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(71) Applicants:
• **Haier Group Corporation**
Qingdao, Shandong 266101 (CN)
• **Qingdao Haier Air Conditioner Gen Corp., Ltd.**
Qingdao, Shandong 266101 (CN)

(72) Inventors:
• **LIU, Weijie**
Qingdao
Shandong 266101 (CN)
• **LI, Dasen**
Qingdao
Shandong 266101 (CN)
• **JIAO, Litao**
Qingdao
Shandong 266101 (CN)

(74) Representative: **Ziebig, Marlene**
Straße 4, Nr. 12A
13125 Berlin (DE)

(54) **VERTICAL AIR CONDITIONER AND AIR SUPPLY DEVICE THEREOF**

(57) A vertical air-conditioner and a vertical air-conditioner air supply apparatus (1) are disclosed. The vertical air-conditioner air supply apparatus (1) includes three circular air guiding bodies (11, 12, 13) that are hollow and have front and rear openings. Each of the circular air guiding bodies (11, 12, 13) is a single component. The three circular air guiding bodies (11, 12, 13) are arranged sequentially from front to rear, and a through-duct that runs through from front to rear is formed in the middle. An air inlet (122) of a rear-end circular air guiding body (12) located at the rear end forms a non-heat-exchanged air inlet of the air supply apparatus. An air outlet (111) of a front-end circular air guiding body (11) located at the front end forms a mixed air outlet. A circular heat-exchanged air duct (14, 15) is formed between two adjacent circular air guiding bodies (11, 12, 13). An airflow distribution assembly (16) for circumferentially distributing heat-exchanged air is disposed in at least one of the circular heat-exchanged air ducts (14, 15). In a vertical air-conditioner that uses the air supply apparatus (1), the air supply is uniform, the air flow of the air supply is large, and the temperature of the air supply is comfortable.

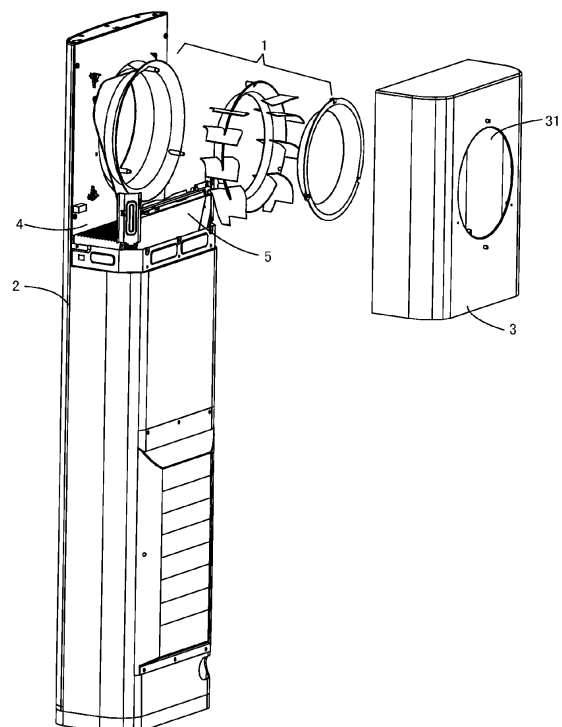


FIG. 2

Description

BACKGROUND

Technical Field

[0001] The present invention relates to the field of air conditioning technologies, and in particular, to a vertical air-conditioner and a vertical air-conditioner air supply apparatus.

Related Art

[0002] When a conventional vertical air-conditioner supplies air, air is subjected to heat exchange by a heat exchanger and is directly blown out from an air outlet provided on the air-conditioner under the action of an internal fan, and all of the blown-out air is heat-exchanged air. Generally, no additional air supply apparatus is disposed between the heat exchanger and the air outlet. One disadvantage of such an air supply method of the air-conditioner is that indoor air circulation is slow because the supplied air is all heat-exchanged air and the air flow rate is low; another disadvantage is that the supplied air is not mild enough, and especially in the cooling mode, the blown-out cool air directly blows on a user, making the user feel uncomfortable.

[0003] To solve the foregoing problems, the applicant proposed an air-conditioner air supply apparatus that can be applied to an air-conditioner. The air-conditioner air supply apparatus includes a circular cover body. A through-duct running through the circular cover body is formed in the middle of the circular cover body. A circular opening is formed on a wall of the circular cover body. A plurality of circular deflectors is disposed on the circular opening. A circular air outlet duct is formed between adjacent circular deflectors. After the air-conditioner air supply apparatus is disposed between an air-conditioner heat exchanger and an air outlet of an air-conditioner housing, the air intake volume of the air-conditioner can be increased, indoor air circulation can be accelerated, and the air-conditioner is enabled to supply milder air, thereby making the user feel more comfortable and improving the user experience. However, because the circular deflector and the circular air outlet duct are both formed on one circular cover body, it is not convenient to flexibly select and control the structure of the circular deflector and air outlet duct, resulting in a narrow application scope. Moreover, because the fan of the air-conditioner supplies air from bottom to top, the heat-exchanged air is not uniformly distributed in the circumferential direction when entering the circular air outlet duct, and the air flow rate is high at the lower end of the circular air outlet duct but low at the left and right sides of the circular air outlet duct. As a result, the air supplied by the air-conditioner air supply apparatus is not uniformly distributed in the entire circumferential direction, affecting the comfort of the user. How to design an air-conditioner

air supply apparatus and an air-conditioner that supply air uniformly, have a wide application range, and can be conveniently assembled is the main problem that the present invention needs to research.

SUMMARY

[0004] One objective of the present invention is to provide a vertical air-conditioner air supply apparatus, and the apparatus has a wide application range, supplies air uniformly, and has high air supply performance.

[0005] To achieve the foregoing objective of the present invention, the present invention is implemented by means of the following technical solutions:

A vertical air-conditioner air supply apparatus is provided, where the air supply apparatus includes three circular air guiding bodies that are hollow and have front and rear openings, each of the circular air guiding bodies is a single component, the rear opening of the circular air guiding body is an air inlet, the front opening of the circular air guiding body is an air outlet, the three circular air guiding bodies are arranged sequentially from front to rear, and a through-duct that runs through from front to rear is formed in the middle, an air inlet of a rear-end circular air guiding body located at the rear end is a non-heat-exchanged air inlet of the air supply apparatus, a circular heat-exchanged air duct is formed between two adjacent circular air guiding bodies, and an airflow distribution assembly for circumferentially distributing heat-exchanged air that enters the circular heat-exchanged air duct from a heat exchanger of a vertical air-conditioner that has the air supply apparatus is disposed in at least one of the circular heat-exchanged air ducts.

[0006] In the vertical air-conditioner air supply apparatus described above, each of the circular air guiding bodies gradually reduces from the air inlet of the circular air guiding body to the air outlet of the circular air guiding body.

[0007] In the vertical air-conditioner air supply apparatus described above, an inner perimeter of the air inlet of each of the circular air guiding bodies is greater than an inner perimeter of the air outlet of the circular air guiding body.

[0008] In the air-conditioner air supply apparatus described above, a surface of the cone-shaped body is a curved surface.

