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(54) VOLUTE FAN ASSEMBLY STRUCTURE AND FLOOR-STANDING AIR CONDITIONER

(57) The disclosure discloses a combined volute blower structure, including a mounting plate (4) and at least two adjacent volute blowers mounted on the mounting plate (4), wherein one volute blower in the two adjacent volute blowers is provided with a middle air outlet positioned between the two adjacent volute blowers, and compared with the other volute blower, the volute blower with the middle air outlet is positioned in front in a front-back direction perpendicular to the mounting plate. The combined volute blower structure may stagger an air outlet of a second volute blower (2) from

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a first volute blower (1) and a third volute blower (3) to reduce interference. In addition, the disclosure further provides a vertical air conditioner with the combined volute blower structure.

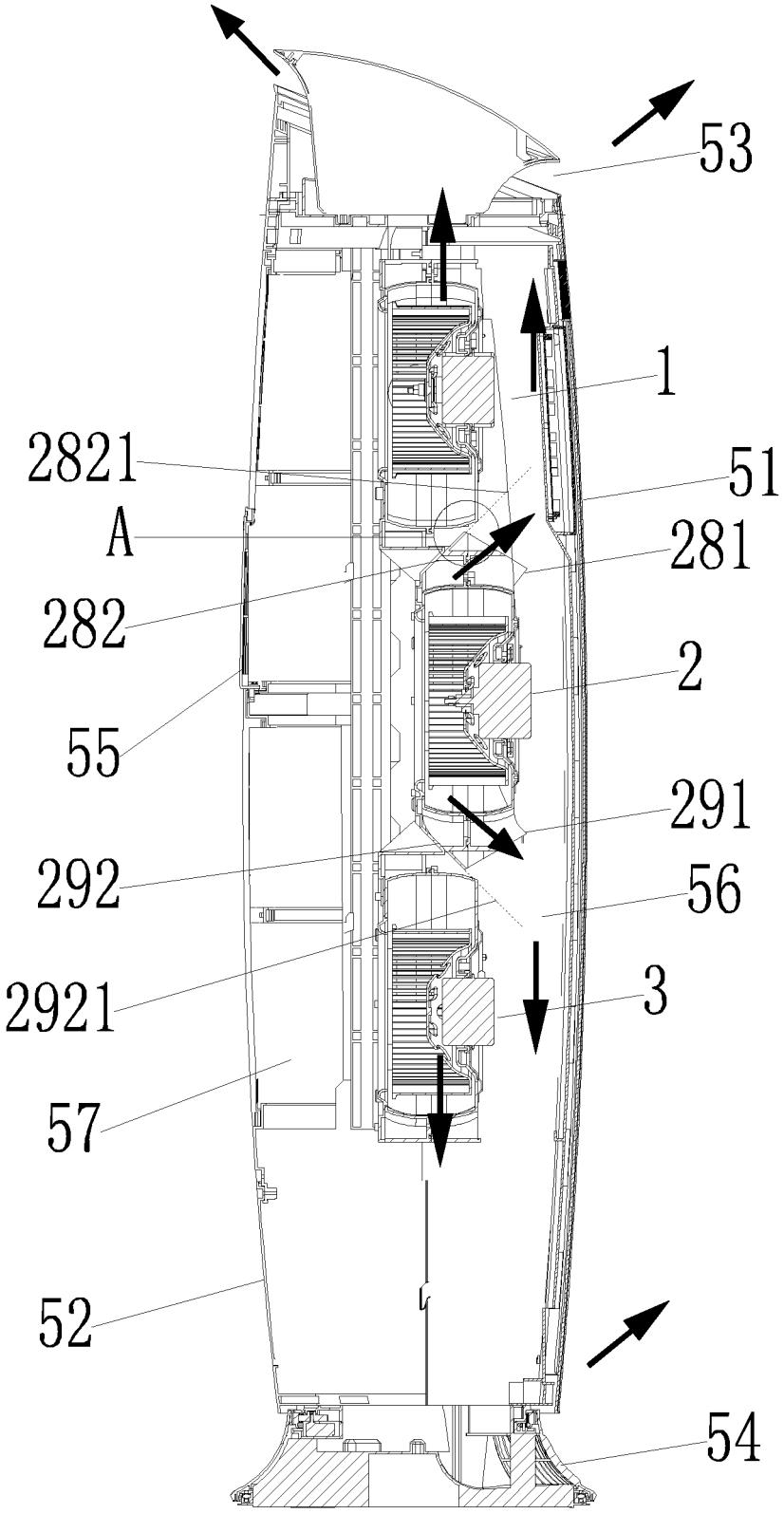

Fig. 3A

Description

[0001] The disclosure claims priority of Chinese Patent Application No. 201510579470.2, filed on September 11, 2015 and named after "combined volute blower structure and vertical air conditioner", the contents of which are hereby incorporated by reference in its entirety.

Technical Field

[0002] The disclosure relates to the field of air supply mechanisms, and particularly to a combined volute blower structure and a vertical air conditioner.

Background

[0003] When there is a bidirectional air supply requirement, air conditioning equipment on the current market is sometimes provided with two volute blowers for supplying air towards two opposite directions. However, under limits of power and size of a volute blower, application to larger air conditioning equipment, such as a vertical air conditioner, may have the problem of insufficient air volume. If the power of the volute blower is increased, the size of the volute blower may also be enlarged, and it is necessary to further enlarge the overall size of the vertical air conditioner, particularly increase a width and/or thickness of the vertical air conditioner and enlarge a transversely occupied space of the vertical air conditioner. This is unfavorable for mounting, use, transportation and the like of the vertical air conditioner.

Summary

[0004] In view of this, the disclosure provides a combined volute blower structure capable of reducing influence of an adjacent volute blower on outlet air of a certain volute blower in an air supply device with multiple volute blowers.

[0005] To this end, the disclosure is implemented by the following technical solutions.

[0006] A combined volute blower structure may comprise a mounting plate and at least two adjacent volute blowers mounted on the mounting plate, one volute blower in the two adjacent volute blowers may be provided with a middle air outlet positioned between the two adjacent volute blowers, and compared with the other volute blower, the volute blower with the middle air outlet may be positioned in front in a front-back direction perpendicular to the mounting plate.

[0007] Preferably, the combined volute blower structure may comprise three volute blowers, and the three volute blowers may comprise a third volute blower, second volute blower and first volute blower sequentially provided from bottom to top; and the second volute blower may be provided with a second volute blower air outlet blowing air upwards and/or downwards, and compared with the first volute blower and the third volute blower, the second volute blower may be positioned in front in the front-back direction.

