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(54) **AIR SUPPLY METHOD OF VERTICAL AIR CONDITIONER**

(57) A vertical air-conditioner air supply method is provided. According to the method, an air-conditioner air supply apparatus is disposed in an internal air duct of an air-conditioner body, the vertical air-conditioner sends heat-exchanged air in the internal air duct that has been subjected to heat exchange by a heat exchanger from a heat-exchanged air duct to a through-duct, and sucks non-heat-exchanged air outside the vertical air-conditioner from a non-heat-exchanged air inlet to the through-duct, and the heat-exchanged air and the non-heat-exchanged air form mixed air and are then blown out together from a mixed air outlet through the through-duct, where a flow rate of the non-heat-ex-

changed air is 0.05 to 0.5 times of a flow rate of the heat-exchanged air. The heat-exchanged air inside the air-conditioner and the non-heat-exchanged air outside the air-conditioner are mixed according to a certain ratio to form the mixed air to be blown out together, so that the air intake rate 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.

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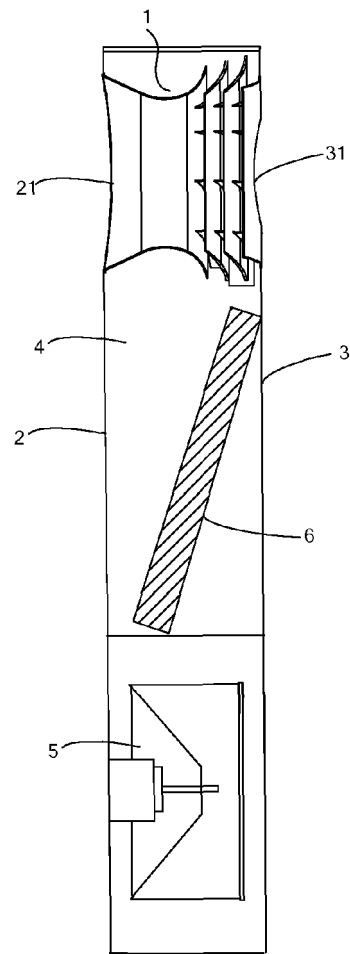


FIG. 2

Description

BACKGROUND

Technical Field

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

Related Art

[0002] An air duct structure of a vertical air-conditioner on a current market generally consists of an air inlet, a centrifugal blower, an evaporator and an air outlet. Indoor air enters the inside of the air-conditioner from air inlet, and after being accelerated by the centrifugal blower, the air enters the evaporator for heat exchange. The air after heat exchange is blown from the air outlet to the indoor, thereby achieving the objective of air-conditioner air supply. Because the existing vertical air-conditioner can only blow out the heat-exchanged air from the evaporator, the supplied air is not mild enough. Especially in the cooling mode, the temperature of the air blown out by the air-conditioner is low. The cool air with such low temperature directly blows on a user, making the user, especially an old person that chills, feel very uncomfortable.

[0003] The applicant proposed an air-conditioner air supply apparatus that can be applied to a vertical air-conditioner. After the air-conditioner air supply apparatus is disposed on the vertical air-conditioner, part of non-heat-exchanged air, which does not pass through a heat exchanger of the air-conditioner directly, from the environmental space in which the air-conditioner is located may be sucked, and the part of non-heat-exchanged air and heat-exchanged air after heat exchange are mixed to form mixed air and are then blown out from an air outlet of the air-conditioner. Because such air-conditioner air supply apparatus is disposed in the vertical air-conditioner, an air supply manner of a conventional vertical air-conditioner is subverted. For the new air supply manner, how to arrange properly the heat-exchanged air and the non-heat-exchanged air so as to provide high use comfort for the user is a key technical problem that needs to be researched. Meanwhile, how to design the structure of the air-conditioner air supply apparatus to meet requirements of the new air supply manner of the air-conditioner is also one of the technical problems that need to be researched. The present invention just aims at the foregoing technical problems that need to be researched.

SUMMARY

[0004] Aiming at the foregoing problems existing in the prior art, the present invention provides a vertical air-conditioner air supply method, heat-exchanged air inside a air-conditioner and non-heat-exchanged air outside the air-conditioner are mixed according to a certain ratio to

form mixed air to be blown out together, so that the air intake rate 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.

[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 method is provided, according to the method, an air-conditioner air supply apparatus is disposed in an internal air duct of an air-conditioner body, the air supply apparatus includes at least two air guiding bodies that are hollow and have front and rear openings, each air guiding body is a single component, the rear opening of the air guiding body is an air inlet, the front opening of the air guiding body is an air outlet, the at least two air guiding bodies are arranged sequentially from front to rear, a through-duct which runs through from front to rear is formed in the middle, a heat-exchanged air duct is formed between two adjacent air guiding bodies, an air inlet of a rear-end air guiding body located at the rear end is a non-heat-exchanged air inlet of the air supply apparatus, an air outlet of a front-end air guiding body located at the front end is a mixed air outlet of the air supply apparatus, the vertical air-conditioner sends heat-exchanged air in the internal air duct that has been subjected to heat exchange by a heat exchanger from the heat-exchanged air duct to the through-duct, and sucks non-heat-exchanged air outside the vertical air-conditioner from the non-heat-exchanged air inlet to the through-duct, and the heat-exchanged air and the non-heat-exchanged air form mixed air and are then blown out together from the mixed air outlet through the through-duct, where a flow rate of the non-heat-exchanged air is 0.05 to 0.5 times of a flow rate of the heat-exchanged air.

[0006] Preferably, the flow rate of the non-heat-exchanged air is 0.15 to 0.35 times of the flow rate of the heat-exchanged air.

[0007] Preferably, the air guiding body is an annular air guiding body, and the heat-exchanged air duct is an annular heat-exchanged air duct.

[0008] Preferably, the annular air guiding body at least partly gradually reduces from rear to front.

[0009] Preferably, the annular air guiding body is of a sheet-like structure, and multiple annular air guiding bodies are arranged sequentially from front to rear to form a nested cylindrical structure.

[0010] Preferably, a radial section contour line of the annular air guiding body is a curve of a variable curvature radius.

[0011] According to the vertical air-conditioner air supply method described above, to facilitate setting flexibly

the quantity and structure of other annular air guiding bodies so as to improve the air supply rate, the air supply speed and the uniformity of air supply, the front-end air guiding body is a front-end annular air guiding body, and a minimum inner caliber of the front-end annular air guiding body is less than a minimum inner caliber of all other annular air guiding bodies.

[0012] Preferably, the minimum inner caliber of the front-end annular air guiding body is not less than 0.95 times of the minimum inner caliber of all other annular air guiding bodies.

