGROUND OF THE INVENTION

10 **[0002]** Generally, the air conditioner is an apparatus which utilizes an air cooler, a heater or an air purifier to cool, warm or purify a room, such that an internal environment of the room is more favorable. The air conditioner is provided with a ventilating device, an air cooling and heating device and an air purifier. The ventilating device circulate the air in the room, that is, absorbs air from the room, performs heat exchanging or purifies the air, and then discharges the air into the room. Improvements have been continually made to the air conditioner in the prior art. Generally, an indoor unit of the air conditioner includes: a rear shell enclosing side portions and a rear portion of the air conditioner, and a panel body arranged in front of the rear shell and closely connected to the rear shell. The rear shell and the panel body define an inner chamber of the air conditioner in which a heat exchanger, a control element and a ventilating component are provided. The panel body is usually fixedly connected to the rear shell via screws or in a snap-fit connecting manner. Since air conditioner market becomes increasing mature, the requirement on the energy-saving performance of the air condition is higher and higher. There is a need to make improvements to the air conditioner so as to develop an air conditioner with a higher energy efficiency ratio, to meet the requirement of the trend.

SUMMARY OF THE INVENTION

25 **[0003]** An object of the present application is to provide an indoor unit of an air conditioner which has a simple structure, improves the performance of the air conditioner and increases the energy efficiency ratio.

[0004] In order to achieve the above object, it is provided according to the present application the following technical solutions.

30 **[0005]** An indoor unit of the air conditioner including: a panel body enclosing side portions and a top portion of the air conditioner and being configured for installing a front panel, a rear shell enclosing a rear portion of the air conditioner, and the front panel arranged in the front of the air conditioner and closely connected to the panel body. The rear shell, the panel body and the front panel define an inner chamber of the air conditioner in which a heat exchanger, a control element, a ventilating component are provided. A lower portion of the front panel is provided with an air outlet. An air deflector is mounted on the front panel or is arranged on the panel body to open or close the air outlet. A vortex forming device is provided at a bottom surface of the air outlet.

35 **[0006]** The vortex forming device is configured as a serrated surface with a plurality of concave grooves.

[0007] To sum up, the present application has advantageous effects, for example:

40 **[0008]** In the indoor unit of the air conditioner according to the present application, since the vortex forming device is provided at the bottom surface of the air outlet and the vortex forming device is configured as a serrated surface with a plurality of concave grooves, air flow passing through the heat exchanger can form a vortex flow at the serrated surface, which can ensure the temperature at the air outlet being relatively uniform, thereby can avoid the formation of condensate water due to a partially large temperature difference, and thus can reduce occurrence of dew-congealing.

BRIEF DESCRIPTION OF THE DRAWINGS

45 **[0009]** Fig. 1 is a side structural schematic view of an indoor unit of an air conditioner according to the present application;
[0010] Fig. 2 is a perspective structural schematic view of an indoor unit of an air conditioner according to the present application;
50 **[0011]** Fig. 3 is a schematic view of a skirt structure of an indoor unit of an air conditioner according to the present application;
[0012] Fig. 4 is an overall structural schematic view of an indoor unit of an air conditioner according to the present application;
[0013] Fig. 5 is a structural schematic view of a panel body of an indoor unit of an air conditioner according to the present application;
55 **[0014]** Fig. 6 is a structural schematic view of an indoor unit of an air conditioner according to the present application, in which a bottom surface of an air outlet of a panel body is shown;
[0015] Fig. 7 is a front structural schematic view of a panel body of an indoor unit of an air conditioner according to the present application;

[0016] Fig. 8 is a structural schematic view of a panel body of an indoor unit of an air conditioner according to the present application; and

[0017] Fig. 9 is a rear structural schematic view of a panel body of an indoor unit of an air conditioner according to the present application.