[0008] Preferably, in the combined volute blower structure, the first volute blower may be provided with a first volute blower air outlet blowing air upwards; the third volute blower may be provided with a third volute blower air outlet blowing air downwards; and the second volute blower may be provided with a second volute blower first air outlet blowing air upwards and a second volute blower second air outlet blowing air downwards.

[0009] Preferably, in the combined volute blower structure, a first blower mounting part, second blower mounting part and third blower mounting part for correspondingly mounting the first volute blower, the second volute blower and the third volute blower may be provided on the mounting plate respectively, wherein the second blower mounting part may be provided in a manner of protruding towards the front of the mounting plate relative to the first blower mounting part and the third blower mounting part.

[0010] Preferably, in the combined volute blower structure, an inner surface of a rear wall of the second volute blower air outlet may be a plane, and an extended surface of the plane may not be intersected with a volute and/or volutes of the first volute blower and/or the third volute blower opposite to the second volute blower air outlet.

[0011] Preferably, in the combined volute blower structure, the second volute blower air outlet may obliquely extend towards a direction far away from a volute of the second volute blower in a direction from back to front.

[0012] Preferably, in the combined volute blower structure, the second volute blower may be provided with a second volute blower first air outlet blowing air upwards and a second volute blower second air outlet blowing air downwards; an inner surface of a rear wall of the second volute blower first air outlet may be an inclined surface or an arched surface, and an extended surface of the inclined surface or an extended surface of a tangent surface of the arched surface may not be intersected with the volute of the first volute blower; and an inner surface of a rear wall of the second volute blower second air outlet may be an inclined surface or an arched surface, and an extended surface of the inclined surface or an extended surface of a tangent surface of the arched surface may not be intersected with the volute of the third volute blower.

[0013] Preferably, in the combined volute blower structure,

a first flow guide part parallel to the mounting plate may be provided at least on a front wall of a third air outlet of a bidirectional volute blower; and/or a second flow guide part parallel to the mounting plate may be provided at least on a front wall of a fourth air outlet of the bidirectional volute blower.

[0014] Preferably, in the combined volute blower structure, the first flow guide part may be a sleeve extending upwards, and the second flow guide part may be a sleeve extending downwards.

[0015] Another purpose of the disclosure is to provide a vertical air conditioner. The following solution is specifically adopted.

[0016] A vertical air conditioner may comprise a housing, and the housing may be provided with a top air outlet positioned in the top and a bottom air outlet positioned in the bottom; a main body air duct provided in the housing may also be comprised, and the main body air duct may be communicated with the top air outlet and the bottom air outlet respectively; and the abovementioned combined volute blower structure may further be comprised, and the combined volute blower structure may be provided in the housing, and may supply air to the top air outlet and/or the bottom air outlet through the main body air duct.

[0017] The disclosure has the following beneficial effects.

1: for the combined structure with multiple volute blowers which are sequentially provided, the adjacent volute blowers are provided at staggered positions in the front-back direction perpendicular to the mounting plate, so that the air outlet of the middle volute blower may be avoided from the volutes of the volute blowers on two sides, and mutual outlet air interference is reduced.

2: furthermore, for the combined structure with the three volute blowers, the second volute blower is spatially staggered from the first volute blower and the third volute blower, so that interference of the first volute blower and the third volute blower to outlet air of the second volute blower may be avoided.

3: influence on an overall dimension of air conditioning equipment such as the vertical air conditioner is less, the volute blowers are staggered makes a thickness increased not so much, a spatial change requirement may be met only by regulating a height of the vertical air conditioner, and since the overall dimension of the vertical air conditioner is usually higher, influence of height regulation on design of the overall dimension is not so great.

4: the second volute blower in middle may bidirectionally blow air, so that an overall air volume may be increased without changing the original volute blower.

5: the two air outlets of the second volute blower are obliquely formed, so that a dimension of the second volute blower protruding from the first volute blower and the third volute blower is reduced, and influence on the overall dimension of the vertical air conditioner in (a) thickness and/or width direction(s) may be reduced.

6: the flow guide parts configured to regulate air directions of the air outlets are provided at the inclined air outlets of the second blower to supply outlet air of the air outlets in a direction approximately parallel to the mounting plate after avoiding the first volute blower and the third volute blower, and when the air conditioning equipment is provided to unidirectionally supply air, influence on a returning airflow may be reduced by reflected air of a front panel.

Brief Description of the Drawings

[0018] The following descriptions made to embodiments of the disclosure with reference to the drawings make the abovementioned and other purposes, characteristics and advantages of the disclosure clearer. In the drawings:

Fig. 1 is an external view of an air conditioning device according to the disclosure;
Fig. 2 is a mounting diagram of a combined volute blower structure in an air conditioning device;
Fig. 3A is an air flowing diagram of an air conditioning device in a state that upper and lower air outlets are both opened according to the disclosure;
Fig. 3B is an air flowing diagram of an air conditioning device in a state that a lower air outlet is closed and an upper air outlet is opened according to the disclosure;
Fig. 4 is a partial enlarged view of a part A in Fig. 3A;
Fig. 5 is a front view of a combined volute blower structure;
Fig. 6 is a side view of a combined volute blower structure;
Fig. 7 is an exploded view of volute blowers and mounting plate of a combined volute blower structure;
Fig. 8 is a front view and side view of a mounting plate with second half shells of volutes;
Fig. 8B is an enlarged view of a part B in Fig. 8;
Fig. 9 is an assembly diagram of a first half shell with an impeller and a motor and a mounting plate with a second half shell;
Fig. 10 is a side view of a second volute blower;
Fig. 11 is a sectional view of a second volute blower;
Fig. 12 is a sectional view of another embodiment of a second volute blower;
Fig. 13 is an exploded view of a first volute blower;
Fig. 14 is an external view of a first volute blower;
Fig. 15 is a sectional view of a first volute blower mounting structure;
Fig. 16 is a partial enlarged view of a region D in Fig. 15;
Fig. 17 is a partial enlarged view of a region E in Fig. 15; and
Fig. 18 is a partial enlarged view of a region F in Fig. 15.

Detailed Description of the Embodiments

[0019] The disclosure will be described below on the basis of embodiments, but the disclosure is not limited to these embodiments. In the following detailed descriptions about the disclosure, some specific details are de-

scribed. Those skilled in the art may completely understand the disclosure without the descriptions about these details. For avoiding confusion of the essence of the disclosure, known methods, processes, flows and elements are not described in detail.