[0013] Preferably, the air supply apparatus includes four annular air guiding bodies.

[0014] According to the vertical air-conditioner air supply method described above, to effectively guide the air direction, an inner caliber of the front-end annular air guiding body in the four annular air guiding bodies first gradually reduces and then gradually expands from an air inlet of the air guiding body to an air outlet of the air guiding body, and a minimum neck portion of the inner caliber is formed in middle, an annular heat-exchanged air duct is formed between the reduced part of the inner caliber of the front-end annular air guiding body and an annular air guiding body adjacent to the front-end annular air guiding body, and except the front-end annular air guiding body, an inner caliber of the other three annular air guiding bodies gradually reduces from an air inlet to an air outlet.

[0015] To achieve the foregoing objective of the present invention, the air supply method provided in the present invention may also be implemented by means of the following technical solutions:

A vertical air-conditioner air supply method is provided, according to the method, an air-conditioner air supply apparatus is disposed in an internal air duct of an air-conditioner body, the air supply apparatus includes a first air guiding body and a second air guiding body, the first air guiding body is hollow and has front and rear openings, the front opening of the first air guiding body is a mixed air outlet, the rear opening of the first air guiding body is an air inlet, the second air guiding body is hollow and has front and rear openings, the front opening of the second air guiding body is an air outlet, the rear opening of the second air guiding body is a non-heat-exchanged air inlet, the first air guiding body and the second air guiding body are arranged sequentially from front to rear, a through-duct which runs through from front to rear is formed in the middle, a heat-exchanged air duct is formed between the first air guiding body and the second air guiding body, the vertical air-conditioner sends heat-exchanged air in the internal air duct that has been subjected to heat exchange by a heat exchanger from the heat-exchanged air duct to the through-duct, and sucks non-heat-exchanged air outside the vertical air-conditioner from the non-heat-exchanged air inlet to the

through-duct, and the heat-exchanged air and the non-heat-exchanged air form mixed air and are then blown out together from the mixed air outlet through the through-duct, where a flow rate of the non-heat-exchanged air is 0.05 to 0.5 times of a flow rate of the heat-exchanged air.

[0016] Preferably, the flow rate of the non-heat-exchanged air is 0.15 to 0.35 times of the flow rate of the heat-exchanged air.

[0017] Preferably, the air-conditioner air supply apparatus includes a first air guiding body and a second air guiding body.

[0018] Preferably, the first air guiding body and the second air guiding body are both annular air guiding bodies, and the heat-exchanged air duct is an annular heat-exchanged air duct.

[0019] Preferably, the first air guiding body at least partly gradually reduces from rear to front, and the second air guiding body at least partly gradually reduces from rear to front.

[0020] More preferably, the first air guiding body and the second air guiding body are arranged sequentially from front to rear to form a nested cylindrical structure.

[0021] Preferably, radial section contour lines of the first air guiding body and the second air guiding body are both a curve of a variable curvature radius.

[0022] Compared with the prior art, the present invention has the following advantages and positive effects: by using the air-conditioner air supply method in the present invention, when heat-exchanged air inside the air-conditioner is blown out, non-heat-exchanged air outside the air-conditioner and in proportion to the flow rate of the heat-exchanged air is sucked under the negative pressure generated by flow of the heat-exchanged air, two parts of air form mixed air to be blown out simultaneously, the temperature of such mixed air conforms to the temperature needed by human body sensible comfort, and when such air is blown to a user, the user feels more comfortable, thereby improving the user experience. Moreover, part of external air that is not subjected to heat exchange is sucked under the negative pressure generated by the air supply apparatus, and becomes part of the air finally supplied from the air-conditioner, which increases the overall air intake rate of the air-conditioner, accelerates indoor air circulation, and further improves the overall uniformity of indoor air.

[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 main view of an embodiment of a vertical air-conditioner to which an air supply method of the

present invention applies;

FIG. 2 is a schematic structural local side-section view of the vertical air-conditioner in FIG. 1;

FIG. 3 is a three-dimensional view of an air-conditioner air supply apparatus in the vertical air-conditioner in FIG. 1;

FIG. 4 and FIG. 5 are both schematic structural radial section views of the air-conditioner air supply apparatus in FIG. 3;

FIG. 6 is a schematic structural side-section view of another embodiment of a vertical air-conditioner to which an air supply method of the present invention applies; and

FIG. 7 is a schematic structural radial section view of an air-conditioner air supply apparatus in the vertical air-conditioner in FIG. 6.

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 or rear 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-exchanged air. In the following description, the shape being annular refers an enclosed structure formed by an annular enclosure, and is not limited to being circular.

[0027] Referring to FIG. 1 and FIG. 2, FIG. 1 is a main view of an embodiment of a vertical air-conditioner to which an air supply method of the present invention applies, and FIG. 2 is a schematic structural local side-section view of the vertical air-conditioner.

[0028] As shown in FIG. 1 and FIG. 2, the vertical air-conditioner of this embodiment includes an indoor unit, and the indoor unit 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 mixed air outlet 21 is formed on an upper part of the front panel 2, and a 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 5, a heat exchanger 6 and an air-conditioner air supply apparatus 1 are disposed from bottom to top in the internal air duct 4, and the blower 5 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. 5.

[0030] As shown in the three-dimensional view in FIG. 3 and the schematic structural radial section view in FIG. 4, and with reference to FIG. 1 and FIG. 2, the air-conditioner air supply apparatus 1 includes four annular air guiding bodies, from front to rear respectively being a front-end annular air guiding body 11, a first middle annular air guiding body 13, a second middle annular air guiding body 14, and a rear-end annular air guiding body 12. The four annular air guiding bodies are all of a sheet-like structure, and are arranged sequentially from front to rear to form a nested cylindrical structure. Each annular air guiding body in the four annular air guiding bodies that are arranged sequentially from front to rear is a single component, and is formed independently. The front-end annular air guiding body 11 located at the farthest front end is hollow and has front and rear two openings, respectively being a mixed air outlet 111 and an air inlet 112; the first middle annular air guiding body 13 is hollow and has front and rear two openings, respectively being an air outlet 131 and an air inlet 132; the second middle annular air guiding body 14 is hollow and has front and rear two openings, respectively being an air outlet 141 and an air inlet 142; and the rear-end annular air guiding body 12 located at the farthest rear end is hollow and has front and rear two openings, respectively being an air outlet 121 and a non-heat-exchanged air inlet 122. The front-end annular air guiding body 11, the first middle annular air guiding body 13, the second middle annular air guiding body 14 and the rear-end annular air guiding body 12 are arranged sequentially from front to rear, and a through-duct 18 that runs through all the four annular air guiding bodies from front to rear is formed in the middle. Moreover, a first annular heat-exchanged air duct 15 is formed between the front-end annular air guiding body 11 and the first middle annular air guiding body 13; a second annular heat-exchanged air duct 16 is formed between the first middle annular air guiding body 13 and the second middle annular air guiding body 14; a third annular heat-exchanged air duct 17 is formed between the second middle annular air guiding body 14 and the rear-end annular air guiding body 12; and the internal air duct 4 in the indoor unit is connected to the through-duct 18 in the air-conditioner air supply apparatus 1 by using the three annular heat-exchanged air ducts.