[0018] Reference numerals:

1. front panel	2. panel body	10. front panel skirt structure
20. panel body skirt structure	11. first combining surface	12. second combining surface
13. third combining surface	21. fourth combining surface	22. fifth combining surface
23. sixth combining surface	24. seventh combining surface	25. serrated surface
26. air-damping rib	27. rear boss	28. side plate
9. rear frame	291. opening	3. air deflector
4. ventilating component	5. heat exchanger	51. copper pipe
52. fin		

DETAILED DESCRIPTION

[0019] The present application provides an indoor unit of an air conditioner. As shown in Figs. 1, 2, 5 and 6, the indoor unit of the air conditioner includes: a panel body 2 enclosing side portions and a top portion of the air conditioner and being configured for installing a front panel, a rear shell enclosing a rear portion of the air conditioner, and the front panel 1 arranged in the front of the air conditioner and closely connected to the panel body. The rear shell, the panel body 2 and the front panel 1 define an inner chamber of the air conditioner in which a heat exchanger 5, a control element, and a ventilating component 4 are provided. A lower portion of the front panel 1 is provided with an air outlet. An air deflector is mounted on the front panel 1 or is arranged on the panel body 2 for opening or closing the air outlet. A vortex forming device is provided at a bottom surface of the air outlet.

[0020] The vortex forming device is configured as a serrated surface 25 with a plurality of concave grooves. Air flow passing through the heat exchanger 5 can form a vortex flow at the serrated surface 25, which can ensure a relatively uniform temperature at the air outlet, thereby can avoid the formation of condensate water due to a partially large temperature difference, and thus can reduce occurrence of dew-congealing phenomenon.

[0021] As shown in Figs. 1, 2, 5, 7 and 8, air-damping ribs 26 are provided on the panel body 1 in a region between the front panel and the heat exchanger.

[0022] The air-damping ribs 26 include more than one horizontal air-damping rib.

[0023] The air-damping ribs 26 further include more than one connecting strip distributed at intervals in a direction perpendicular to the horizontal air-damping ribs.

[0024] The heat exchanger 5 includes fins 52 and a plurality of copper pipes 51 penetrating through the fins 52. The horizontal air-damping ribs are arranged in front of a gap between two adjacent copper pipes 51, which are close to an air outlet region of the ventilating component 4, of the heat exchanger 5.

[0025] The rear shell is mounted at a rear portion of the panel body 2. A lower portion of a front portion of the panel body 2 is closely connected to a bottom portion of the front panel 1. Side surfaces of the indoor unit of the air conditioner are of a "U" shape structure. Front, rear and bottom surfaces of a lower portion of the indoor unit of the air conditioner are formed by more than one curved surface.

[0026] The front panel 1 includes, from the top to the bottom in sequence, a first combining surface 11, a second combining surface 12 and a third combining surface 13. A sectional profile line of the first combining surface 11 is of a straight line or an arc line with a curvature approaching to zero. A sectional profile line of the second combining surface 12 is of a curved line with a curvature gradually increased from upper to lower, and the maximum curvature is less than or equal to 0.025. A sectional profile line of the third combining surface 13 is of a curved line with a curvature gradually decreased from upper to lower, and the minimum curvature is larger than 0.0005.

[0027] An assembly of the panel body 2 and the rear shell includes, from front to rear in sequence, a fourth combining surface 21, a fifth combining surface 22, a sixth combining surface 23 and a seventh combining surface 24.

[0028] Sectional profile lines of the fourth combining surface 21, the fifth combining surface 22, the sixth combining surface 23 and the seventh combining surface 24 have different curvatures, respectively, such that a bottom of the air conditioner has an arc transition structure.

[0029] As shown in Figs. 3, 4 and 9, the front panel 1 covers the front portion of the panel body 2, and a width of the front panel 1 is larger than a width of the front portion of the panel body 2, thereby forming a front panel skirt structure 10 at at least one side of bonding portion of the front panel 1 and the panel body 2. As shown in Figs. 3 and 6, the panel body 2 includes: a rear frame 29 at a rear portion of the panel body 2, and a left side plate 28 and a right side plate 28.