[0009] In the air-conditioner air supply apparatus described above, a plurality of circular air guiding bodies is arranged coaxially, an inner perimeter of the air outlet of each of the circular air guiding bodies gradually increases in a direction from an air inlet of the rear-end circular air guiding body to an air outlet of the front-end circular air guiding body.

[0010] In the vertical air-conditioner air supply apparatus

tus described above, the air supply apparatus is further provided with a mixed air flow guiding portion that is hollow and has front and rear openings, and the mixed air flow guiding portion is disposed at a front end of the front-end circular air guiding body.

[0011] In the vertical air-conditioner air supply apparatus described above, for convenience of installation, the air supply apparatus is further provided with an installation portion, and the installation portion is disposed at a rear end of the rear-end circular air guiding body.

[0012] In the vertical air-conditioner air supply apparatus described above, the circular heat-exchanged air duct has an air outlet end that is proximal to the through-duct and an air inlet end that is distal from the through-duct, and the circular heat-exchanged air duct gradually reduces from the air inlet end to the air outlet end.

[0013] In the vertical air-conditioner air supply apparatus described above, a diameter of a tangent circle between the two adjacent circular air guiding bodies that form the circular heat-exchanged air duct gradually reduces by a reduction ratio of 5-25% from the air inlet end to the air outlet end, and the two adjacent circular air guiding bodies that form the circular heat-exchanged air duct have an air inlet end tangent circle at the air inlet end, and have an air outlet end tangent circle at the air outlet end, and a diameter of the air outlet end tangent circle is 60-70% of a diameter of the air inlet end tangent circle.

[0014] In the vertical air-conditioner air supply apparatus described above, a first circular heat-exchanged air duct is formed between the front-end circular air guiding body and a middle circular air guiding body that is located between the front-end circular air guiding body and the rear-end circular air guiding body, a second circular heat-exchanged air duct is formed between the middle circular air guiding body and the rear-end circular air guiding body, and a diameter of an air inlet end tangent circle and a diameter of an air outlet end tangent circle of the second circular heat-exchanged air duct are greater than a diameter of an air inlet end tangent circle and a diameter of an air outlet end tangent circle of the first circular heat-exchanged air duct respectively.

[0015] In the vertical air-conditioner air supply apparatus described above, the airflow distribution assembly is disposed on the middle circular air guiding body that is located between the front-end circular air guiding body and the rear-end circular air guiding body, and extends into inner and outer two circular heat-exchanged air ducts formed by the middle circular air guiding body.

[0016] In the vertical air-conditioner air supply apparatus described above, the airflow distribution assembly includes a plurality of airflow distribution plates, and the plurality of airflow distribution plates is bilaterally symmetrically arranged in a circumferential direction of the circular heat-exchanged air duct, and along an air supply direction of the heat-exchanged air.

[0017] Preferably, the plurality of airflow distribution plates is bent distribution plates of the same bending di-

rection, and the bending direction of the plurality of airflow distribution plates is reverse to the air supply direction of the heat-exchanged air.

[0018] Preferably, the airflow distribution assembly includes four pairs of the airflow distribution plates that are arranged bilaterally symmetrically in the circumferential direction of the circular heat-exchanged air duct, and along the air supply direction of the heat-exchanged air.

[0019] Preferably, a spacing of multiple pairs of the airflow distribution plates gradually reduces along the air supply direction of the heat-exchanged air.

[0020] Preferably, surfaces of the airflow distribution plates are all arc-shaped curved surfaces.

[0021] To achieve the foregoing objective of the present invention, the vertical air-conditioner provided in the present invention is implemented by means of the following technical solutions:

A vertical air-conditioner includes a front panel, a rear panel, a left panel and a right panel, and an internal air duct of the air-conditioner is defined by the front panel, the rear panel, the left panel and the right panel, where the front panel is provided with a circular mixed air outlet, the rear panel is provided with a circular non-heat-exchanged air inlet at least at a position corresponding to the circular mixed air outlet, the vertical air-conditioner air supply apparatus described above is disposed inside the air-conditioner, and the air outlet of the front-end circular air guiding body or the front opening of the mixed air flow guiding portion and the air inlet of the rear-end circular air guiding body in the air-conditioner air supply apparatus are respectively correspondingly sealed to the circular mixed air outlet on the front panel and the circular non-heat-exchanged air inlet on the rear panel.

[0022] Compared with the prior art, the present invention has the following advantages and positive effects:

Three circular air guiding bodies in a form of a single component are combined to form a vertical air-conditioner air supply apparatus, so that it is convenient to control flexibly the structure of each circular air guiding body according to requirements of air supply, and to manufacture conveniently circular air guiding bodies of different structures, and an assembling method of the entire air supply apparatus in the air-conditioner may also be selected flexibly, thereby improving the application scope of the air-conditioner air supply apparatus and the production efficiency of the air-conditioner. After the air supply apparatus is applied in a vertical air-conditioner, when heat-exchanged air in an internal air duct of the air-conditioner is blown out from a front end of a through-duct, part of external non-heat-exchanged air that is not subjected to heat exchange is sucked by using the negative pressure effect, and becomes part of the air finally supplied from the air-conditioner, which increases the overall air intake volume of the air-conditioner, accelerates indoor air cir-

culation, and further improves the overall uniformity of indoor air. Moreover, the mixed air is mild, which makes the user feel more comfortable, thereby improving the comfort of the user.

[0023] Other features and advantages of the present invention will become apparent after reading the detailed description of the present invention with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

FIG. 1 is a three-dimensional view of an embodiment of a vertical air-conditioner according to the present invention;

FIG. 2 is a schematic view of a partial blast structure of FIG. 1.

FIG. 3 is a schematic three-dimensional structural view of the vertical air-conditioner air supply apparatus in FIG. 2;

FIG. 4 is a schematic view of a blast structure of FIG. 3;

FIG. 5 is a schematic structural radial section view of FIG. 3;

FIG. 6 is a simplified schematic structural view of FIG. 5; and

FIG. 7 is a schematic structural rear view of FIG. 4.

DETAILED DESCRIPTION

[0025] The technical solutions of the present invention are further described in detail below with reference to the accompanying drawings and the detailed description.

[0026] First, technical terms involved in the detailed description are briefly described. The front end or rear end of each structural component as mentioned below is defined in terms of the position of the structural component in the normal use state relative to the user; front or rear, when used to describe the positions at which multiple structural components are arranged, is also defined in terms of the position of an apparatus formed by the multiple structural components in the normal use state relative to the user. In the following description, heat-exchanged air refers to air that is from the inside of an air-conditioner and has been subjected to heat exchange by a heat exchanger; non-heat-exchanged air refers to air from the environmental space in which the air-conditioner is located, is relative to the heat-exchanged air, and is part of air that is not directly from the heat exchanger; and mixed air refers to air formed by mixing the heat-exchanged air with the non-heat-ex-

changed air.

[0027] Refer to an embodiment of a vertical air-conditioner of the present invention shown in FIG. 1 and FIG. 2. FIG. 1 is a three-dimensional view of this embodiment, and FIG. 2 is a schematic view of a partial blast structure of FIG. 1.