[0031] When the air-conditioner air supply apparatus 1 is assembled into the air-conditioner, the mixed air outlet 111 of the front-end annular air guiding body 11 being 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 non-heat-exchanged air inlet 122 in the rear-end annular air guiding body 12 being 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.

[0032] Based on the air-conditioner air supply apparatus 1 of the foregoing structure, the vertical air-conditioner air supply method in this embodiment is as follows:

When the air-conditioner operates, indoor air enters the inside of the air-conditioner, is accelerated by the blower 5, and enters the heat exchanger 6 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, enters the through-duct 18 through the first annular heat-exchanged air duct 15, the second annular heat-exchanged air duct 16 and the third annular heat-exchanged air duct 17, and is blown out from the mixed air outlet 111 on the front-end annular air guiding body 11 and the mixed air outlet 21 on the front panel 2 through the through-duct 18. The air speed 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 decreases to form a negative pressure in the through-duct 18. 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 18 from the non-heat-exchanged air inlet 31 on the rear panel 3 and the non-heat-exchanged air inlet 122 of the rear-end annular air guiding body 12, and is mixed with the heat-exchanged air blown out from the annular heat-exchanged air duct to form mixed air, and then sent to the indoors. Besides, the flow rate of the non-heat-exchanged air sucked from the non-heat-exchanged air inlet 122 is 0.05 to 0.5 times of the flow rate of the heat-exchanged air blown out from all annular heat-exchanged air ducts. As a preferable implementation manner, the flow rate of the non-heat-exchanged air is 0.15 to 0.35 times of the flow rate of the heat-exchanged air.

[0033] The mixed air sent out by using the method is mild, which makes the user feel more comfortable, thereby improving the comfort of the user. For specific details, reference may be made to the following detection results of air supply tests. 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 rate of the air-conditioner, accelerates indoor air circulation, and further improves the overall uniformity of indoor air.

[0034] To improve air guiding performance of the air-conditioner air supply apparatus 1, and particularly air guiding ability for the heat-exchanged air, so as to enable the mixed air to be sent out along surfaces of the annular air guiding bodies uniformly, surfaces of the four annular air guiding bodies are all curved surfaces. That is, a radial section contour line of the annular air guiding body is a curve, and is preferably a curve of a variable curvature radius. Moreover, in the four annular air guiding bodies of the vertical air-conditioner in this embodiment, an inner caliber of the front-end annular air guiding body 11 first gradually reduces and then gradually expands in a direction from the air inlet 112 of the air guiding body to the air outlet of the air guiding body, that is, in a direction of the mixed air outlet 111, to form a reducing portion 113 and an expanding portion 114. A transition point of the reducing portion 113 and the expanding portion 114 is a neck portion 115 of the front-end annular air guiding body 11, and the neck portion 115 is a minimum position for inner calibers at different positions on the front-end annular air guiding body 11. The inner caliber of the air inlet 112 of the front-end annular air guiding body 11 is further greater than an inner caliber of the mixed air outlet 111 when being used as an air outlet. The front-end annular air guiding body 11 is arranged to have a structure of having the expanding portion 114, so that a flaring flow guiding portion can be formed, smoothness of air flow can be increased, especially smooth flow of the mixed air.

[0035] For the front-end annular air guiding body 11 of the foregoing structure, the first heat-exchanged air duct 15 is formed by the reducing portion 113 of the front-end annular air guiding body 11 and the adjacent first middle annular air guiding body 13. Inner calibers of the first middle annular air guiding body 13, the second middle annular air guiding body 14 and the rear-end annular air guiding body 12 all gradually reduce in a direction from an air inlet to an air outlet. That is, an inner caliber of the air inlet 132 is greater than an inner caliber of the air outlet 131, an inner caliber of the air inlet 142 is greater than an inner caliber of the air outlet 141, and an inner caliber of the non-heat-exchanged air inlet 122 is greater than an inner caliber of the air outlet 121. By using the annular air guiding body of such structure, air flow can be effectively guided to flow along surfaces of the annular air guiding bodies, and thereby beneficial to improvement of the air supply rate and the uniformity of air supply.

[0036] Besides, in this embodiment, an inner caliber of the neck portion 115 of the front-end annular air guiding body 11 being the minimum inner caliber of the entire front-end annular air guiding body 11 is less than the minimum inner caliber of the other three annular air guiding bodies. That is, the inner caliber of the neck portion 115 is less than a minimum value of inner calibers of air outlets of the other three annular air guiding bodies. The inner caliber described above refers to an inner perimeter

at different positions of inner walls of the annular air guiding body.

[0037] Because the minimum inner caliber of the air-conditioner air supply apparatus 1 is located on the front-end annular air guiding body 11, and the front-end annular air guiding body 11 is located at the farthest front end of the entire air-conditioner air supply apparatus 1, when the air-conditioner air supply apparatus 1 is assembled into the indoor unit of the air-conditioner, as shown in the main view in FIG. 1, the user can see only the expanding portion 114 and the neck portion 115 of the front-end annular air guiding body 11 from the front of the indoor unit, the other structure behind cannot be seen, and good appearance consistency is achieved, thereby improving visual feeling of the user. Therefore, the other structure of the air-conditioner air supply apparatus 1 except the expanding portion 114 and the neck portion 115 of the front-end annular air guiding body 11 may be arranged flexibly and arbitrarily according to actual needs, so as to improve entire air supply performance of the air-conditioner air supply apparatus 1. For example, the air-conditioner air supply apparatus 1 may be arranged to have a structure of having four annular air guiding bodies, so as to reduce a gap between adjacent annular air guiding bodies, that is, to make the annular heat-exchanged air ducts become narrower, which both improves an air supply speed of the heat-exchanged air and can also increase the negative pressure generated in the through-duct, so that relatively much non-heat-exchanged air is sucked in a case of low noise, an overall air supply rate is improved, and air supply uniformity of the air-conditioner air supply apparatus 1 in the circumferential direction can also be improved.

[0038] Considering that an excessively small inner caliber of the neck portion 115 affects air exhaust, in this embodiment, although the inner caliber of the neck portion 115 is less than the minimum inner caliber of the other three annular air guiding bodies, the inner caliber of the neck portion 115 is not less than 0.95 times of the minimum inner caliber of the other three annular air guiding bodies.