[0020] In the disclosure, definitions about directions are shown in Fig. 1 and 2, wherein a front-back direction is defined as a direction perpendicular to a mounting plate 4, wherein a front panel 51 is positioned in front, and a rear panel 55 is positioned in the back; and a top-bottom direction is defined as a direction parallel to the mounting plate, wherein a top air outlet 53 is positioned in the top, and a lower air outlet 54 is positioned in the bottom. A left-right direction is defined as a direction parallel to the mounting plate and perpendicular to the top-bottom direction, wherein, in Fig. 1, a left-hand direction is a left side, and a right-hand direction is a right side; and for Fig. 2, the side close to an observer in a direction perpendicular to a paper surface is a left side, and the side opposite to the left side is a right side.

[0021] The disclosure designs a combined volute blower structure of air conditioning equipment, which comprises a mounting plate 4 and multiple volute blowers. The air conditioning equipment specifically refers to electrical equipment with an air blowing function and capable of regulating an indoor air parameter such as a vertical air conditioner, a blower and an air purifier. As shown in Fig. 1-3, the air conditioning equipment is provided with a housing 5, and a top air outlet 53 is formed in an upper part of the housing 5, preferably in the top; a bottom air outlet 54 is formed in a lower part of the housing 5, preferably in a base at a bottom of the housing 5; and the housing comprises a front panel 51 and a rear panel 55, and a hollow chamber is enclosed between the front panel 51 and the rear panel 55. The combined volute blower structure is provided in the hollow chamber, and mainly consists of the mounting plate 4 and the multiple volute blowers, and its specific structure will be described hereinafter in detail. The combined volute blower structure is provided in the hollow chamber along a top-bottom direction, and volutes are provided in front of the mounting plate 4, and are opposite to a position of the front panel 51. The mounting plate 4 divides the hollow chamber into two independent parts, a space between a rear side of the mounting plate 4 and the rear panel 55 forms an air inlet duct 57, the air inlet duct 57 is communicated with an air inlet grid positioned on the rear panel 55, and as a preferred solution, a heat exchange mechanism such as an evaporator is also provided in the air inlet duct 57. A space between a front side of the mounting plate 4 and the front panel 51 forms a main body air duct 56 of the air conditioning equipment, and the main body air duct 56 is communicated with the top air outlet 53 and the bottom air outlet 54 respectively. A mounting plate air inlet is formed in a position corresponding to mounting positions of the volute on the mounting plate 4, the position of the mounting plate air inlet is opposite to positions of volute air inlets, and volute air outlets are communicated with the main body air duct 56. When the air conditioning equipment works, air enters the air inlet duct 57 after passing through the air inlet grid on the rear panel 55, then enters the volute air inlets through the mounting plate air inlet, is supplied to the main body air duct 56 through the volute air outlets after being accelerated by centrifugal fans of the volute blowers, and may move downwards in the main body air duct 56 to be blown from the bottom air outlet 54 and/or move upwards to be blown from the top air outlet 53.

[0022] The combined volute blower structure of the disclosure comprises the mounting plate and at least three volute blowers mounted on a front lateral surface of the mounting plate, the at least three volute blowers comprise an upper volute blower positioned at the upper part and provided with an air outlet blowing air upwards and a lower volute blower positioned at the lower part and provided with an air outlet blowing air downwards, and further comprise at least one middle volute blower provided between the upper volute blower and the lower volute blower, the at least one middle volute blower comprises at least one bidirectional volute blower, the bidirectional volute blower is provided with a bidirectional air outlet simultaneously blowing air upwards and downwards, and the bidirectional air outlet is staggered from the volute blower adjacent to the bidirectional volute blower in a front-back direction. The at least one middle volute blower may be a combination of a bidirectional volute blower and a volute blower unidirectionally blowing air, and may also be all bidirectional volute blower. A specific manner for staggering the bidirectional air outlet from the volute blower adjacent to the bidirectional volute blower in the front-back direction may be staggering the volute blower in the front-back direction, setting the bidirectional air outlet to blow air obliquely and a combination of the two manners, and a specific structure will be described below in detail.

[0023] The combined volute blower structure of the disclosure will be described below in detail with Fig. 3-18 as an example. As shown in Fig. 5-7, the combined volute blower structure comprises a mounting plate 4 and three volute blowers (called as blowers for short hereinafter). The three volute blowers comprise a first blower 1 provided on an upper side of the mounting plate 4, a third blower 3 provided on a lower side of the mounting plate 4 and a second blower 2 provided on the mounting plate 4 and positioned between the first blower 1 and the third blower 3, wherein the first blower 1 is provided with a first blower air outlet 18 blowing air upwards; the third blower is provided with a third blower air outlet 39 blowing air downwards; and the second blower is provided with two air outlets, wherein a second blower first air outlet 28 is formed to blow air upwards, and a second blower second air outlet 29 is formed to blow air downwards. It is important to note that: although the mounting plate is provided in a top-bottom direction in the embodiment and the three volute blowers are also provided in the top-bottom direction, the technical solution of the disclosure should not

be limited to such a mounting plate structure provided in the top-bottom direction, the mounting plate may be horizontally provided or obliquely provided, and top-down, left-right and front-back mentioned in the disclosure are relative directions relative to the mounting plate.

[0024] The second blower 2 is provided between the first blower 1 and the third blower 3, and the air outlets are formed to blow air upwards and downwards. If the three blowers are mounted on the same plane according to a conventional manner, a volute of the first blower 1 and a volute of the third blower 3 may block outlet air of the second blower 2 to hinder air blown by the second blower 2 from smoothly entering a main body air duct 56. Therefore, the three blowers are provided into a spatially staggered structure, and the second blower first air outlet 28 and the second blower second air outlet 29 are spatially staggered from positions of the first blower 1 and the third blower 3 to reduce influence of the first blower 1 and the third blower 3 on the outlet air of the second blower 2 as maximally as possible. For example, the three blowers are staggered in the front-back direction and/or the left-right direction.