[0028] As shown in FIG. 1 and FIG. 2, the air-conditioner of this embodiment includes a front panel 2, a rear panel 3, a left panel, a right panel, a top plate and a bottom plate (not marked in the figure) that constitute a housing of the air-conditioner. The housing defines an internal air duct 4 of the air-conditioner. A circular mixed air outlet 21 is formed on an upper part of the front panel 2, and a circular non-heat-exchanged air inlet 31 is formed on an upper part of the rear panel 3 and at a position corresponding to the mixed air outlet 21 on the front panel 2. A blower (not shown in the figure), a heat exchanger 5 and an air-conditioner air supply apparatus 1 are disposed from bottom to top in the internal air duct 4, and the blower 6 is arranged in such a manner that air from the internal air duct 4 of the air-conditioner is blown out from the mixed air outlet 21 on the front panel 2.

[0029] For the structure of the air-conditioner air supply apparatus 1, refer to FIG. 3 to FIG. 7.

[0030] As show in the schematic three-dimensional structural view in FIG. 3 and the schematic view of a blast structure in FIG. 4, and with reference to FIG. 1 and FIG. 2, the air-conditioner air supply apparatus 1 in this embodiment includes three circular air guiding bodies, namely, a front-end circular air guiding body 11, a first middle circular air guiding body 13, and a rear-end circular air guiding body 12. Each circular air guiding body in the three circular air guiding bodies that are arranged sequentially from front to rear is a single component, and is formed independently. The front-end circular air guiding body 11 is hollow and has front and rear two openings, the front opening is an air outlet 111, and the rear opening is an air inlet 112; the first middle circular air guiding body 13 is hollow and has front and rear two openings, the front opening is an air outlet 131, and the rear opening is an air inlet 132; and the rear-end circular air guiding body 12 is hollow and has front and rear two openings, the front opening is an air outlet 121, the rear opening is an air inlet 122, and the air inlet 122 is the non-heat-exchanged air inlet of the air-conditioner air supply apparatus 1. After the front-end circular air guiding body 11, the first middle circular air guiding body 13 and the rear-end circular air guiding body 12 are arranged sequentially from front to rear, a through-duct (not marked in the figure) that runs through all the three circular air guiding bodies from front to rear is formed in the middle. Moreover, a first circular heat-exchanged air duct 14 is formed between the front-end circular air guiding body 11 and the first middle circular air guiding body 13; a second circular heat-exchanged air duct 15 is formed between the first middle circular air guiding body 13 and the rear-end circular air guiding body 12. When the air-conditioner air supply apparatus 1 is applied in the air-

conditioner, the internal air duct 4 of the air-conditioner is connected to the through-duct in the air-conditioner air supply apparatus 1 by using the first circular heat-exchanged air duct 14 and the second circular heat-exchanged air duct 15.

[0031] In addition, an airflow distribution assembly 16 that extends into the first circular heat-exchanged air duct 14 and the second circular heat-exchanged air duct 15 is disposed on the first middle circular air guiding body 13. Besides, for convenience of manufacturing, the airflow distribution assembly 16 is preferably integrally formed with the first middle circular air guiding body 13. Definitely, they may also be separately formed, and then the airflow distribution assembly 16 is fixedly installed on the first middle circular air guiding body 13.

[0032] With reference to FIG. 2, when the air-conditioner air supply apparatus 1 is assembled into the air-conditioner, the rear-end circular air guiding body 12 is fixed to the rear panel 3 of the air-conditioner, the first middle circular air guiding body 13 is first fixed to the front-end circular air guiding body 11 by using a screw, and then the front-end circular air guiding body 11 that is fixed with the first middle circular air guiding body 13 is fixed to the front panel 2 of the air-conditioner. After it is fixed in place, the air outlet 111 of the front-end circular air guiding body 11 used as an air outlet of the entire air-conditioner air supply apparatus 1 is assembled in an enclosed manner with the mixed air outlet 21 on the front panel 2; and the air inlet 122 in the rear-end circular air guiding body 12 used as a non-heat-exchanged air inlet of the entire air-conditioner air supply apparatus 1 is assembled in an enclosed manner with the non-heat-exchanged air inlet 31 on the rear panel 3.

[0033] In the air-conditioner that uses the air-conditioner air supply apparatus 1 of the above structure, when the air-conditioner operates, indoor air enters the inside of the air-conditioner, is accelerated by the blower, and enters the heat exchanger 5 for heat exchange. Heat-exchanged air after heat exchange is blown from the internal air duct 4 to the air-conditioner air supply apparatus 1. The heat-exchanged air is distributed by the airflow distribution assembly 16 to enter the first circular heat-exchanged air duct 14 and the second circular heat-exchanged air duct 15 uniformly in the circumferential direction, then enter the through-duct through the heat-exchanged air duct, and is blown out from the air outlet 111 on the front-end circular air guiding body 11 and the mixed air outlet 21 on the front panel 2 through the through-duct. Because the heat-exchanged air is blown from the internal air duct 4 having a larger area into the annular heat-exchanged air duct having a smaller area, the flow rate of the heat-exchanged air blown out from the annular heat-exchanged air duct is increased, so that the surface pressure of the corresponding annular air guiding body reduces to form a negative pressure in the through-duct. Indoor air outside the air-conditioner is used as the non-heat-exchanged air. Under the negative pressure, the non-heat-exchanged air enters the

through-duct from the non-heat-exchanged air inlet 31 on the rear panel 3 and the air inlet 122 on the rear-end circular air guiding body 12, and is mixed with the heat-exchanged air blown out from the circular heat-exchanged air duct to form mixed air, and then sent to the indoors smoothly under guiding of an extended mixed air flow guiding portion 113.

[0034] Under a certain fan rotating speed, air flow test and temperature detection is performed on the vertical air-conditioner. After the foregoing air-conditioner air supply apparatus 1 is used, air flow of the inducted non-heat-exchanged air is about 1.1 times of air flow of the heat-exchanged air, and air flow of the obtained mixed air is about 2.1 times of the air flow of the heat-exchanged air. Under a same condition, and compared with air supply of an air-conditioner that does not use the air-conditioner air supply apparatus 1, air flow of the air-conditioner increases about 1.1 times. Moreover, if the room temperature is about 26, air blown out from the air-conditioner that does not use the air-conditioner air supply apparatus 1 is the heat-exchanged air, and a temperature of the heat-exchanged air is about 13 ; while after the air-conditioner air supply apparatus 1 is used, the mixed air sent out by the air-conditioner is about 19.5 , and the temperature of the mixed air satisfies comfort requirements of the human body sensible temperature better. Such mixed air is mild, which makes the user feel more comfortable, thereby improving the comfort of the user. Moreover, part of external air that is not subjected to heat exchange is sucked under the negative pressure generated by the air supply apparatus 1, and becomes part of the air finally supplied from the air-conditioner, which increases the overall air intake volume of the air-conditioner, accelerates indoor air circulation, and further improves the overall uniformity of indoor air.