[0039] In this embodiment, to avoid that the user sees the internal structure of the air-conditioner air supply apparatus 1 from a side direction of the indoor unit, the inner calibers of air outlets of the other three annular air guiding bodies except the front-end annular air guiding body 11 gradually reduce in a direction from the rear-end annular air guiding body 12 to the front-end annular air guiding body 11. That is, an inner caliber of the air outlet 141 of the second middle annular air guiding body 14 is less than that of the air outlet 121 of the rear-end annular air guiding body 12, and an inner caliber of the air outlet 131 of the first middle annular air guiding body 13 is less than that of the air outlet 141 of the second middle annular air guiding body 14. Besides, if it is considered that an excessively large reduction ratio impedes flow of air flow, the inner calibers of the three air outlets preferably gradually reduce according a reduction ratio of 2% to 5%.

[0040] For the air-conditioner air supply apparatus 1 that can send out the mixed air that is formed by the heat-exchanged air after exchange by the heat exchanger 6 and the external non-heat-exchanged air, the structure of the annular heat-exchanged air duct is of great importance for reducing air resistance, reducing pressure loss and noise, and therefore further affects the air blowing rate of the external non-heat-exchanged air sucked in by the air-conditioner air supply apparatus 1 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 annular air guiding bodies that form the air duct and the structure of the air guiding bodies. In this embodiment, the structure of the annular heat-exchanged air duct is as follows:

Using the first annular heat-exchanged air duct 15 as an example, and as shown in the schematic structural radial section view in FIG. 5, the air duct has an air outlet end 151 that is proximal to the through-duct of the air-conditioner air supply apparatus 1 and an air inlet end 152 that is distal from the through-duct, and the first annular heat-exchanged air duct 15 gradually reduces from the air inlet end 151 to the air outlet end 152.

[0041] Specifically, as shown in FIG. 5, multiple inscribed circles between a surface of the reducing portion 113 and a surface of the first middle annular air guiding body 13 exist in the first annular heat-exchanged air duct 15 formed by the reducing portion 113 of the front-end annular air guiding body 11 and the first middle annular air guiding body 13, for example, inscribed circles 153, 154, 155 and 156, and the diameters of the inscribed circles gradually reduce in a direction from the air inlet end 151 to the air outlet end 152. As shown in FIG. 5, the inscribed circles 153, 154, 155 and 156 are inscribed circles drawn sequentially from the air inlet end 151 to the air outlet end 152, and a diameter D1 of the inscribed circle 153, a diameter D2 of the inscribed circle 154, a diameter D3 of the inscribed circle 155 and a diameter D4 of the inscribed circle 156 satisfy the following relationship: $D1 > D2 > D3 > D4$. Besides, considering that change of the air supply direction is different, the air inlet end 151 changes air supply direction greatly in an up-down direction, and air supply direction change of the air outlet end 152 is relatively small. A reduction ratio of the diameters of the inscribed circles is preferably non-proportional, and a reduction ratio of diameters of inscribed circles near to the air inlet end 151 is greater than a reduction ratio of diameters of inscribed circles near to the air outlet end 152. For example, supposing that the inscribed circle 153 is an air-inlet-end inscribed circle at the air inlet end 151, the inscribed circle 154 is an inscribed circle near to the inscribed circle 153, the inscribed circle 156 is an air-outlet-end inscribed circle at the air outlet end 152, and the inscribed circle 155 is an inscribed circle near to the inscribed circle 156, then D1,

D2, D3 and D4 satisfy the following relationship: $(1-D2/D1) > (1-D4/D3)$.

[0042] Similarly, the second annular heat-exchanged air duct 16 and the third annular heat-exchanged air duct 17 are also arranged according to the foregoing condition of the first annular heat-exchanged air duct 15.

[0043] The air-conditioner air supply apparatus 1 uses the heat-exchanged air duct of the foregoing structure, which not only benefits uniformity of air exhaust in the circumferential direction of the heat-exchanged air duct, but also can change the direction of the heat-exchanged air, so that the heat-exchanged air and the non-heat-exchanged air both are blown out along surfaces of the annular air guiding bodies, which effectively avoids that problems of speed reduction, noise and condensation occur because two parts of air meets and collides at the surfaces of the annular air guiding bodies in the through-duct.

[0044] FIG. 6 and FIG. 7 show another embodiment of a vertical air-conditioner to which an air supply method of the present invention applies. FIG. 6 is a schematic structural side-section view of this embodiment, and FIG. 7 is a schematic structural radial section view of an air-conditioner air supply apparatus in this embodiment.

[0045] A basic structure of the vertical air-conditioner in this embodiment is similar to that of the embodiment in FIG. 1 to FIG. 5, and a difference is in the structure of the air-conditioner air supply apparatus. As shown in FIG. 6 and FIG. 7, an air-conditioner air supply apparatus 7 is disposed on an upper part of the vertical air-conditioner in this embodiment. The air-conditioner air supply apparatus 7 includes two annular air guiding bodies, namely, a first air guiding body 71 and a second air guiding body 72. The first annular air guiding body 71 is hollow and has front and rear openings, the front opening is a mixed air outlet 711, and the rear opening is an air inlet 712; and the second annular air guiding body 72 is hollow and has front and rear openings, the front opening is an air outlet 721, the rear opening is a non-heat-exchanged air inlet 722. The two annular air guiding bodies are both of a sheet-like structure, and are arranged sequentially from front to rear to form a nested cylindrical structure. A through-duct 74 which runs through the two annular air guiding bodies from front to rear is formed in the middle. The first annular air guiding body 71 and the second annular air guiding body 72 are both single components, and are formed independently. An annular heat-exchanged air duct 73 is formed between the first annular air guiding body 71 and the second annular air guiding body 72. An internal air duct (referring to FIG. 2) in an indoor unit is connected to the through-duct 74 in the air-conditioner air supply apparatus 7 by using the annular heat-exchanged air duct 73.

[0046] Similar to the first embodiment, to improve air guiding performance of the air-conditioner air supply apparatus 7, and particularly air guiding ability for the heat-exchanged air, so as to enable the mixed air to be sent out along surfaces of the annular air guiding bodies uni-

formly, surfaces of the first annular air guiding body 71 and the second annular air guiding body 72 are both curved surfaces. That is, radial section contour lines of the two annular air guiding bodies are both curves, and are preferably curves of a variable curvature radius. Moreover, as shown in FIG. 7, an inner caliber of the first annular air guiding body 71 first gradually reduces and then gradually expands in a direction from the air inlet 712 of the air guiding body to the mixed air outlet 711 of the air guiding body, and an inner caliber of the second annular air guiding body 72 first gradually reduces and then gradually expands from the air inlet 722 of the air guiding body to the air outlet 721 of the air guiding body, so as to form a better structure that facilitates air guiding.