At least one side of the rear frame 29 extends beyond corresponding side plate 28 at the same side, thereby forming a panel body skirt structure 20. The front panel skirt structure 10 and the panel body skirt structure 20 are connected to form a "U" shape side decorative edge of the indoor unit of the air conditioner.

[0030] Preferably, each of a left side and a right side of the bonding portion of the front panel 1 and the panel body 2 is formed with the skirt structure 10, and each of a left side and a right side of the panel body 2 is formed with the panel body skirt structure 20, such that each of a left side and a right side of the indoor unit has a decorative edge.

[0031] Top portions of the front panel 1 and the rear frame 29 are higher than a top surface of the rear shell.

[0032] Widths L2 of the front panel skirt structure 10 and the panel body skirt structure 20 are ranged from 2 millimeter (mm) to 8mm, and preferably are 4mm. A height H1 of the front panel skirt structure 10 and a height H2 of the panel body skirt structure 20 are ranged from 3mm to 10mm, and preferably are 8mm.

[0033] As shown in Fig. 6, a back portion of the panel body 2 is formed with an opening 291 for installing the rear shell, and is provided with a rear boss 27 at a lower edge of the opening 291. After the air conditioner is mounted, the rear boss 27 abuts against a wall surface, to form an installing space for a drain pipe and a refrigerant connecting pipe between the rear shell and the wall surface.

[0034] The rear boss 27 is arranged in a transverse direction, and has upward bending portions at left and right ends thereof.

[0035] A size of the rear boss 27 in a horizontal direction is less than that of the rear frame 29.

[0036] The above embodiments are not intended to limit the present application. Various improvements and variations made by the person skilled in the art, without departing from the scope of the present application, are deemed to fall into the protection scope of the present application.

Claims

1. An indoor unit of an air conditioner comprising: a panel body (2) enclosing side portions and a top portion of the air conditioner and being configured for installing a front panel, a rear shell enclosing a rear portion of the air conditioner, and the front panel (1) arranged in the front of the air conditioner and closely connected to the panel body, wherein the rear shell, the panel body (2) and the front panel (1) define an inner chamber of the air conditioner in which a heat exchanger (5), a control element, a ventilating component (4) are provided; a lower portion of the front panel (1) is provided with an air outlet, and an air deflector is mounted on the front panel (1) or is arranged on the panel body (2) to open or close the air outlet,

characterized in that,

a vortex forming device is provided at a bottom surface of the air outlet.

2. The indoor unit of the air conditioner according to claim 1, wherein the vortex forming device is configured as a serrated face (25) with a plurality of concave grooves.

3. The indoor unit of the air conditioner according to claim 2, wherein air-damping ribs (26) are provided on the panel body (1) in a region between the front panel and the heat exchanger.

4. The indoor unit of the air conditioner according to claim 3, wherein the air-damping ribs (26) comprises more than one horizontal air-damping rib.

5. The indoor unit of the air conditioner according to claim 4, wherein the air-damping ribs (26) comprises more than one connecting strip distributed at intervals in a direction perpendicular to the horizontal air-damping ribs.

6. The indoor unit of the air conditioner according to claim 5, wherein the heat exchanger (5) comprises fins (52) and a plurality of copper pipes (51) penetrating through the fins, and the horizontal air-damping ribs are arranged in front of a gap between two adjacent copper pipe (51), which are close to an air outlet region of the ventilating component (4), of the heat exchanger (5).

7. The indoor unit of the air conditioner according to any one of claims 1 to 6, wherein the rear shell is mounted at a rear portion of the panel body (2), a lower portion of a front portion of the panel body (2) is closely connected to a bottom portion of the front panel (1), side surfaces of the indoor unit of the air conditioner are of a "U" shape structure, and front, rear and bottom surfaces of a lower portion of the indoor unit of the air conditioner are formed by more than one curved surface.