[0035] In this embodiment, a plurality of circular air guiding bodies in a form of a single component is combined to form the air-conditioner air supply apparatus 1, so that it is convenient to control flexibly the structure of each circular air guiding body according to requirements of air supply, and to manufacture conveniently circular air guiding bodies of different structures, so as to ensure the uniformity of air supply and the speed of the air supply. Moreover, because each circular air guiding body is a single component, an assembling method of the entire air-conditioner air supply apparatus 1 in the air-conditioner may be selected flexibly, thereby improving the application scope of the air-conditioner air supply apparatus 1 and the production efficiency of the air-conditioner. Moreover, an airflow distribution assembly is disposed in a heat-exchanged air duct, so that the airflow distribution assembly can be used to distribute heat-exchanged air that enters an air supply apparatus in a circumferential direction, thereby improving the uniformity of air supply from the air supply apparatus.

[0036] With reference to the schematic structural radial section view in FIG. 5, in this embodiment, in order to improve the air guiding performance of the air-conditioner

air supply apparatus 1, particularly the air guiding performance for the heat-exchanged air, so as to send the mixed air out uniformly along a surface of an annular air guiding body, surfaces of the three circular air guiding bodies are all curved surfaces, each of the circular air guiding bodies gradually reduces from the air inlet of the circular air guiding body to the air outlet of the circular air guiding body to from a structure that a rear section is thicker than a front section, and an inner perimeter of the air inlet of each of the circular air guiding bodies is greater than an inner perimeter of the air outlet of the circular air guiding body. That is, using the first middle circular air guiding body 13 as example, the inner perimeter of the air inlet 132 of the first middle circular air guiding body 13 is greater than the inner perimeter of the air outlet 131 of the first middle circular air guiding body 13.

[0037] Moreover, the three circular air guiding bodies are arranged coaxially, the inner perimeter of the air outlet of each of the circular air guiding bodies gradually increases in a direction from the air inlet 122 of the rear-end circular air guiding body 12 to the air outlet 111 of the front-end circular air guiding body 11. That is, from front to rear, the inner perimeter of the air outlet 111 of the front-end circular air guiding body 11 is greater than the inner perimeter of the air outlet 131 of the first middle circular air guiding body 13, and the inner perimeter of the air outlet 131 of the first middle circular air guiding body 13 is greater than the inner perimeter of the air outlet 121 of the rear-end circular air guiding body 12. The inner perimeter mentioned herein refers to the inner perimeter of a circular opening.

[0038] To increase smoothness of air flow, particularly smoothness of mixed air flow, the air-conditioner air supply apparatus 1 may further dispose the mixed air flow guiding portion 113 at a front end of the front-end circular air guiding body 11, that is, the mixed air flow guiding portion 113 is located between the front-end circular air guiding body 11 and the front panel 2 of the air-conditioner. Preferably, the front-end circular air guiding body 11 is integrally formed with the mixed air flow guiding portion 113, to form seamlessly combination, so as to ensure continuity of surfaces, which facilitates air flow.

[0039] The front-end circular air guiding body 11 is a main component for guiding flow of the heat-exchanged air, and a surface of the front-end circular air guiding body 11 is a curved surface, so as to guide the heat-exchanged air to enter the through-duct along the front-end circular air guiding body 11. The mixed air flow guiding portion 113 is a main component for guiding flow of the mixed air that is formed by mixing the heat-exchanged air and non-heat-exchanged air, and a surface of the mixed air flow guiding portion 113 is of a structure of a flat surface or a slightly curved surface (a curved surface with a relatively large radius of curvature), and is preferably a flat surface. Besides, the mixed air flow guiding portion 113 gradually expands outside overall from rear to front, to form a shape of a bellmouth, and can smoothly guide flow of the mixed air from the through-duct to a front open-

ing 1131 thereof, so as to be blown out from the mixed air outlet 21 on the front panel 2 of the air-conditioner.

[0040] In addition, to facilitate assembling the air-conditioner air supply apparatus 1 on the air-conditioner, a rear end of the rear-end circular air guiding body 12 is further provided with an installation portion 124. The installation portion 124 is of a flanging structure, and is preferably integrally formed with the rear-end circular air guiding body 12. The rear-end circular air guiding body 12 is a main component for guiding flow of the heat-exchanged air and the non-heat-exchanged air, and a surface of the rear-end circular air guiding body 12 uses a structure of curved surface, so as to guide the heat-exchanged air and the non-heat-exchanged air to enter the through-duct separately along inner and outer two air guiding surfaces. The installation portion 124 preferably uses a flanging structure with the surface being a flat surface, to facilitate being installed fixedly with the rear panel 3 of the air-conditioner.

[0041] For the air-conditioner air supply apparatus 1 that can send out the mixed air that is formed by the heat-exchanged air of the air-conditioner heat exchanger and the external non-heat-exchanged air, the structure of the heat-exchanged air duct is of great importance for reducing air resistance, reducing pressure loss and noise, and therefore further affects the amount of the external non-heat-exchanged air sucked in by the air-conditioner air supply apparatus and the temperature of the supplied mixed air, and the structure of the heat-exchanged air duct mainly depends on a relative position relationship of two adjacent circular air guiding bodies that form the air duct and the structure of the air guiding bodies. Therefore, the heat-exchanged air ducts of the air-conditioner air supply apparatus 1 in this embodiment specifically use the structure shown in FIG. 6.

[0042] FIG. 6 is a simplified schematic structural view of FIG. 5, and the airflow distribution assembly 16 is omitted in the figure. Any one of the heat-exchanged air ducts is arranged according to the following conditions: using a first circular heat-exchanged air duct 14 formed between the front-end circular air guiding body 11 and the first middle circular air guiding body 13 as an example, the air duct has an air outlet end 142 that is proximal to the through-duct of the air-conditioner air supply apparatus 1 and an air inlet end 141 that is distal from the through-duct and located at an opposite side of the air outlet end 142, and the first circular heat-exchanged air duct 14 gradually reduces from the air inlet end 141 to the air outlet end 142.

[0043] Specifically, a front-end circular air guiding body n and the first middle circular air guiding body 13 are arranged in such a manner that a diameter of a tangent circle located in the first circular heat-exchanged air duct 14 and between surfaces of the two air guiding bodies gradually reduces by a reduction ratio of 5-25% from the air inlet end 141 to the air outlet end 142, and preferably gradually reduces at a non-proportional reduction speed. The reduction ratio is more preferably 10-20%.

For example, as shown in FIG. 6, there are three tangent circles in the first circular heat-exchanged air duct 14, namely tangent circles 143, 144 and 145. The tangent circle 143 is a tangent circle at the air inlet end 141, and is defined as an air inlet end tangent circle, a diameter of which is D1; the tangent circle 145 is a middle tangent circle, a diameter of which is D2; the tangent circle 144 is a tangent circle at the air outlet end 142, and is defined as an air outlet end tangent circle, a diameter of which is D3. The diameters satisfy the following relations: $D3/D2=[1-(5-25\%)]$, and $D2/D1=[1-(5-25\%)]$. Preferably, $D3/D2=[1-(10-20\%)]$, $D2/D1=[1-(10-20\%)]$, and $D3/D2 \neq D2/D1$. In addition, in this embodiment, the diameter D1 of the air inlet end tangent circle 143 and the diameter D3 of the air outlet end tangent circle 144 further satisfy the following relation: $D3/D1=60-70\%$. More preferably, $D3/D1=65\%$.