[0047] Based on the air-conditioner air supply apparatus 7 of the foregoing structure, the vertical air-conditioner air supply method in this embodiment is similar to that of the embodiment in FIG. 1, which is simply described as follows:

When the air-conditioner operates, indoor air enters the inside of the air-conditioner, is accelerated by a blower, and enters a heat exchanger for heat exchange. Heat-exchanged air after heat exchange is blown from the internal air duct to the air-conditioner air supply apparatus 7, enters the through-duct 74 through the annular heat-exchanged air duct 73, and is blown out from the mixed air outlet 711 on the first annular air guiding body 71 and a mixed air outlet on a front panel through the through-duct 74. Meanwhile, a negative pressure is formed in the through-duct 74, and 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 74 from the non-heat-exchanged air inlet on the rear panel and the non-heat-exchanged air inlet 722 of the second annular air guiding body 72, and is mixed with the heat-exchanged air blown out from the annular heat-exchanged air duct 73 to form mixed air, and then sent to the indoors. Besides, the flow rate of the non-heat-exchanged air sucked from the non-heat-exchanged air inlet 722 is 0.05 to 0.5 times of the flow rate of the heat-exchanged air blown out from the annular heat-exchanged air duct 73. As a preferable implementation manner, the flow rate of the non-heat-exchanged air is 0.15 to 0.35 times of the flow rate of the heat-exchanged air.

[0048] The mixed air sent out by using the method is mild, which makes the user feel more comfortable, thereby improving the comfort of the user. For specific details, reference may be made to the following detection results of air supply tests. Moreover, part of external air that is not subjected to heat exchange is sucked under the negative pressure generated by the air supply apparatus 7, and becomes part of the air finally supplied from the air-conditioner, which increases the overall air intake rate of

the air-conditioner, accelerates indoor air circulation, and further improves the overall uniformity of indoor air.

[0049] After a vertical air-conditioner uses the air-conditioner air supply apparatus 1 and the air-conditioner air supply apparatus 7 of the foregoing embodiments, the flow rate of the heat-exchanged air and the flow rate of the non-heat-exchanged air may be detected by using air blowing rate tests, and the temperature of the heat-exchanged air and the temperature of the mixed air may be detected by temperature detection. A specific detection process may be performed by using the following method:

The mixed air outlet 111 in the air-conditioner air supply apparatus 1 or the mixed air outlet 711 in the air-conditioner air supply apparatus 7 are connected to a receiving room for use of the air blowing rate tests, the air flow rate blown from the mixed air outlet is detected by using the receiving room. A specific detection process may be executed according to related detection standards, which is the prior art and is not described in detail herein. It should be noted that, if the non-heat-exchanged air inlet 31 on the rear panel 3 of the air-conditioner is blocked by using an air blocking panel, in this case, the air blowing rate blown from the mixed air outlet are entirely the flow rate of the heat-exchanged air, which is defined as the air blowing rate of the heat-exchanged air; if the air blocking panel is removed, as described above, the air-conditioner air supply apparatus also blows the non-heat-exchanged air outside the air-conditioner out from the mixed air outlet, that is, the air blowing rate blown from the mixed air outlet is a total rate of the heat-exchanged air and the non-heat-exchanged air, which is defined as the total air blowing rate. The air blowing rate of the heat-exchanged air and the total air blowing rate can be easily obtained by using the receiving room. A difference between the total air blowing rate and the air blowing rate of the heat-exchanged air that are obtained under a same condition is the flow rate of the non-heat-exchanged air sucked under the negative pressure, which is defined as the air blowing rate of the non-heat-exchanged air. The same condition mentioned herein refers to a condition that the detection is performed in a same vertical air-conditioner and by using a same air-conditioner air supply apparatus, and a motor works at a same rotation speed.

[0050] By using the foregoing detection method, detection results of the air blowing rate and the air exhaust temperature for the vertical air-conditioner that uses the air-conditioner air supply apparatus of the present invention are listed below.

Embodiment 1 of an air supply detection test:

[0051] A depth of an air-conditioner air supply apparatus from front to rear is 400mm (a thickness of an upper part of a housing of an air-conditioner is also 400 mm), and the air-conditioner is of 3 horse-powers (7200W).

[0052] Under a condition that a rotation speed of a motor of a fan is 550r/min, the air blowing rate of the heat-exchanged air, the total air blowing rate and the air blowing rate of the non-heat-exchanged air are 1053m³/h, 1274m³/h, and 221m³/h respectively, the air blowing rate of the non-heat-exchanged air is 0.21 times of the air blowing rate of the heat-exchanged air.

[0053] Under a condition that a rotation speed of a motor of a fan is 500r/min, the air blowing rate of the heat-exchanged air, the total air blowing rate and the air blowing rate of the non-heat-exchanged air are 982m³/h, 1178m³/h and 196m³/h respectively, and the air blowing rate of the non-heat-exchanged air is 0.20 times of the air blowing rate of the heat-exchanged air.

[0054] Under a condition that a rotation speed of a motor of a fan is 450r/min, the air blowing rate of the heat-exchanged air, the total air blowing rate and the air blowing rate of the non-heat-exchanged air are 928m³/h, 1104m³/h and 176m³/h respectively, the air blowing rate of the non-heat-exchanged air is 0.19 times of the air blowing rate of the heat-exchanged air.

[0055] Under different rotation speeds, if the room temperature is about 27°C, the detected temperature of the heat-exchanged air is about 13°C, the temperature of the mixed air is about 19.5°C, the temperature of the mixed air better conforms to the temperature needed by human body sensible comfort.

Embodiment 2 of an air supply detection test:

[0056] A depth of an air-conditioner air supply apparatus from front to rear is 400mm (a thickness of an upper part of a housing of an air-conditioner is also 400 mm), and the air-conditioner is of 2 horse-powers (5000W).

[0057] Under a condition that a rotation speed of a motor of a fan is 550r/min, the air blowing rate of the heat-exchanged air, the total air blowing rate and the air blowing rate of the non-heat-exchanged air are 982m³/h, 1178m³/h and 196m³/h respectively, the air blowing rate of the non-heat-exchanged air is 0.20 times of the air blowing rate of the heat-exchanged air.

[0058] Under a condition that a rotation speed of a motor of a fan is 500r/min, the air blowing rate of the heat-exchanged air, the total air blowing rate and the air blowing rate of the non-heat-exchanged air are 928m³/h, 1104m³/h and 176m³/h respectively, the air blowing rate of the non-heat-exchanged air is 0.19 times of the air blowing rate of the heat-exchanged air.