[0025] As a preferred implementation mode, as shown in Fig. 6, a manner of staggering the three blowers in the front-back direction is adopted. Specifically, a mounting position of the second blower 2 on the mounting plate is provided on a front side of mounting positions of the first and third blowers, that is, an providement position of the second blower 2 is closer to the main body air duct 56 than providement positions of the first blower 1 and the third blower 3, so that the outlet air of the second blower 2 in the top-bottom direction may be at least partially avoided from interference of the volute of the first blower 1 and the volute of the third blower 3, and is supplied from the main body air duct 56 more smoothly. Preferably, arranging the mounting position of the second blower 2 on the mounting plate 4 on the front side of the mounting positions of the first and third blowers is implemented by changing a shape of the mounting plate 4. As shown in Fig. 6-8, a first blower mounting part 41, a second blower mounting part 42 and a third blower mounting part 43 are provided on the mounting plate, wherein steps are formed between the second blower mounting part 42 and each of the first blower mounting part 41 and the third blower mounting part 43, so that the second blower mounting part 42 protrudes towards a direction of a front panel 51 in front compared with the first blower mounting part 41 and the third blower mounting part 43, and the mounting position of the second blower 2 on the mounting plate 4 is provided on the front side of the mounting positions of the first and third blowers when the three blowers are mounted on the mounting plate 4 under the condition that shapes of the three blowers are kept unchanged. Staggering in the front-back direction has the advantages that a width of a volute blower component in the left-right direction is prevented from being increased, only a thickness in the front-back direction is increased to a certain extent and influence on an overall dimension of an air conditioning device is less. As a preferred mode, inner surfaces of rear walls of the second blower first air outlet 28 and the second blower second air outlet 29 may be planes parallel to the mounting plate, and extended surfaces of the planes are not intersected with the volutes of the first blower 1 and the third blower 3 respectively. Therefore, the outlet air of the second blower 2 may be prevented from being blown onto the volutes of the first blower 1 and the third blower 3, and the influence of the volutes of the first blower 1 and the third blower 3 on the outlet air of the second blower 2 is maximally reduced.

[0026] A manner of staggering the three blowers in the left-right direction may also be adopted (not shown in the figures). That is, arranging the second blower 2 on a left side or right side of the first blower 1 and the third blower 3 may also reduce the interference of the first blower 1 and the third blower 3 to the outlet air of the second blower 2. However, such a manner may greatly increase the width of the volute blower component in the left-right direction, and is unfavorable for overall layout of the air conditioning device.

[0027] As another preferred implementation mode, the second blower first air outlet 28 and second blower second air outlet 29 of the second blower 2 may also be formed to be inclined relative to a volute of the second blower 2. For example, as shown in Fig. 3-6, in a practical mounting state, the volute of the second blower 2 is mounted approximately parallel to the plane of the second blower mounting part 42 of the mounting plate 4. As shown in Fig. 3, a volute plane of the second blower 2 extends approximately in the top-bottom direction. The second blower first air outlet 28 and the second blower second air outlet 29 are formed to extend from a direction from the mounting plate 4 and the front panel 51 (i.e. the front-back direction) to a direction far away from the volute. Specifically, the second blower first air outlet 28 is formed to blow air towards an upper front direction, and the second blower second air outlet 29 is formed to blow air towards a lower front direction. Referring to Fig. 6, 10 and 11, the second blower first air outlet 28 comprises a second blower first air outlet rear wall inner surface 282 close to the second blower mounting part 42 and a second blower first air outlet front wall inner wall 281 close to the front panel 51, the second blower first air outlet front wall inner wall 281 may be an inclined surface or an arched surface, and an extended surface 2811 of a tangent surface of the inclined surface of the arched surface forms a first inclination angle $\theta 1$ with a plane of the mounting plate 42; and the second blower first air outlet rear wall inner surface 282 may be an inclined surface or an arched surface, and an extended surface 2821 of the inclined surface or the arched surface forms a second inclination angle $\theta 2$ with the plane of the mounting plate 4. Sizes of the first inclination angle $\theta 1$ and the second inclination angle $\theta 2$ may be the same or different. The second blower second air outlet 29 is provided with a second blower second air outlet rear wall inner surface 292 close to the second blower mounting part 42 and a

second blower second air outlet front wall inner wall 291 close to the front panel 51, and the second blower second air outlet front wall inner wall 291 may be an inclined surface or an arched surface, and a tangent surface direction 2911 of the inclined surface of the arched surface forms a third inclination angle θ3 with the plane of the mounting plate 4; and the second blower second air outlet rear wall inner surface 292 may be an inclined surface or an arched surface, and a tangent surface direction 2921 of the inclined surface or the arched surface forms a fourth inclination angle θ4 with the plane of the mounting plate 4. Sizes of the third inclination angle θ3 and the fourth inclination angle θ4 may be the same or different. As a preferred mode, the extended surface of the inclined surface or the extended surface 2821 of a tangent surface of the arched surface of the second blower first air outlet rear wall inner surface 282 is not intersected with the volute of the first blower 1, as shown in Fig. 4; an extended surface of the inclined surface or an extended surface 2921 of a tangent surface of the arched surface of the second blower second air outlet rear wall inner surface 292 is not intersected with the volute of the third blower 3 (not shown in Fig. 3); and not intersecting specifically means that a part, overlapped with a projection of the volute on the mounting plate, of the extended surface of the inclined surface or the extended surface 2821 of the tangent surface of the arched surface is positioned in front of the volute in the front-back direction. In such a manner, the air blown from the second blower first air outlet 28 and lower air outlet 29 may be prevented from being blown onto the volutes of the first blower 1 and the third blower 3, and the interference of the volutes of the first blower 1 and the third blower 3 to the outlet air of the second blower 2 may be reduced.

[0028] As another preferred implementation mode, a combination of the abovementioned staggering manners is adopted. As shown in Fig. 3-7, the first blower mounting part 41, the second blower mounting part 42 and the third blower mounting part 43 are provided on the mounting plate, wherein the steps are formed between the second blower mounting part 42 and each of the first blower mounting part 41 and the third blower mounting part 43, so that the second blower mounting part 42 protrudes towards the direction of the front panel 51 in front compared with the first blower mounting part 41 and the third blower mounting part 43; and meanwhile, the second blower first air outlet 28 and the second blower second air outlet 29 are formed to be inclined relative to the volute, namely extending from the direction from the mounting plate 4 to the front panel 51 (i.e. the front-back direction) to the direction far away from the volute. Preferably, the extended surface of the inclined surface or the extended surface 2821 of the tangent surface of the arched surface of the second blower first air outlet rear wall inner surface 282 is not intersected with the volute of the first blower 1, as shown in Fig. 4; and the extended surface of the inclined surface of the extended surface 2921 of the tangent surface of the arched surface of the second blower second air outlet rear wall inner surface 292 is not intersected with the volute of the third blower 1. In such a combined staggering manner, thickness (front-back direction) increase of the combined volute blower structure caused by staggering in the front-back direction may be reduced, influence of excessively large inclination angles of the second blower first air outlet 28 and the second blower second air outlet 29 relative to the volute on the outlet air of the volute blower may also be avoided, great dimension increase of the thickness (front-back direction) and width (left-right direction) of the combined volute blower structure may be prevented, overall structure optimization design of the air conditioning equipment is facilitated, meanwhile, the interference of the first blower and the third blower to the outlet air of the second blower is lower, and the outlet air of the three blowers may smoothly move in the main body air duct 56.