[0044] Similarly, there are also three tangent circles in the second circular heat-exchanged air duct 15, namely, an air inlet end tangent circle proximal to an air inlet end 151, an air outlet end tangent circle 154 proximal to an air outlet end 152 and a middle tangent circle 155 located in the middle, and a relationship of diameters of the three tangent circles also satisfy the foregoing conditions.

[0045] Moreover, in this embodiment, a diameter of the air inlet end tangent circle 153 of the second circular heat-exchanged air duct 15 is greater than a diameter of the air inlet end tangent circle 143 of the first circular heat-exchanged air duct 14, and a diameter of the air outlet end tangent circle 154 of the second circular heat-exchanged air duct 15 is greater than a diameter of the air outlet end tangent circle 144 of the first circular heat-exchanged air duct 14. So that volumes of the heat-exchanged air ducts satisfy a changing trend of reducing gradually in a direction from the non-heat-exchanged air inlet 122 of the rear-end circular air guiding body 12 to the mixed air outlet 111 of the front-end circular air guiding body 11.

[0046] After the annular heat-exchanged air ducts are arranged according to the foregoing structure, the direction of the heat-exchanged air may be changed, so that the heat-exchanged air and the non-heat-exchanged air both are blown out along surfaces of annular air guiding bodies, which effectively avoids problems that the air speed is reduced and condensation occurs because two parts of air meets and collides at surfaces of non-annular air guiding bodies in the through-duct.

[0047] Refer to the schematic structural rear view of FIG. 7, the airflow distribution assembly 16 in this embodiment is implemented by using a plurality of airflow distribution plates. In this embodiment, the airflow distribution assembly 16 totally includes eight airflow distribution plates in pairs, namely, primary airflow distribution plates 161 and 162, first auxiliary airflow distribution plates 163 and 164, second auxiliary airflow distribution plates 165 and 166, and third auxiliary airflow distribution plates 167 and 168. All the airflow distribution plates are bent distribution plates of the same bending direction,

and the surface of each of the airflow distribution plates is an arc-shaped curved surface, which can effectively guide the air, reduce pressure loss and noise during splitting of the air flow, and achieve a high-speed air supply at low noise. The four pairs of airflow distribution plates are arranged bilaterally symmetrically in the circumferential direction of the first circular heat-exchanged air duct 14 and the second circular heat-exchanged air duct 15 in such a manner that the primary airflow distribution plates 161 and 162, the first auxiliary airflow distribution plates 163 and 164, the second auxiliary airflow distribution plates 165 and 166, and the third auxiliary airflow distribution plates 167 and 168 are sequentially arranged from bottom to top. That is, in the air supply direction of the heat-exchanged air that is from bottom to top, the primary airflow distribution plate 161, the first auxiliary airflow distribution plate 163, the second auxiliary airflow distribution plate 165 and the third auxiliary airflow distribution plate 167 are disposed from bottom to top on the left side of the air-conditioner air supply apparatus 1 (in terms of the left and right sides in the rear view), and the primary airflow distribution plate 162, the first auxiliary airflow distribution plate 164, the second auxiliary airflow distribution plate 166 and the third auxiliary airflow distribution plate 168 are arranged bilaterally symmetrically on the right side of the air-conditioner air supply apparatus 1. In addition, the bending direction of each of the airflow distribution plates is reverse to the air supply direction of the heat-exchanged air. That is, the air supply direction of the heat-exchanged air is from bottom to top, and accordingly, the bending direction of each of the airflow distribution plates will be reverse to the air supply direction, that is, each of the airflow distribution plates is bent in the anticlockwise direction shown in FIG. 7.

[0048] The airflow distribution assembly 16 formed by a plurality of bent airflow distribution plates radially symmetrically arranged is disposed in the heat-exchanged air duct, so that the primary airflow distribution plates 161 and 162 can be used to divide the heat-exchanged air from the heat exchanger into left, middle and right parts, and the heat-exchanged air on the left and right sides is further divided by the auxiliary airflow distribution plates, uniform air intake and outtake in the circumferential direction of the heat-exchanged air duct of the air-conditioner air supply apparatus 1 are finally achieved, thereby improving the uniformity of air supply from the air-conditioner air supply apparatus 1.

[0049] Definitely, the airflow distribution assembly 16 may not necessarily be implemented by a plurality of bent airflow distribution plates, and may also use other structures, as long as the heat-exchanged air from the heat exchanger 5 can be uniformly distributed in the circumferential direction.

[0050] The shape, area and position of each of the airflow distribution plates in the heat-exchanged air duct are key factors affecting the uniformity of air supply. In this embodiment, the pairs of airflow distribution plates are of the same shape and area. However, for the plurality

of airflow distribution plates on one side, from bottom to top, the area of the primary airflow distribution plate 161 or 162 is greater than that of the first auxiliary airflow distribution plate 163 or 164, the area of the first auxiliary airflow distribution plate 163 or 164 is greater than that of the second auxiliary airflow distribution plate 165 or 166, and the area of the second auxiliary airflow distribution plate 165 or 166 is greater than that of the third auxiliary airflow distribution plate 167 or 168.

[0051] Furthermore, because the density of air flow is not identical in the circumferential direction, the airflow distribution plates on the same side are distributed at unequal spacings. In particular, the length of an arc L2 between the primary airflow distribution plate 161 or 162 and the first auxiliary airflow distribution plate 163 or 164 (indicating the spacing between the two) is greater than the length of an arc L3 between the first auxiliary airflow distribution plate 163 or 164 and the second auxiliary airflow distribution plate 165 or 166, and the length of the arc L3 between the first auxiliary airflow distribution plate 163 or 164 and the second auxiliary airflow distribution plate 165 or 166 is greater than the length of an arc L4 between the second auxiliary airflow distribution plate 165 or 166 and the third auxiliary airflow distribution plate 167 or 168. Preferably, the ratio of the lengths of the arc L2, the arc L3 and the arc L4 is 6:5:3.

[0052] Moreover, for the primary airflow distribution plates 161 and 162 disposed at a lower part of the first circular heat-exchanged air duct 14 and the second circular heat-exchanged air duct 15, the two circular heat-exchanged air ducts are divided into an upper part and a lower part, the lower part being corresponding to the arc L1, and all other arcs being the upper part. To ensure the uniformity of air supply in the circumferential direction, the ratio of the length of the arc L1 corresponding to the lower part to the length of the arcs of the upper part (not marked in the figure, which are arcs in the entire circumferential direction other than L1) is 1:2 to 1:4. The third auxiliary airflow distribution plates 167 and 168 at the top of the two circular heat-exchanged air ducts define an arc L5 at the top, and the length of the arc L5 accounts for 1/5 to 1/3 of the total circumferential length of the first circular heat-exchanged air duct 14 or the second circular heat-exchanged air duct 15.