[0059] Under a condition that a rotation speed of a motor of a fan is 450r/min, the air blowing rate of the heat-exchanged air, the total air blowing rate and the air blowing rate of the non-heat-exchanged air are 864m³/h,

1016m³/h and 152m³/h respectively, the air blowing rate of the non-heat-exchanged air is 0.18 times of the air blowing rate of the heat-exchanged air.

[0060] Under different rotation speeds, if the room temperature is about 26°C, the detected temperature of the heat-exchanged air is about 13°C, the temperature of the mixed air is about 19°C, the temperature of the mixed air better conforms to the temperature needed by human body sensible comfort.

Embodiment 3 of an air supply detection test:

[0061] A depth of an air-conditioner air supply apparatus from front to rear is 260mm (a thickness of an upper part of a housing of an air-conditioner is also 260 mm), and the air-conditioner is of 3 horse-powers (7200W).

[0062] Under a condition that a rotation speed of a motor of a fan is 550r/min, the air blowing rate of the heat-exchanged air, the total air blowing rate and the air blowing rate of the non-heat-exchanged air are 1005m³/h, 1331m³/h and 326m³/h respectively, the air blowing rate of the non-heat-exchanged air is 0.32 times of the air blowing rate of the heat-exchanged air.

[0063] Under a condition that a rotation speed of a motor of a fan is 500r/min, the air blowing rate of the heat-exchanged air, the total air blowing rate and the air blowing rate of the non-heat-exchanged air are 951m³/h, 1236m³/h and 285m³/h respectively, the air blowing rate of the non-heat-exchanged air is 0.30 times of the air blowing rate of the heat-exchanged air.

[0064] Under a condition that a rotation speed of a motor of a fan is 450r/min, the air blowing rate of the heat-exchanged air, the total air blowing rate and the air blowing rate of the non-heat-exchanged air are 898m³/h, 1158m³/h and 260m³/h respectively, the air blowing rate of the non-heat-exchanged air is 0.29 times of the air blowing rate of the heat-exchanged air.

[0065] Under different rotation speeds, if the room temperature is about 30°C, the detected temperature of the heat-exchanged air is about 14°C, the temperature of the mixed air is about 20°C, the temperature of the mixed air better conforms to the temperature needed by human body sensible comfort.

Embodiment 4 of an air supply detection test:

[0066] A depth of an air-conditioner air supply apparatus from front to rear is 260mm (a thickness of an upper part of a housing of an air-conditioner is also 260 mm), and the air-conditioner is of 2 horse-powers (5000W).

[0067] Under a condition that a rotation speed of a motor of a fan is 550r/min, the air blowing rate of the heat-exchanged air, the total air blowing rate and the air blowing rate of the non-heat-exchanged air are 951m³/h, 1236m³/h and 285m³/h respectively, the air blowing rate of the non-heat-exchanged air is 0.30 times of the air blowing rate of the heat-exchanged air.

[0068] Under a condition that a rotation speed of a mo-

tor of a fan is 500r/min, the air blowing rate of the heat-exchanged air, the total air blowing rate and the air blowing rate of the non-heat-exchanged air are 898m³/h, 1158m³/h and 260m³/h respectively, the air blowing rate of the non-heat-exchanged air is 0.29 times of the air blowing rate of the heat-exchanged air.

[0069] Under a condition that a rotation speed of a motor of a fan is 450r/min, the air blowing rate of the heat-exchanged air, the total air blowing rate and the air blowing rate of the non-heat-exchanged air are 836m³/h, 1070m³/h and 234m³/h respectively, the air blowing rate of the non-heat-exchanged air is 0.28 times of the air blowing rate of the heat-exchanged air.

[0070] Under different rotation speeds, if the room temperature is about 30°C, the detected temperature of the heat-exchanged air is about 14°C, the temperature of the mixed air is about 20°C, the temperature of the mixed air better conforms to the temperature needed by human body sensible comfort.

[0071] 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 modifications 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 method, wherein, according to the method, an air-conditioner air supply apparatus is disposed in an internal air duct of an air-conditioner body, the air supply apparatus comprises at least two air guiding bodies that are hollow and have front and rear openings, each air guiding body is a single component, the rear opening of the air guiding body is an air inlet, the front opening of the air guiding body is an air outlet, the at least two air guiding bodies are arranged sequentially from front to rear, a through-duct which runs through from front to rear is formed in the middle, a heat-exchanged air duct is formed between two adjacent air guiding bodies, an air inlet of a rear-end air guiding body located at the rear end is a non-heat-exchanged air inlet of the air supply apparatus, an air outlet of a front-end air guiding body located at the front end is a mixed air outlet of the air supply apparatus, the vertical air-conditioner sends heat-exchanged air in the internal air duct that has been subjected to heat exchange by a heat exchanger from the heat-exchanged air duct to the through-duct, and sucks non-heat-exchanged air outside the

vertical air-conditioner from the non-heat-exchanged air inlet to the through-duct, and the heat-exchanged air and the non-heat-exchanged air form mixed air and are then blown out together from the mixed air outlet through the through-duct, wherein a flow rate of the non-heat-exchanged air is 0.05 to 0.5 times of a flow rate of the heat-exchanged air.

2. The vertical air-conditioner air supply method according to claim 1, wherein the flow rate of the non-heat-exchanged air is 0.15 to 0.35 times of the flow rate of the heat-exchanged air.
3. The vertical air-conditioner air supply method according to claim 1, wherein the air guiding body is an annular air guiding body, and the heat-exchanged air duct is an annular heat-exchanged air duct.
4. The vertical air-conditioner air supply method according to claim 3, wherein the annular air guiding body at least partly gradually reduces from rear to front.
5. The vertical air-conditioner air supply method according to claim 4, wherein the annular air guiding body is of a sheet-like structure, and multiple annular air guiding bodies are arranged sequentially from front to rear to form a nested cylindrical structure.
6. The vertical air-conditioner air supply method according to claim 4, wherein a radial section contour line of the annular air guiding body is a curve of a variable curvature radius.
7. The vertical air-conditioner air supply method according to any one of claims 3 to 6, wherein the front-end air guiding body is a front-end annular air guiding body, and a minimum inner caliber of the front-end annular air guiding body is less than a minimum inner caliber of all other annular air guiding bodies.
8. The vertical air-conditioner air supply method according to claim 7, wherein the minimum inner caliber of the front-end annular air guiding body is not less than 0.95 times of the minimum inner caliber of all other annular air guiding bodies.
9. The vertical air-conditioner air supply method according to claim 3, wherein the air supply apparatus comprises four annular air guiding bodies.
10. The vertical air-conditioner air supply method according to claim 9, wherein an inner caliber of the front-end annular air guiding body in the four annular air guiding bodies first gradually reduces and then gradually expands from an air inlet of the air guiding body to an air outlet of the air guiding body, and a minimum neck portion of the inner caliber is formed

in middle, an annular heat-exchanged air duct is formed between the reduced part of the inner caliber of the front-end annular air guiding body and an annular air guiding body adjacent to the front-end annular air guiding body, and except the front-end annular air guiding body, an inner caliber of the other three annular air guiding bodies gradually reduces from an air inlet to an air outlet.