[0029] As another preferred mode, a flow guide part and/or flow guide parts may be provided at the inclined second blower first air outlet 28 and/or second blower second air outlet 29 of the second blower. As shown in Fig. 12, an upper flow guide part 280 is provided at the second blower first air outlet 28, and a lower flow guide part 290 is provided at the second blower second air outlet 29. The upper flow guide part 280 is at least provided on a front wall of the second blower first air outlet 28, i.e. at a position close to the front panel 51; the lower flow guide part 290 is at least provided on a front wall of the second blower second air outlet 29, i.e. at a position close to the front panel 51; and the upper flow guide part 280 and the lower flow guide part 290 are wholly extend approximately in parallel with the mounting plate 4 and/or the front panel 51, i.e. along the top-bottom direction. Preferably, each of the upper flow guide part 280 and the lower flow guide part 290 has a structure of a sleeve, the sleeves are provided at the second blower first air outlet 28 and the second blower second air outlet 29, and the sleeves extend approximately along the top-bottom direction. Therefore, the air blown from the upper air outlet 28 and the lower air outlet 29 may enter the main body air duct 56 approximately in parallel to an extending direction of the main body air duct 56, interference of a reflected airflow of the front panel 51 to an airflow in the main body air duct 56 may be reduced, the airflow in the main body air duct 56 may be smoother, and energy loss is reduced. Meanwhile, if one of the top air outlet 53 or the bottom air outlet 54 is closed, as shown in Fig. 3B, for example, the bottom air outlet 54 is closed, at this moment, air downwards blown from the second blower second air outlet 29 and the third blower air outlet 39 returns after moving to a lower end of the main body air duct 56, and moves towards the top air outlet 53 through channels formed between the volutes of the third blower 3 and the second blower and the front panel 51. Due to existence of the lower flow guide part 290, the air downwards blown from the lower air outlet 29 is approximately parallel to the main body air duct 56, and the air returning from the lower part may be prevented from interference

of the outlet air of the lower air outlet 29 and thus may smoothly move upwards when passing through the channel between the volute of the second blower 2 and the front panel 51. If the lower flow guide part 290 is not provided, the air obliquely blown towards the lower front part by the lower air outlet 29 may hinder the air returning from the lower part, and the returning air may not smoothly move upwards. Such descriptions are similarly applied to the upper flow guide part 280. When the top air outlet 53 is closed, a function of the upper flow guide part 280 is the same as a function of the lower flow guide part 290.

[0030] A specific mounting manner for the volute blower component will be described below, such as a structure shown in Fig. 7-9. A first blower mounting part 41, a second blower mounting part 42 and a third blower mounting part 43 are provided on a mounting plate, and a first blower mounting surface, a second blower mounting surface and a third blower mounting surface (not shown in the figures) are provided on the first blower mounting part 41, the second blower mounting part 42 and the third blower mounting part 43 respectively, wherein the second blower mounting surface is provided in a manner of protruding towards a direction of a front panel 51 relative to the first blower mounting surface and the third blower mounting surface; hoardings capable of strengthening overall strength of the mounting plate are provided on edges of the first blower mounting surface and the third blower mounting surface, and in addition, the first blower mounting part 41 and the third blower mounting part 43 form sunken parts, as shown in Fig. 8; and a first mounting plate air inlet 411, a second mounting plate air inlet 421 and a third mounting plate air inlet 431 are formed in the first blower mounting surface, the second blower mounting surface and the third blower mounting surface respectively, as shown in Fig. 8. A volute of a blower consists of two half shells, the two half shells have approximately the same thickness, the two half shells are preferably formed by dividing the volute from a centerline perpendicular to an axis of the volute, and such an providement manner facilitates manufacturing of the half shells. Specifically, a first blower 1 comprises a first blower rear half shell 15, a first blower front half shell 13, a first motor 11 and a first impeller 14, the first blower rear half shell 15 and the first blower front half shell 13 form a first volute, a first volute air inlet is formed in the first blower rear half shell 15, and the first motor 11 and the first impeller 14 are mounted on the first blower front half shell 13; a second blower 2 comprises a second blower rear half shell 25, a second blower front half shell 23, a second motor 21 and a second impeller 24, the second blower rear half shell 25 and the second blower front half shell 23 form a second volute, a second volute air inlet is formed in the second blower rear half shell 25, and the second motor 21 and the second impeller 24 are mounted on the second blower front half shell 23; and a third blower 3 comprises a third blower rear half shell 35, a third blower front half shell 33, a third motor 31 and a third impeller 34, the third blower rear half shell 35 and the third blower front half shell 33 form a third volute, a third volute air inlet is formed in the third blower rear half shell 35, and the third motor 31 and the third impeller 34 are mounted on the third blower front half shell 33, specifically as shown in Fig. 9.

[0031] When the first blower 1, the second blower 2 and the third blower 3 are mounted on the first blower mounting part 41, the second blower mounting part 42 and the third blower mounting part 43 respectively, the first blower rear half shell 15, the second blower rear half shell 25 and the third blower rear half shell 35 are fixed on the first blower mounting surface, second blower mounting surface and third blower mounting surface of the first blower mounting part 41, the second blower mounting part 42 and the third blower mounting part 43 through connecting pieces respectively, the connecting pieces may be screws, bolts, rivets and the like, and as shown in Fig. 8B, screws 91 are adopted. The first volute air inlet, the second volute air inlet and the third volute air inlet are opposite to the first mounting plate air inlet 411, the second mounting plate air inlet 421 and the third mounting plate air inlet 431 respectively. Since the first blower mounting part 41 and the third blower mounting part 43 form the sunken parts, the first blower rear half shell 15 and the third blower rear half shell 35 are embedded into the sunken parts, and the second blower rear half shell 25 is positioned on the second blower mounting part 41 and protrudes from the mounting plate 4. The first blower front half shell 13, the second blower front half shell 23 and the third blower front half shell 33 are integrally connected with the first blower rear half shell 15, the second blower rear half shell 25 and the third blower rear half shell 35 respectively after the corresponding motors and impellers are mounted, to further form the whole combined volute blower structure, as shown in Fig. 9. Compared with a conventional manner of fixing the motors on the mounting plate, the motors of the disclosure are mounted on the volutes, the motors and the impellers may be disassembled together with the volutes, and the mounting plate is not required to be disassembled, so that overall assembly convenience and maintainability are improved. specific structures of the volute blowers will be described hereinafter in detail.