8. The indoor unit of the air conditioner according to claim 7, wherein the front panel (1) comprises, from top to bottom

in sequence, a first combining surface (11), a second combining surface (12) and a third combining surface (13), wherein a sectional profile line of the first combining surface (11) is of a straight line or an arc line with a curvature approaching to zero; a sectional profile line of the second combining surface (12) is of a curved line with a curvature gradually increased from upper to lower, the maximum curvature being less than or equal to 0.025; and a sectional profile line of the third combining surface (13) is of a curved line with a curvature gradually decreased from upper to lower, the minimum curvature being larger than 0.0005.

9. The indoor unit of the air conditioner according to claim 8, wherein the front panel (1) covers the front portion of the panel body (2), and a width of the front panel (1) is larger than a width of the front portion of the panel body (2), thereby forming a front panel skirt structure (10) at at least one side of a bonding portion of the front panel (1) and the panel body (2); the panel body (2) comprises: a rear frame (29) at a rear portion of the panel body (2), and a left side plate (28) and a right side plate (28), and at least one side of the rear frame (29) extends beyond corresponding side plate (28), thereby forming a panel body skirt structure (20); and the front panel skirt structure (10) and the panel body skirt structure (20) are connected to form a "U" shape side decorative edge of the indoor unit of the air conditioner.
10. The indoor unit of the air conditioner according to claim 9, wherein a back portion of the panel body (2) is formed with an opening (291) for installing the rear shell, and is provided with a rear boss (27) at a lower edge of the opening (291).