11. A vertical air-conditioner air supply method, wherein, according to the method, an air-conditioner air supply apparatus is disposed in an internal air duct of an air-conditioner body, the air supply apparatus comprises a first air guiding body and a second air guiding body, the first air guiding body is hollow and has front and rear openings, the front opening of the first air guiding body is a mixed air outlet, the rear opening of the first air guiding body is an air inlet, the second air guiding body is hollow and has front and rear openings, the front opening of the second air guiding body is an air outlet, the rear opening of the second air guiding body is a non-heat-exchanged air inlet, the first air guiding body and the second air guiding body are arranged sequentially from front to rear, a through-duct which runs through from front to rear is formed in the middle, a heat-exchanged air duct is formed between the first air guiding body and the second air guiding body, the vertical air-conditioner sends heat-exchanged air in the internal air duct that has been subjected to heat exchange by a heat exchanger from the heat-exchanged air duct to the through-duct, and sucks non-heat-exchanged air outside the vertical air-conditioner from the non-heat-exchanged air inlet to the through-duct, and the heat-exchanged air and the non-heat-exchanged air form mixed air and are then blown out together from the mixed air outlet through the through-duct, wherein a flow rate of the non-heat-exchanged air is 0.05 to 0.5 times of a flow rate of the heat-exchanged air.
12. The vertical air-conditioner air supply method according to claim 11, wherein the flow rate of the non-heat-exchanged air is 0.15 to 0.35 times of the flow rate of the heat-exchanged air.
13. The vertical air-conditioner air supply method according to claim 11, wherein the air-conditioner air supply apparatus comprises a first air guiding body and a second air guiding body.
14. The vertical air-conditioner air supply method according to claim 13, wherein the first air guiding body and the second air guiding body are both annular air guiding bodies, and the heat-exchanged air duct is an annular heat-exchanged air duct.
15. The vertical air-conditioner air supply method according to claim 14, wherein the first air guiding body

at least partly gradually reduces from rear to front,
and the second air guiding body at least partly gradually reduces from rear to front.

16. The vertical air-conditioner air supply method according to claim 15, wherein the first air guiding body and the second air guiding body are arranged sequentially from front to rear to form a nested cylindrical structure. 5
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17. The vertical air-conditioner air supply method according to claim 14, wherein radial section contour lines of the first air guiding body and the second air guiding body are both a curve of a variable curvature radius. 15

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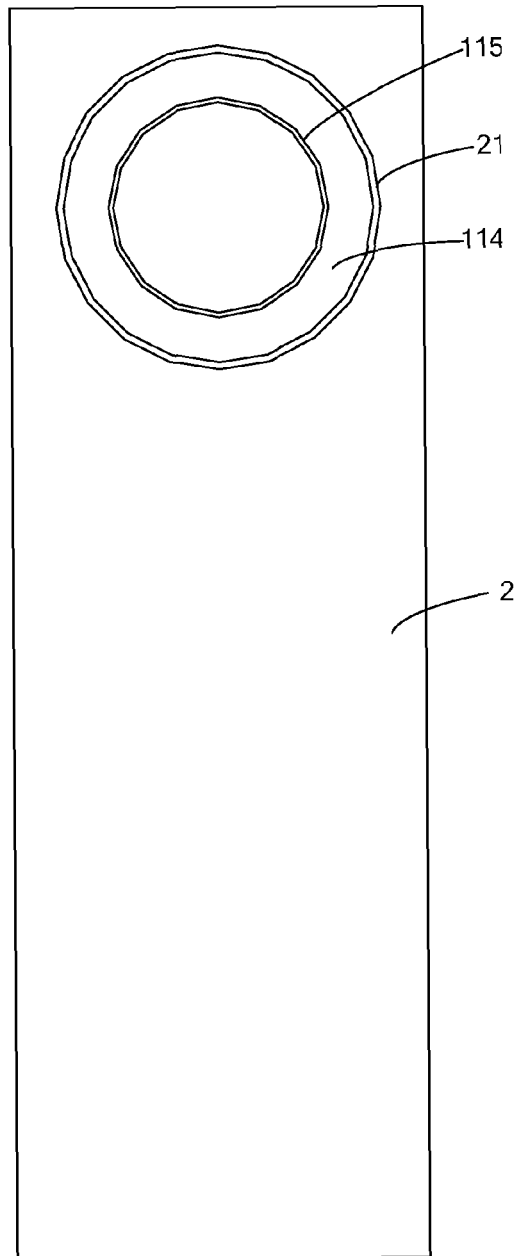