[0032] A mounting structure of a volute blower will be described below in detail with the first blower 1 and the mounting plate 4 as an example, as shown in Fig. 13-18. In the following descriptions, an axial direction is defined as a direction parallel to an axis of a motor, a radial direction is defined as a direction perpendicular to the axis of the motor, and a circumferential direction is defined as a direction of rotation around the axis of the motor; and a side is mentioned relative to an axis direction of the motor. For example, in Fig. 13, a first half shell 13 (the first blower front half shell) is positioned on one side, a second half shell 15 (the first blower rear half shell) is positioned on the other side, and an impeller 14 is positioned between the first half shell 13 and the second half shell 15.

[0033] As shown in Fig. 15, from an axial section, obtained by cutting a volute from a plane comprising an axis 111 of a motor, of the volute, a distance between a volute circumferential wall close to a volute midline in a direction of the axis and the axis is longer than a distance between the volute circumferential wall positioned on two sides on the axis and the axis 111, the distance is a distance between a midline of the circumferential wall and an axis 144 of an impeller, and a difference value is H. Preferably, a distance between an outer wall of the volute circumferential wall close to the volute midline 139 in the direction of the axis 111 and the axis 111 is longer than a distance between the outer wall of the volute circumferential wall positioned on the two sides on the axis 111 and the axis 111, and their difference value is H1 (not shown in the figures). Preferably, an axial section of the outer wall of the volute circumferential wall may be an arc, a trapezoid, a trimmed arc, a triangle or another polygon. Preferably, from the axial section, obtained by cutting the volute from the plane comprising the axis 111 of the motor, of the volute, a distance between an inner wall of the volute circumferential wall close to the volute midline 139 in the direction of the axis 111 and the axis 111 is also longer than a distance between the inner wall of the volute circumferential wall positioned on the two sides on the axis and the axis, and their difference value is H2 (not shown in the figures). H1 and H2 may be the same as or different from H, and it specifically depends on a thickness change of the volute circumferential wall. Preferably, an axial section of the inner wall of the volute circumferential wall may also be an arc, trapezoid, trimmed arc, triangle or another polygon matched with a shape of the outer wall of the circumferential wall. The outer wall of the volute circumferential wall is designed into a middle protruding structure to achieve adaptability to different vertical air conditioner structures such as a vertical air conditioner structure with a curved housing. In addition, a thickness of the volute circumferential wall is usually uniform, so that protrusion of the outer wall of the circumferential wall may also make the inner wall of the circumferential wall form a protruding structure, which may enlarge an internal volume of the volute and improve an air supply capability of a volute blower compared with a volute of which a circumferential wall and a sidewall are perpendicular.

[0034] For convenient manufacturing, the volute may be provided into a split structure, as shown in Fig. 13-15. The volute comprises the first half shell 13 and the second half shell 15, the first half shell 13 comprises a first half shell circumferential wall 131 and a first half shell sidewall 132, the second half shell comprises a second half shell circumferential wall 151 and a second half shell sidewall 152, and the first half shell circumferential wall 131 and the second half shell circumferential wall 151 are curved in a manner of enclosing an outer periphery of the impeller 14. The first half shell circumferential wall 141 comprises a fixed end connected with an edge part of the first half shell sidewall 132 and a first connecting end 1311 far away from the first half shell sidewall 132, the second half shell circumferential wall 151 comprises a fixed end connected with an edge part of the second half shell sidewall 152 and a second connecting end 1311 far away from the second half shell sidewall 152, and the first connecting end 1411 of the first half shell circumferential wall 131 is connected with the second connecting end 1311 of the second half shell circumferential wall 151, thereby forming an accommodation cavity configured to accommodate the impeller 14 in the first half shell 13 and the second half shell 15 and forming a cylinder of which a radius increases along a rotating direction of the impeller 14 relative to the axis 111 of the motor.

[0035] In the embodiment, the motor 11 of the volute blower comprises a motor body 117 and a rotating shaft 112. The impeller 14 is mounted in the accommodation cavity, and is shaped into a cylinder formed by arranging multiple blades slenderly formed in an axial direction of the axis 111 of the motor radially relative to the axis 111 of the motor at specified intervals. One end of each blade 141 is mounted on an outer edge part of a rotating round plate 142 which is approximately round, and the other end of each blade 141 is mounted in an annular support ring 143 and forms an impeller air inlet inside. A center of the rotating round plate 142 is fixed on the rotating shaft 112 of the motor, and under driving of the motor 11, the impeller 14 rotates around the rotating shaft 112. A motor mounting opening 133 is formed in the first half shell 13, the rotating round plate 142 of the impeller is provided close to the motor mounting opening 133, the rotating shaft 112 of the motor 11 penetrates through the motor mounting opening to be connected with the rotating round plate 142 of the impeller 14 to further drive the rotating round plate 142 to rotate, a volute air inlet 153 is formed in the second half shell 15, and the volute air inlet 15 corresponds to a position of the impeller air inlet, and is configured to guide air to an inner side of the impeller 14. The motor body 117 is supported by the first half shell 13. A first vibration reduction device is provided between the motor body 117 and the first half shell 13, and a structure and specific mounting manner of the first vibration reduction device will be described hereinafter in detail.

[0036] Since the volute is usually made from a plastic material, and is not strong in overall strength, directly mounting the motor body 117 on the first half shell 13 may make strength of the first half shell 13 insufficient to support power of the motor to deform or damage the first half shell 13. Therefore, as a preferred implementation mode, a support disk 12 is comprised, the support disk 12 is made from a metal material, the support disk 12 is fixed on the first half shell 13, and is preferably fixed on an outer wall of the first half shell sidewall 132 of the first half shell 13, and the motor body 117 is fixed on the support disk 12. Preferably, the motor body 117 is fixed on a lateral surface, far away from the first half shell 13, of the support disk 12. The support disk 12 is provided, so that the motor body 117 may be provided on the volute, and is supported by the volute, and meanwhile, the volute

is prevented from being deformed or damaged.

[0037] When the support disk 12 is provided, the first vibration reduction device may be provided between the support disk 12 and the motor body 117. A flange 133 is provided on an outer wall of a circumferential wall of the motor body 117, the flange 133 is fixed on the support disk 12, and the first vibration reduction device is provided between the flange 133 and the support disk 12. Preferably, the first vibration reduction device is preferably a first vibration reduction washer 114 provided between the flange 133 and the support disk 12. As a preferred solution, as shown in Fig. 13, the first vibration reduction washer 114 is provided to be columnar, a jack is formed in an outer periphery of the columnar first vibration reduction washer 114, the flange 133 is flaky, and is inserted into the first vibration reduction washer 114 from the jack, a through hole communicated with a mounting hole of the flange 133 is formed in the first vibration reduction washer 114, and a connecting piece such as a screw and a stud is connected with the support disk 12 to further fix the motor body 117 after penetrating through the through hole of the first vibration reduction washer 114 and the mounting hole of the flange 133. The first vibration reduction washer 114 preferably adopts a rubber support. When the support disk 12 is not provided, the motor 11 may also be directly connected with the first half shell 13 through the first vibration device in a manner of replacing the support disk 12 with the first half shell 13.