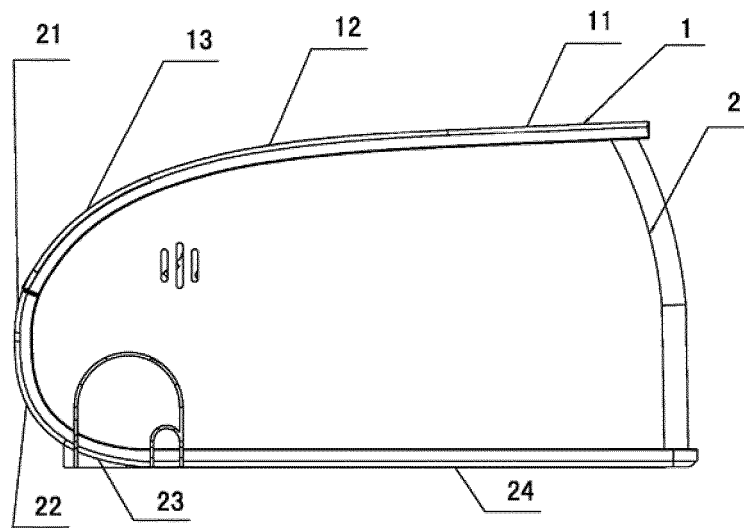


Fig. 1

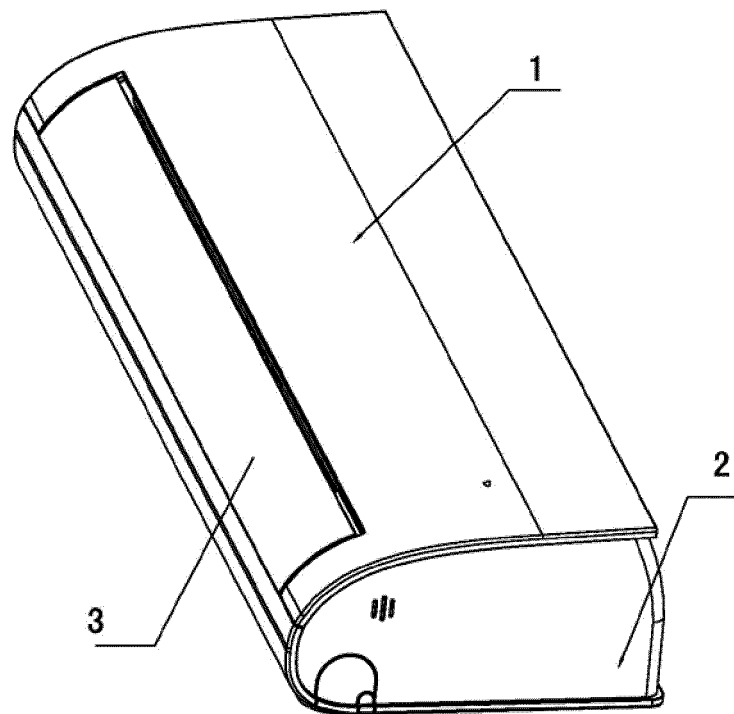


Fig. 2

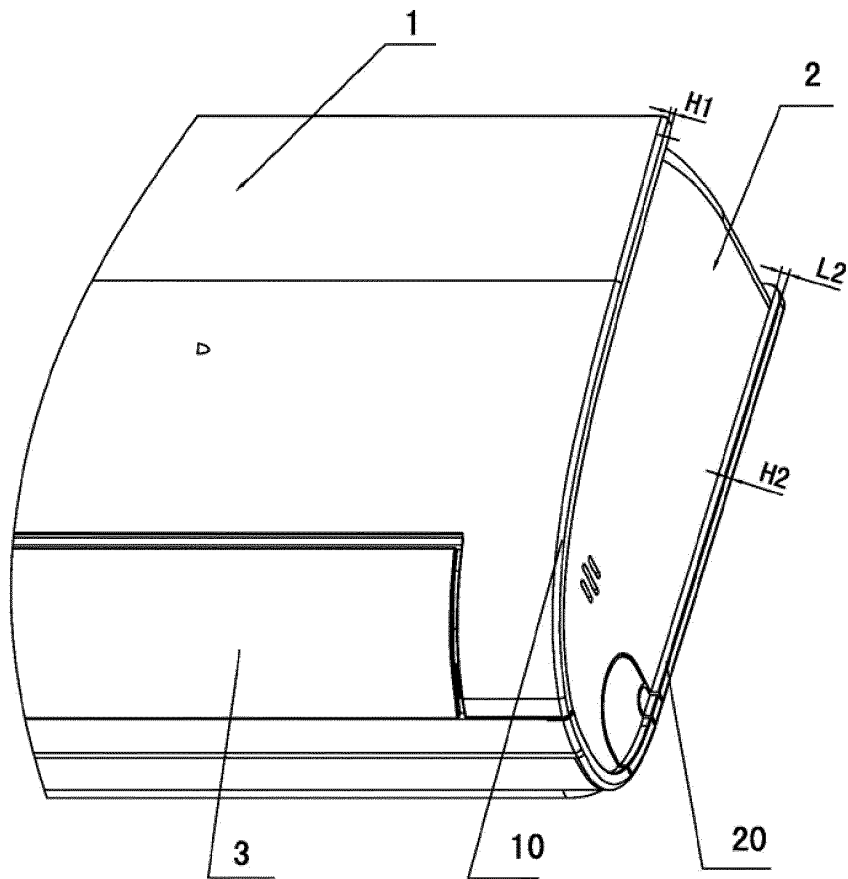


Fig. 3

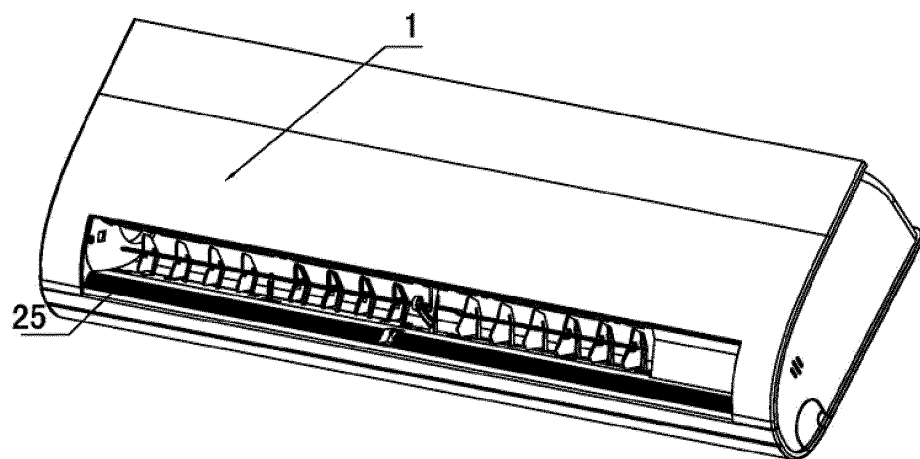


Fig. 4

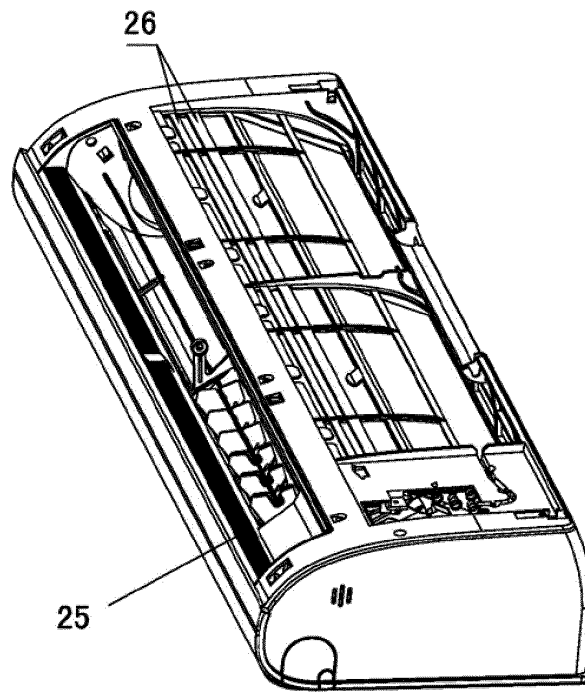


Fig. 5

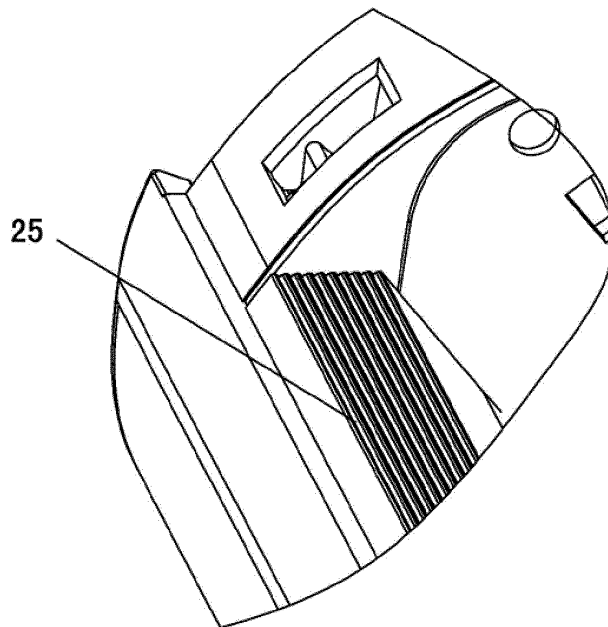


Fig. 6

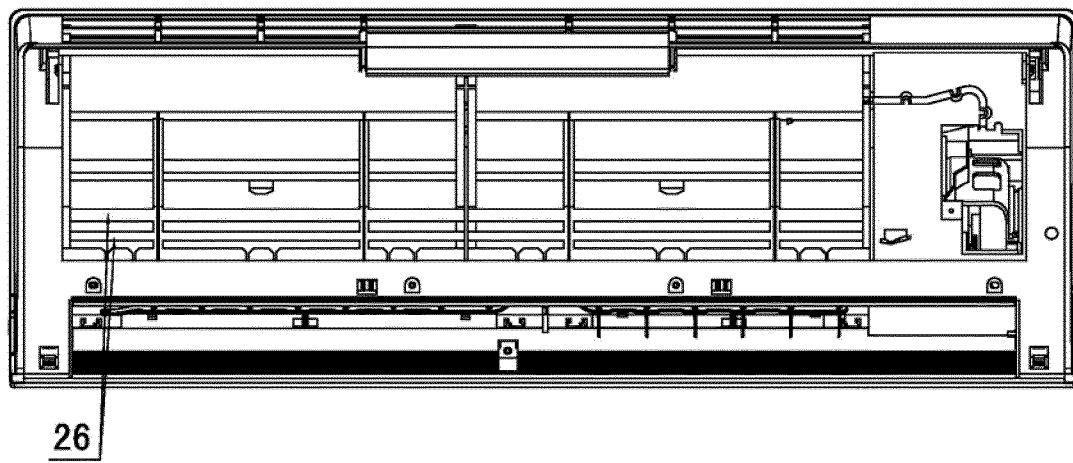


Fig. 7

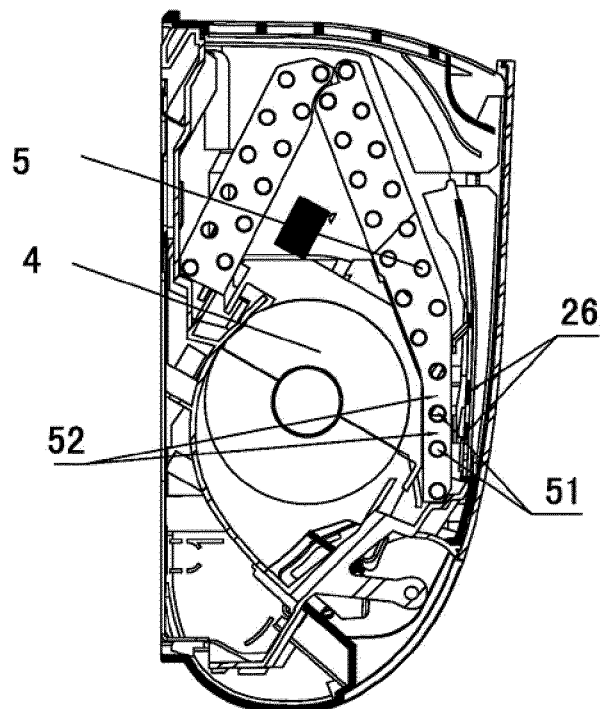


Fig. 8

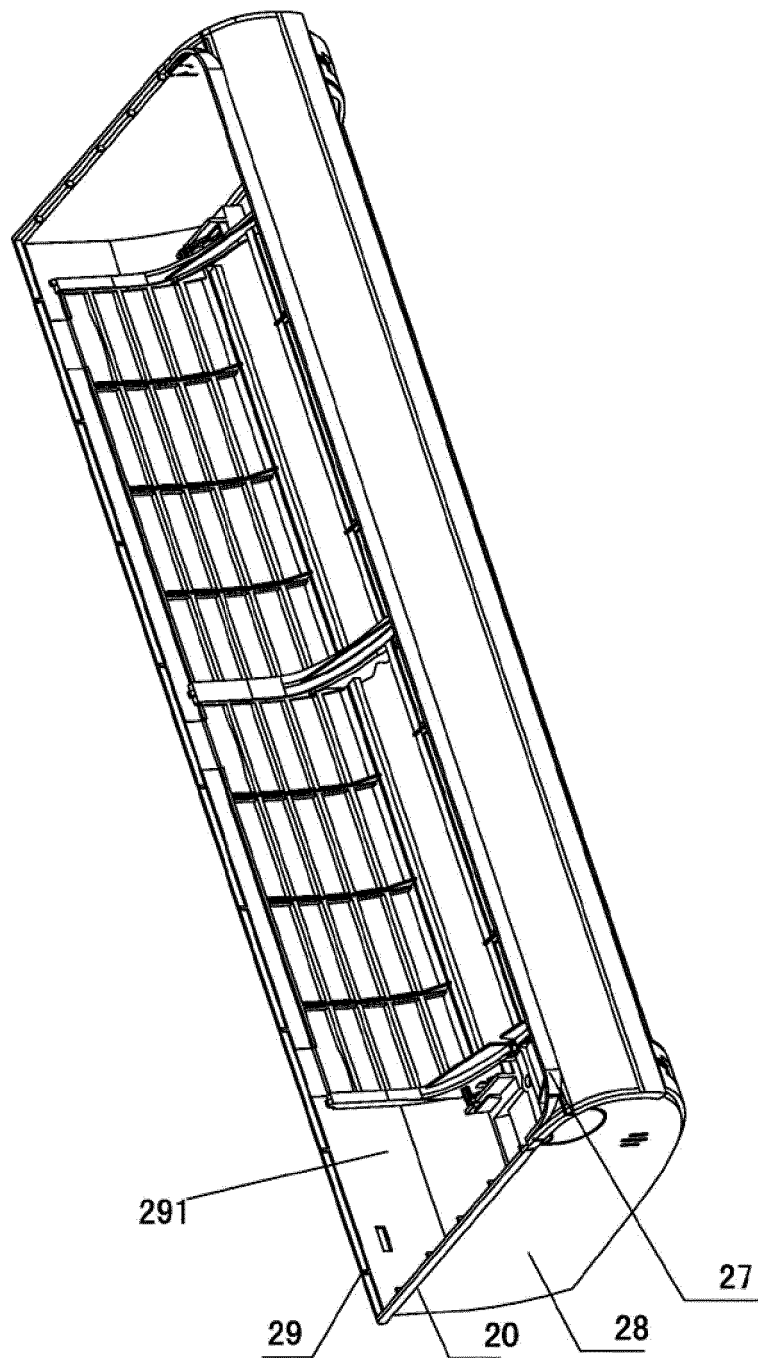


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2011/072171

A. CLASSIFICATION OF SUBJECT MATTER														
F24F 13/08 (2006.01)i														
According to International Patent Classification (IPC) or to both national classification and IPC														
B. FIELDS SEARCHED														
Minimum documentation searched (classification system followed by classification symbols)														