[0053] The shape, area and position of each of the airflow distribution plates in the heat-exchanged air duct are designed properly to make the heat-exchanged air to enter the heat-exchanged air duct uniformly in the circumferential direction, thereby improving the uniformity of air supply from the air-conditioner air supply apparatus.

[0054] The foregoing embodiments are merely used to describe rather than limit the technical solutions of the present invention. Although the present invention is described in detail with reference to the foregoing embodiments, a person of ordinary skill in the art can still make modifications to the technical solutions described in the foregoing embodiments, or make equivalent replacements to some technical features thereof. Such modifi-

cations or replacements should not make the essence of corresponding technical solutions depart from the spirit and scope of the technical solutions of the present invention.

Claims

1. A vertical air-conditioner air supply apparatus, wherein the air supply apparatus comprises three circular air guiding bodies that are hollow and have front and rear openings, each of the circular air guiding bodies is a single component, the rear opening of the circular air guiding body is an air inlet, the front opening of the circular air guiding body is an air outlet, the three circular air guiding bodies are arranged sequentially from front to rear, and a through-duct that runs through from front to rear is formed in the middle, an air inlet of a rear-end circular air guiding body located at the rear end is a non-heat-exchanged air inlet of the air supply apparatus, a circular heat-exchanged air duct is formed between two adjacent circular air guiding bodies, and an airflow distribution assembly for circumferentially distributing heat-exchanged air that enters the circular heat-exchanged air duct from a heat exchanger of a vertical air-conditioner that has the air supply apparatus is disposed in at least one of the circular heat-exchanged air ducts.
2. The vertical air-conditioner air supply apparatus according to claim 1, wherein each of the circular air guiding bodies gradually reduces from the air inlet of the circular air guiding body to the air outlet of the circular air guiding body.
3. The vertical air-conditioner air supply apparatus according to claim 2, wherein an inner perimeter of the air inlet of each of the circular air guiding bodies is greater than an inner perimeter of the air outlet of the circular air guiding body.
4. The vertical air-conditioner air supply apparatus according to claim 2, wherein a surface of each of the circular air guiding bodies is a curved surface.
5. The air-conditioner air supply apparatus according to claim 2, wherein a plurality of circular air guiding bodies is arranged coaxially, an inner perimeter of the air outlet of each of the circular air guiding bodies gradually increases in a direction from an air inlet of the rear-end circular air guiding body to an air outlet of the front-end circular air guiding body.
6. The vertical air-conditioner air supply apparatus according to claim 1, wherein the air supply apparatus is further provided with a mixed air flow guiding portion that is hollow and has front and rear openings,

and the mixed air flow guiding portion is disposed at a front end of the front-end circular air guiding body.

7. The vertical air-conditioner air supply apparatus according to claim 4, wherein the air supply apparatus is further provided with an installation portion, and the installation portion is disposed at a rear end of the rear-end circular air guiding body. 5
8. The vertical air-conditioner air supply apparatus according to claim 1, wherein the circular heat-exchanged air duct has an air outlet end that is proximal to the through-duct and an air inlet end that is distal from the through-duct, and the circular heat-exchanged air duct gradually reduces from the air inlet end to the air outlet end. 10
9. The vertical air-conditioner air supply apparatus according to claim 8, wherein a diameter of a tangent circle between the two adjacent circular air guiding bodies that form the circular heat-exchanged air duct gradually reduces by a reduction ratio of 5-25% from the air inlet end to the air outlet end, and the two adjacent circular air guiding bodies that form the circular heat-exchanged air duct have an air inlet end tangent circle at the air inlet end, and have an air outlet end tangent circle at the air outlet end, and a diameter of the air outlet end tangent circle is 60-70% of a diameter of the air inlet end tangent circle. 20 25
10. The vertical air-conditioner air supply apparatus according to claim 9, wherein a first circular heat-exchanged air duct is formed between the front-end circular air guiding body and a middle circular air guiding body that is located between the front-end circular air guiding body and the rear-end circular air guiding body, a second circular heat-exchanged air duct is formed between the middle circular air guiding body and the rear-end circular air guiding body, and a diameter of an air inlet end tangent circle and a diameter of an air outlet end tangent circle of the second circular heat-exchanged air duct are greater than a diameter of an air inlet end tangent circle and a diameter of an air outlet end tangent circle of the first circular heat-exchanged air duct respectively. 30 35 40 45
11. The vertical air-conditioner air supply apparatus according to any one of claims 1 to 10, wherein the airflow distribution assembly is disposed on the middle circular air guiding body that is located between the front-end circular air guiding body and the rear-end circular air guiding body, and extends into inner and outer two circular heat-exchanged air ducts formed by the middle circular air guiding body. 50
12. The vertical air-conditioner air supply apparatus according to claim 11, wherein the airflow distribution assembly comprises a plurality of airflow distribution 55

plates, and the plurality of airflow distribution plates is bilaterally symmetrically arranged in a circumferential direction of the circular heat-exchanged air duct, and along an air supply direction of the heat-exchanged air.

13. The vertical air-conditioner air supply apparatus according to claim 12, wherein the plurality of airflow distribution plates is bent distribution plates of the same bending direction, and the bending direction of the plurality of airflow distribution plates is reverse to the air supply direction of the heat-exchanged air.
14. The vertical air-conditioner air supply apparatus according to claim 13, wherein the airflow distribution assembly comprises four pairs of the airflow distribution plates that are arranged bilaterally symmetrically in the circumferential direction of the circular heat-exchanged air duct, and along the air supply direction of the heat-exchanged air.
15. The vertical air-conditioner air supply apparatus according to claim 14, wherein a spacing of multiple pairs of the airflow distribution plates gradually reduces along the air supply direction of the heat-exchanged air.
16. The vertical air-conditioner air supply apparatus according to claim 15, wherein surfaces of the airflow distribution plates are all arc-shaped curved surfaces.
17. A vertical air-conditioner, comprising a front panel, a rear panel, a left panel and a right panel, an internal air duct of the air-conditioner being defined by the front panel, the rear panel, the left panel and the right panel, wherein the front panel is provided with a circular mixed air outlet, the rear panel is provided with a circular non-heat-exchanged air inlet at least at a position corresponding to the circular mixed air outlet, the vertical air-conditioner air supply apparatus according to any one of claims 1 to 5 and 6 to 16 is disposed inside the air-conditioner, and the air outlet of the front-end circular air guiding body and the air inlet of the rear-end circular air guiding body in the air-conditioner air supply apparatus are respectively correspondingly sealed to the circular mixed air outlet on the front panel and the circular non-heat-exchanged air inlet on the rear panel.
18. A vertical air-conditioner, comprising a front panel, a rear panel, a left panel and a right panel, an internal air duct of the air-conditioner being defined by the front panel, the rear panel, the left panel and the right panel, wherein the front panel is provided with a circular mixed air outlet, the rear panel is provided with a circular non-heat-exchanged air inlet at least at a position corresponding to the circular mixed air out-

let, the vertical air-conditioner air supply apparatus according to claim 6 is disposed inside the air-conditioner, and the front opening of the mixed air flow guiding portion and the air inlet of the rear-end circular air guiding body in the air-conditioner air supply apparatus are respectively correspondingly sealed to the circular mixed air outlet on the front panel and the circular non-heat-exchanged air inlet on the rear panel.