[0038] The first half shell circumferential wall 131 extends from the fixed end to the first connecting end 1311 towards a direction far away from the axis 111 of the motor in a radial direction, and the second half shell circumferential wall 151 extends from the fixed end to the second connecting end 1311 towards the direction far away from the axis 111 of the motor in the radial direction. Preferably, a joint of the first connecting end 1311 of the first half shell circumferential wall 131 and the second connecting end 1311 of the second half shell circumferential wall 151 is close to the volute midline 139 perpendicular to the axis 111 of the motor or is overlapped with the volute midline 139 perpendicular to the axis 111 of the motor.

[0039] For improving air tightness of the volute, a sealing structure may be provided at a joint of the first half shell 13 and the second half shell 15. Preferably, the sealing structure comprises a convex rib provided at one of the first connecting end 1311 of the first half shell circumferential wall 131 and the second connecting end 1311 of the second half shell circumferential wall 151 and a groove formed in the other. Preferably, as shown in Fig. 15, a convex rib 1312 extending towards the second half shell 15 is provided at the first connecting end 1311 of the first half shell circumferential wall 131, a groove 1512 corresponding to the convex rib 1312 is formed in the second half shell circumferential wall 151, and when the first half shell 13 is connected with the second half shell 15, the convex rib 1312 is embedded into the groove 1512, so that sealing performance of the half shells may be improved, and air leakage of the circumferential wall of the volute may be avoided to reduce efficiency of the volute blower. There may be one or more convex ribs 1312 and grooves 1512.

[0040] The sealing structure may also adopt a form of sealing ring. A flange is provided on one of the first half shell 13 and the second half shell 15, and a groove is formed in the other. The flange is pressed against the groove, and a sealing ring is tightly pressed in the groove for sealing. The sealing ring may adopt rubber or another flexible material. The sealing structure is provided on an outer side of the radial direction or an inner side of the radial direction of the volute circumferential wall.

[0041] As a preferred implementation mode, as shown in Fig. 15, the rotating round plate 142 is provided in a manner of protruding towards an interior of the impeller 14 in a direction from an edge to an axle center of the rotating round plate 142, the rotating round plate 142 is approximately bowl-shaped or tapered, the inner side of the radial direction of the rotating round plate 142 forms a motor accommodation space, the rotating shaft 112 of the motor penetrates through the volute and enters the volute, and part of the motor body 117 may be positioned in the motor accommodation space, to achieve the advantages of reducing a length of the motor 11 protruding from the volute, reducing a mounting width of the volute blower in the axial direction and make an overall structure of the volute blower more compact. At this moment, an inwards-sunken part 1321 is correspondingly formed in the first half shell sidewall 132 of the first half shell 13, a motor mounting opening 133 is formed in a center of the inwards-sunken part 1321, and the inwards-sunken part 1321 is also formed in a manner of protruding towards the interior of the impeller 14 in a direction from an edge to an axle center of the motor mounting opening 133.

[0042] For further reducing vibration between the motor and the support disk, as shown in Fig. 17, preferably, a flange 133 is provided on an outer wall of a circumferential wall of the motor body 117, the flange 133 is fixed on the support disk 12, and a first vibration reduction structure is provided between the flange 133 and the support disk 12. Preferably, the first vibration reduction structure is preferably a first vibration reduction washer 114 provided between the flange 133 and the support disk 12. As a preferred solution, as shown in Fig. 17, the first vibration reduction washer 114 is provided to be columnar, a jack is formed in an outer periphery of the columnar first vibration reduction washer 114, the flange 133 is flaky, and is inserted into the first vibration reduction washer 114 from the jack, a through hole communicated with a mounting hole of the flange 133 is formed in the first vibration reduction washer 114, and a connecting piece such as a screw and a stud is connected with the support disk 12 to further fix the motor body 117 after penetrating through the through hole of the first vibration reduction washer 114 and the mounting hole of the flange 133. The first vibration reduction washer 114 preferably adopts a rubber support.

[0043] For further reducing vibration between the motor 11 and the impeller 14, as shown in Fig. 18, a second vibration reduction structure is provided between the rotating shaft 112 of the motor and the rotating round plate 142 of the impeller. Preferably, the second vibration reduction structure comprises a rubber sleeve 115 and a metal ferrule 116. The rubber sleeve 115 is fixed on an outer periphery of the rotating shaft 112 of the motor, and synchronously rotates along with the axis 111 of the motor, an outer periphery of the metal ferrule is connected with the rotating round plate 142, an inner periphery is connected with the rubber sleeve 115, power of the rotating shaft 112 of the motor is transmitted to the rotating round plate 142 to further drive the impeller 14 to rotate, and existence of the rubber sleeve 115 may effectively reduce the vibration transmitted to the impeller 14 by the motor 11 and effectively reduce noise.

[0044] Preferably, for reducing vibration transmitted to the volute 14 by the motor body 117, a cylindrical support 134 may be provided at the edge of the motor mounting opening 133 of the first half shell 13, and a through hole communicated with the motor mounting opening 133 is formed in the cylindrical support 134. As shown in Fig. 17, a fixed end of the cylindrical support 134 is connected with the edge of the motor mounting opening 133, and a free end of the cylindrical support 134 extends towards a direction far away from the center of the volute on the axis. The motor body 117 is at least partially positioned in the cylindrical support 134, so that the rotating shaft 112 of the motor penetrates through the motor mounting opening 133 to be connected with the impeller 14. A third vibration reduction structure is provided between the cylindrical support 134 and the outer wall of the circumferential wall of the motor body 117. Preferably, the third vibration reduction structure is a second sealing ring 135 provided on an end part or inner wall of the cylindrical support 134, and when the motor 11 is positioned in the cylindrical support 134, the second sealing ring 135 forms elastic fit with the outer wall of the circumferential wall of the motor body 117, so that the vibration transmitted to the volute by the motor may be reduced; and meanwhile, sealing fit may also be formed, and the motor mounting opening 133 may be sealed to implement sealing at the motor mounting opening 133 to prevent air leakage from the motor mounting opening and reduce the efficiency of the volute blower. The second sealing ring 135 may be mounted on the cylindrical support 134, and may also be mounted on the outer periphery of the motor body 117. Preferably, as shown in Fig. 17, the second sealing ring 135 is provided into an annular structure with a U-shaped section, an opening of the annular structure with the U-shaped section faces the free end of the cylindrical support 134, and is mounted at the free end of the cylindrical support 134, and an inner circumferential wall of the second sealing ring 135 is pressed against the outer wall of the circumferential wall of the motor body 117. Preferably, a sealing lip part extending towards the motor is provided on the inner periphery of the second sealing ring 135, and may be pressed against the outer wall of the circumferential wall of the motor body 117. Preferably, a mounting support 136 is provided on the volute 13, the support disk 12 is connected with the mounting support 136 to be mounted on the first half shell 13, and a lateral surface, opposite to the cylindrical support 134, of the support disk tightly presses the second sealing ring 135 and clamp the second sealing ring between the support disk 12 and the cylindrical support 134 to better fix the second sealing ring 135.