FIG. 1

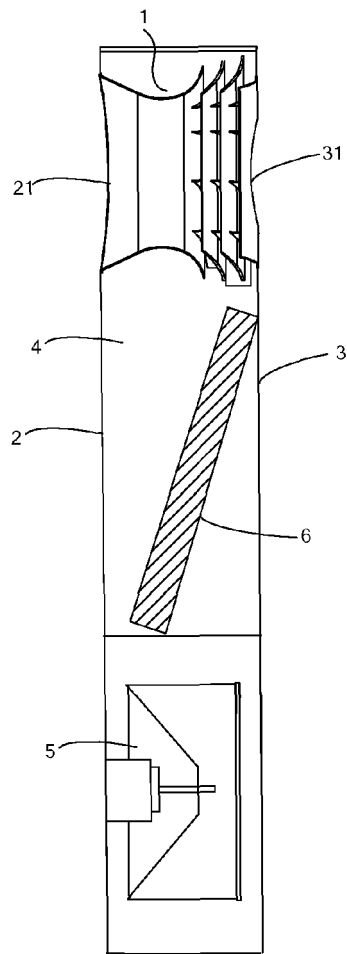


FIG. 2

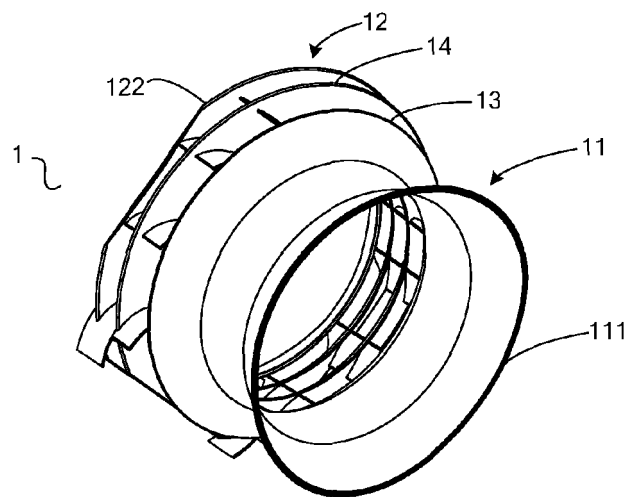


FIG. 3

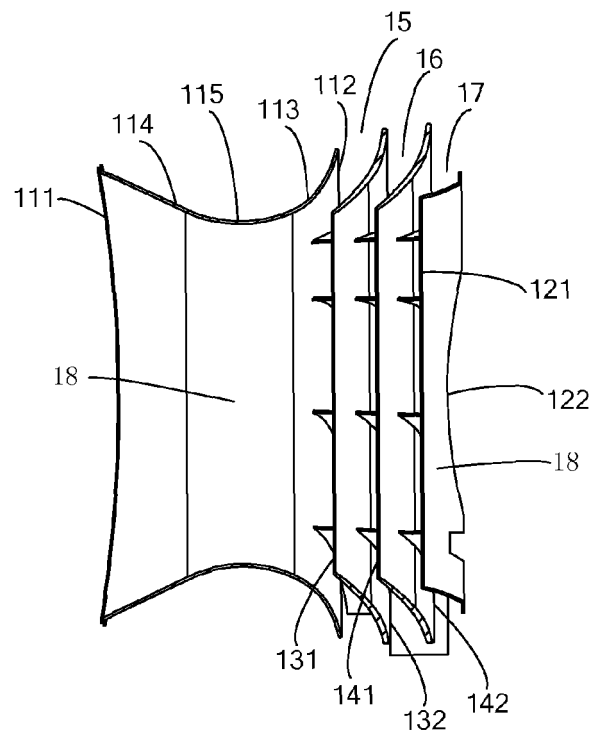


FIG. 4

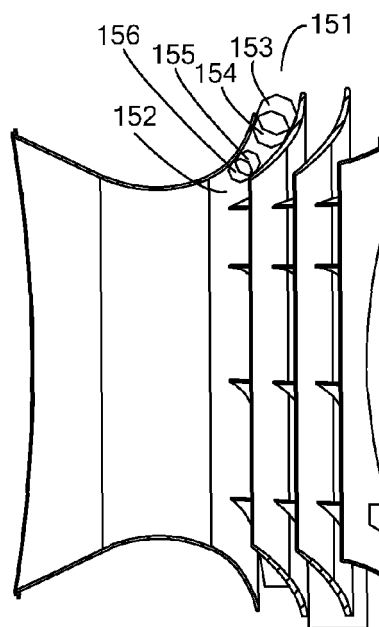


FIG. 5

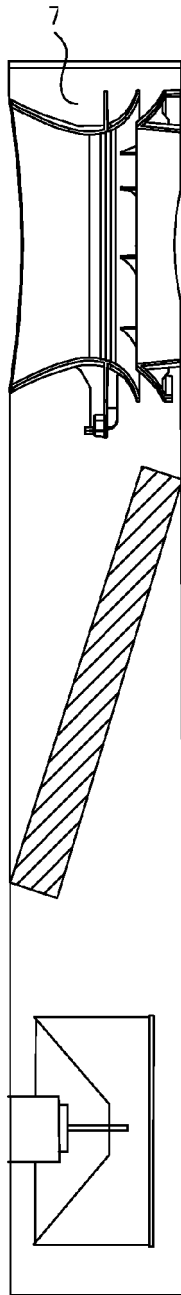


FIG. 6

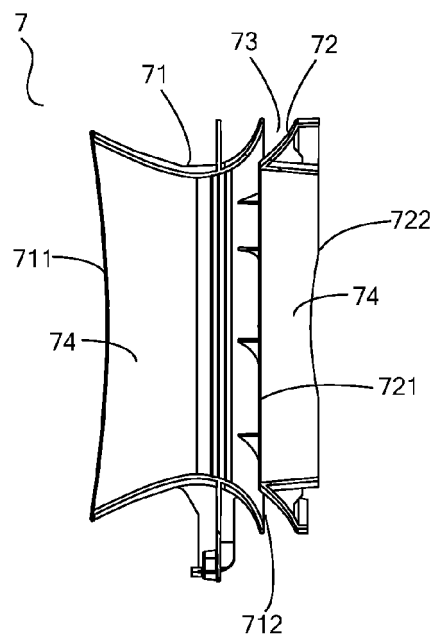


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2014/073417

A. CLASSIFICATION OF SUBJECT MATTER

F24F 13/08 (2006.01) i; F24F 13/062 (2006.01) i; F24F 13/26 (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 13/08; F24F 13/062; F24F 13/26; F24F 13/00

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, WPI, EPODOC: air conditioning, Haier, WANG Yongtao, FU Yu, XU Rongji, JIAO Litao, WANG Jingjing, YU Shipeng,
ZHANG Mingjie, YUAN Junjun, WANG Xiaogang, annular+, ring, circular+, rotary; guid???, diversion, train???, baffle, induc???,
deflect+, outlet?, vent????, discharge????, exhaust???, blow???, blast???, mix+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 103591674 A (HAIER GROUP CO., LTD. et al.) 19 February 2014 (19.02.2014) description, paragraphs [0019]-[0030] and figures 1-5	1-17
PX	CN 203478537 U (HAIER GROUP CO., LTD. et al.) 12 March 2014 (12.03.2014) description, paragraphs [0024]-[0036] and figures 1-5	1-17
PX	CN 103604203 A (HAIER GROUP CO., LTD. et al.) 26 February 2014 (26.02.2014) claims 1-17	1-17
A	CN 201983401 U (KIMURA KOHKI CO., LTD.) 21 September 2011 (21.09.2011) description, paragraphs [0054]-[0060] and figures 1-6	1-17

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

* Special categories of cited documents:

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Date of the actual completion of the international search

15 May 2014

Date of mailing of the international search report

20 June 2014

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2014/073417

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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A	CN 201041399 Y (CUI, Guohua) 26 March 2008 (26.03.2008) the whole document	1-17
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A	JP H10141751 A (SHINKO KOGYO KK) 29 May 1998 (29.05.1998) the whole document	1-17

Form PCT/ISA /210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
 Information on patent family members

 International application No.
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JP H10141751 A	29 May 1998	None	