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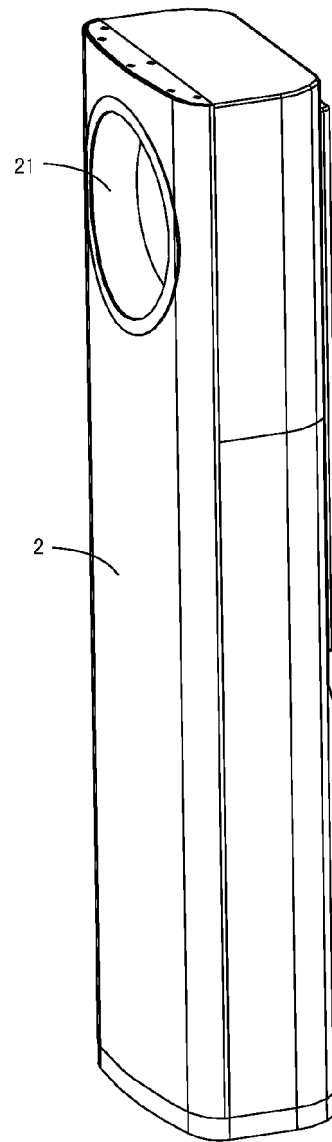


FIG. 1

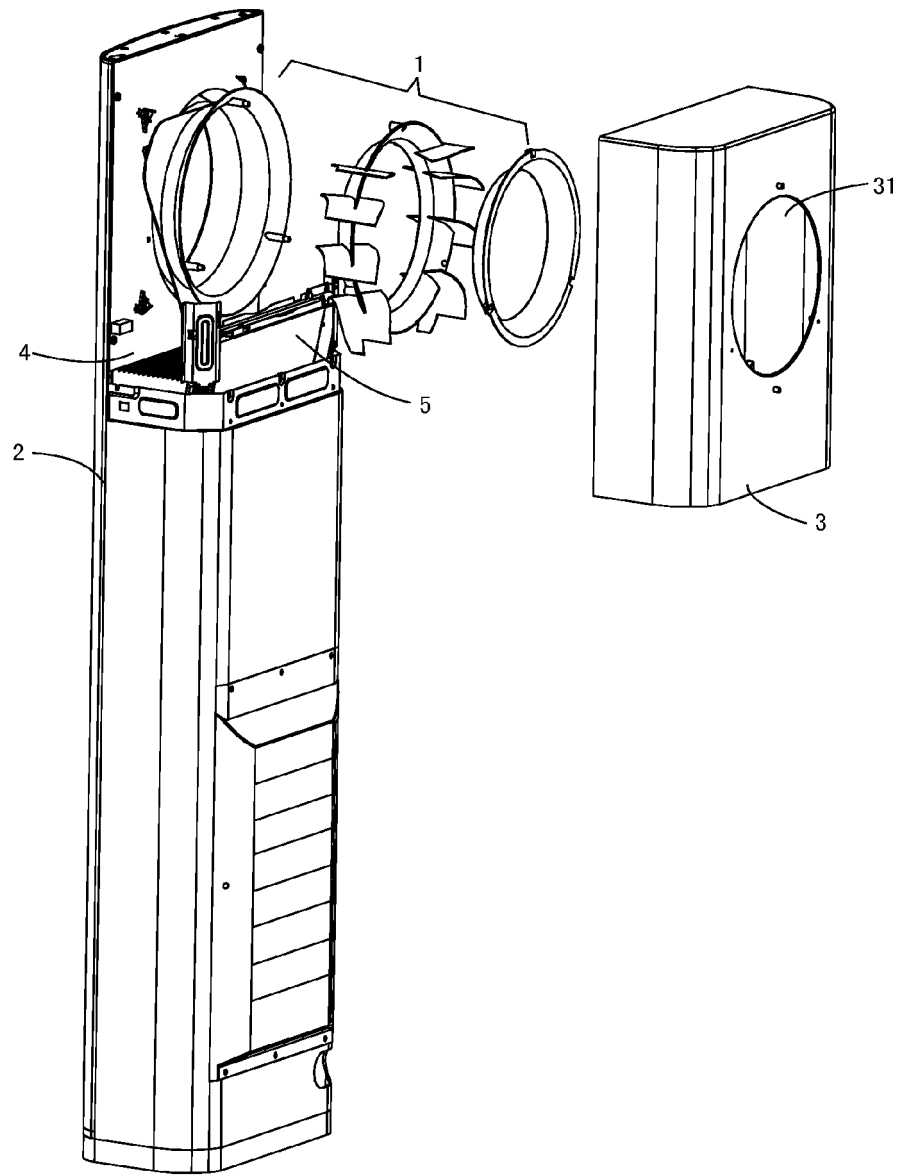


FIG. 2

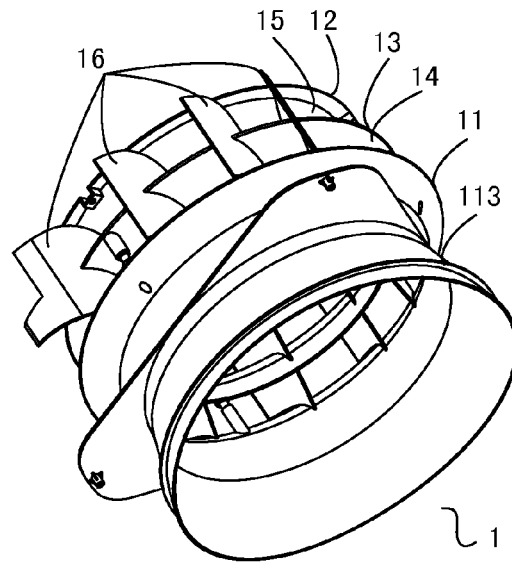


FIG. 3

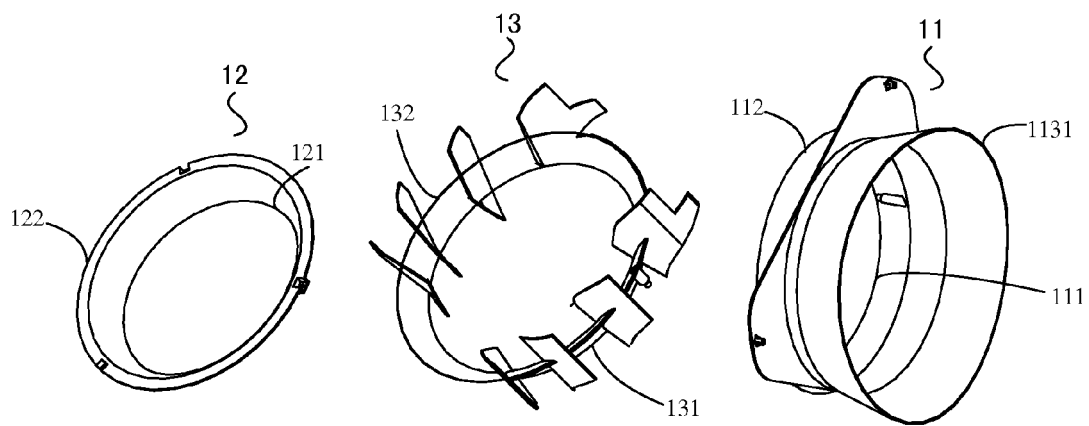


FIG. 4

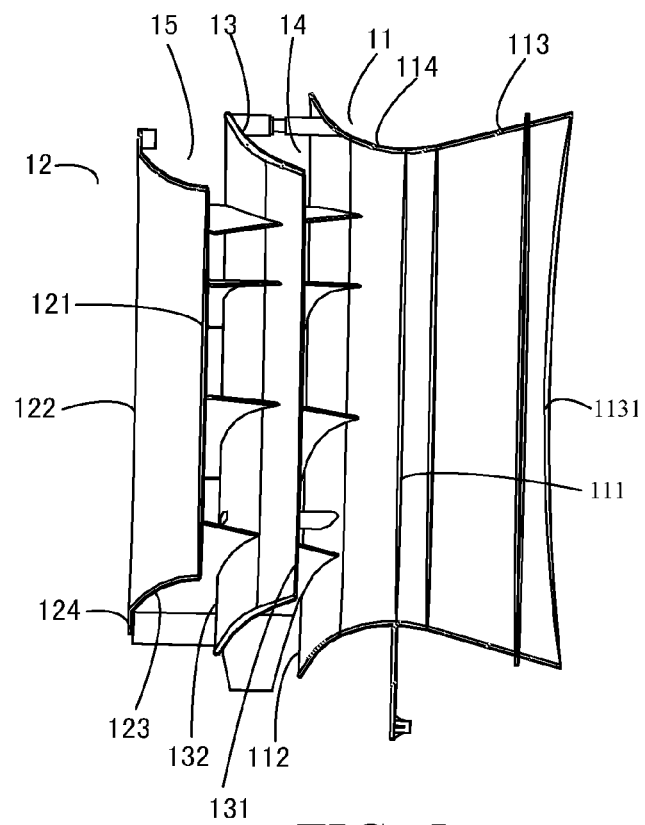


FIG. 5

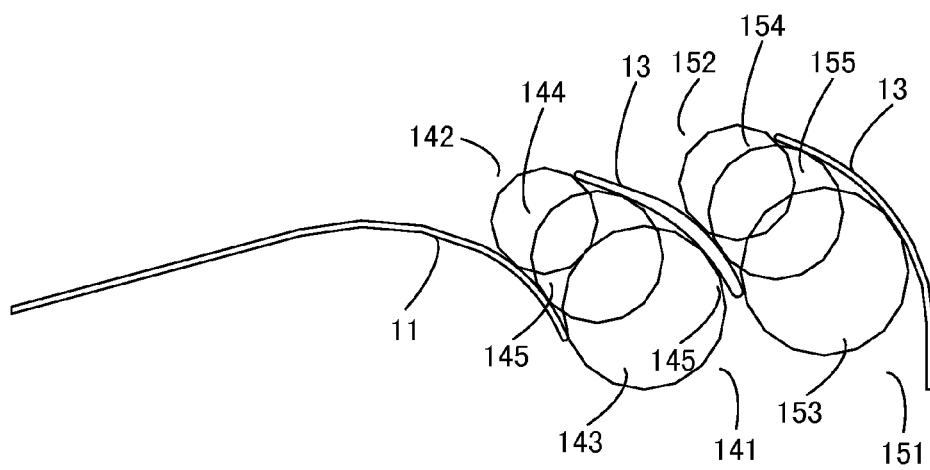


FIG. 6

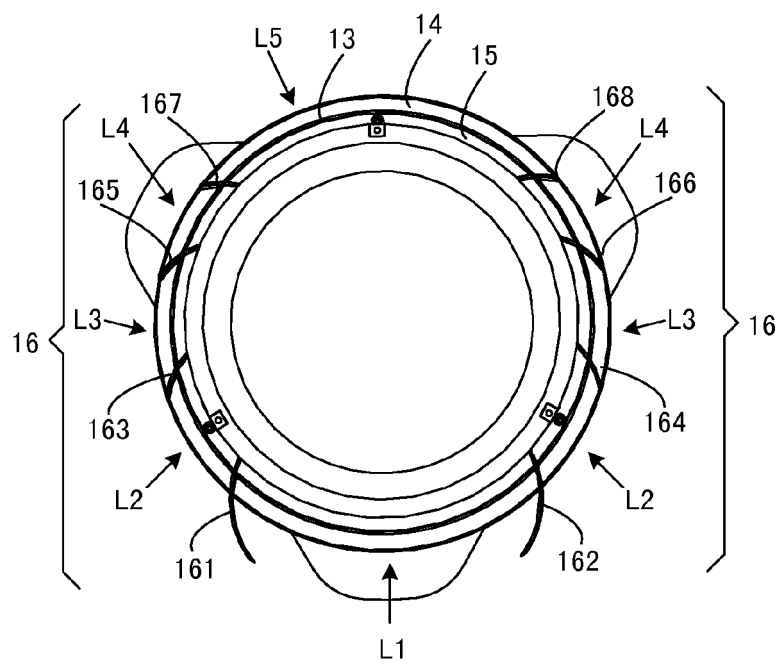


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2014/073396

A. CLASSIFICATION OF SUBJECT MATTER

F24F 1/00 (2011.01) i; 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)

F24F

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, CNTXT, WPI, EPODOC: air supply, air discharge, air guide, mixed flow, mixed air, air w condition, cabinet, floor, vertical, upright, blow, supply, discharge, exhaust, outlet, circle, annular, ring, circular, round, guide, induct, induce, mix, hybrid

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	CN 102374625 A (KIMURA KOHKI CO., LTD.), 14 March 2012 (14.03.2012), description, paragraphs 0013-0017, and figures 1-4	1-18
Y	CN 102829511 A (LG ELECTRONICS INC.), 19 December 2012 (19.12.2012), description, paragraphs 0034-0106, and figures 1-7	1-18
Y	CN 102374624 A (KIMURA KOHKI CO., LTD.), 14 March 2012 (14.03.2012), description, paragraphs 0014-0019, and figures 1-5	1-18
PX	CN 103453644 A (HAIER GROUP CORPORATION et al.), 18 December 2013 (18.12.2013), the whole document	1-18
PX	CN 203274163 U (HAIER GROUP CORPORATION et al.), 06 November 2013 (06.11.2013), the whole document	1-18

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

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

Date of the actual completion of the international search

13 May 2014 (13.05.2014)

Date of mailing of the international search report

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Name and mailing address of the ISA/CN:
State Intellectual Property Office of the P. R. China
No. 6, Xitucheng Road, Jimenqiao
Haidian District, Beijing 100088, China
Facsimile No.: (86-10) 62019451

Authorized officer

HUO, Fang

Telephone No.: (86-10) 62084833

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2014/073396

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CN 203274149 U	06 November 2013	None	
CN 203274153 U	06 November 2013	None	
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KR 20130129062 A	27 November 2013	None	
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Form PCT/ISA/210 (patent family annex) (July 2009)