IPC: F24F; F25D17/00,17/04,17/06;														
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched														
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)														
CNPAT,CNKI,EPODOC,WPI: width or breadth or extent; angularity or flexure or circumflexion or camber or curve or curvature or buckling; eddy or vortex or whirlpool or remous or swirl or vortices or turbulence or turbulent; recess or groove or flute or notch or concave or socket or slot or indent or fillister;														
C. DOCUMENTS CONSIDERED TO BE RELEVANT														
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.												
E	CN 201787704 U(GREE ELECTRIC APPLIANCES INC. OF ZHUHAI) 06 Apr. 2011 (06.04.2011) whole document	1-2												
PX	CN 201666645 U(GREE ELECTRIC APPLIANCES INC. OF ZHUHAI) 08 Dec.2010 (08.12.2010) whole document	1-10												
PX	CN 201666646 U(GREE ELECTRIC APPLIANCES INC. OF ZHUHAI) 08 Dec.2010 (08.12.2010) whole document	1-10												
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“A” document defining the general state of the art which is not considered to be of particular relevance	“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone													
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Date of the actual completion of the international search 21 May 2011 (21.05.2011)		Date of mailing of the international search report 07 Jul. 2011 (07.07.2011)												
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451		Authorized officer HAO, Rongrong Telephone No. (86-10)62084800												

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2011/072171

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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E	CN 201819366 U (GREE ELECTRIC APPLIANCES INC. OF ZHUHAI) 04 May 2011 (04.05.2011) whole document	7-10
X	JP 2003021387 A (FUJITSU GENERAL LTD) 24 Jan. 2003 (24.01.2003) Desc. Paragraphs 12-21, Figs. 1-3	1-2
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Y	CN 1403748 A (TOSHIBA CARRIER CORP) 19 Mar. 2003(19.03.2003) Desc. Pages 3-4, Figs. 1-9	7-8
A	JP 2009115390 A (SHARP KK) 28 May 2009 (28.05.2009) whole document	1-10

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/CN2011/072171

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 201787704 U	06.04.2011	None	
CN 201666645 U	08.12.2010	None	
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JP 2009115390 A	28.05.2009	None	

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