[0045] The mounting structure of the volute blower of the embodiment will be described below. As shown in Fig. 14, the mounting structure of the volute blower of the embodiment comprises the volute blower and a mounting plate 4, the volute blower is mounted on the mounting plate 4, a mounting plate air inlet 41 is formed in the mounting plate 4, a second half shell 15 is fixedly connected with the mounting plate 4 through a fixing part such as a screw, a stud and a rivet, a volute air inlet 153 in the second half shell 15 is opposite to a position of the mounting plate air inlet 41 in the mounting plate 4, and a motor 11 and an impeller 14 are both mounted on a first half shell 13; and the first half shell mounted with the motor 11 and the impeller 14 is connected with the second half shell 15 to further mount the volute blower on the mounting plate 4.

[0046] A specific assembly manner for the volute blower and the mounting plate 4 will be described below in detail.

[0047] When the volute blower is fixed on the mounting plate 4, the following steps are comprised.

[0048] In Step 1,

the second half shell 15 is connected with the mounting plate 4. Preferably, a second half shell sidewall 152 is connected with the mounting plate 4 through a fixing part, and a second half shell circumferential wall 151 is positioned on the side, far away from the mounting plate 4, of the second half shell sidewall 152. The fixing part may adopt a connecting piece such as a screw and a rivet.

[0049] In Step 2, the motor 11, the impeller 14 and the first half shell 13 are connected. Two manners are specifically adopted.

[0050] A first manner:

a support disk 12 is fixed on the first half shell 13;

a rotating shaft 112 of the motor 11 penetrates through a motor mounting opening 133 in the first half shell 13, and the motor 11 is fixed on the support disk 12, thereby fixing the motor 11 on the first half shell 13; and

a rotating round plate 142 of the impeller 14 is connected with the rotating shaft 112 of the motor 11 to connect the impeller 14 with the motor.

[0051] Or, a second manner:

the motor 11 is connected with the support disk 12;

the support disk 12 is fixed on the first half shell 13

together with the motor 11, and the rotating shaft 112 of the motor 11 penetrates through the motor mounting opening 133 in the first half shell 13; and
the rotating round plate 142 of the impeller 14 is connected with the rotating shaft 112 of the motor 11 to connect the impeller 14 with the motor 11.

[0052] In Step 3, the first half shell 13 mounted with the motor 11 and the impeller 14 is connected with the second half shell 15 to further mount the whole volute blower on the mounting plate 4.

[0053] Wherein, Step 1 and Step 2 may be exchanged, and may also be simultaneously executed.

[0054] Compared with an existing volute blower structure, the motor 11 and impeller 14 of the volute blower of embodiment 1 are both mounted on the first half shell 13, and during mounting, the first half shell 13 is integrally mounted, so that more convenience for mounting is achieved. When it is necessary to execute an operation such as overhauling, maintenance and replacement on the motor 11 or the impeller 14, it is only necessary to disassemble the whole first half shell 13 and the second half shell 15 together with the motor 11 and the impeller 14. The second volute 15 is not required to be disassembled, and the mounting plate 4 is also not required to be disassembled, so that overall maintainability is higher.

[0055] In addition, those skilled in the art should know that the drawings provided here are all for description, and the drawings are not always drawn to scale.

[0056] In addition, it should be understood that the exemplary embodiments are provided to make the disclosure comprehensive and completely express its scope to those skilled in the art. Many specific details (such as examples of specific parts, equipment and methods) are given to provide a comprehensive understanding to the disclosure. The those skilled in the art should know that the exemplary embodiments may be implemented in various forms without specific details, and the exemplary embodiments should not be understood to limit the scope of the disclosure. In some exemplary embodiments, there are no detailed descriptions made to well-known equipment structures and well-known technologies.

[0057] When an element or layer is mentioned to be "on" another element or layer and "bonded", "connected" or "linked" onto the other element or layer, it may be directly on the other element or layer, directly bonded, connected to linked to the other element or layer, or a middle element or layer may exist. By comparison, when an element is mentioned to be "directly" "on" another element or layer, "directly bonded", "directly connected" or "directly linked" onto the other element or layer, an no middle element or layer may be required. Other words configured to describe a relationship between elements should be explained in a similar manner (for example "between" and "directly between", and "adjacent" and "directly adjacent"). For example, term "and/or", used here, comprises any one or all combinations of one or more associated items which are listed.

[0058] Although terms first, second, third and the like may be adopted here to describe each element, part, region, layer and/or section, these elements, parts, regions, layers and/or sections should not be limited by these terms. These terms may only be adopt to distinguish one element, part, region, layer or section from another element, region, layer or section. Terms such as "first" and "second" and other numerical terms used here do not mean orders or sequences, unless explicitly specified in the context. Therefore, a first element, part, region, layer or section discussed below may be called as a second element, part, region, layer or section, without departing from the instruction of the exemplary embodiments. In addition, in the descriptions of the disclosure, "multiple" means two or more than two, unless otherwise noted.

[0059] For easy description, space-related terms such as "in", "outside", "under", "below", "lower part", "above" and "upper part" are adopted here to describe a relationship between an element or characteristic and another element or characteristic shown in the drawings. It is understood that the space-related terms may be intended to comprise different orientations except orientations shown in the drawings during use or operation of equipment. For example, if the equipment in the drawings is overturned, an element described to be "below" or "under" another element or characteristic is to be positioned to be "above" the other element or characteristic. Therefore, the exemplary term "below" may comprise two directions above and below. The equipment may be oriented in another manner (rotating 90 degrees or at other orientations), and the space-related descriptors used here should be correspondingly explained.

[0060] The above is the preferred embodiment of the disclosure and not intended to limit the disclosure. For those skilled in the art, the disclosure may have various modifications and variations. Any modifications, equivalent replacements, improvements and the like made within the spirit and principle of the disclosure shall fall within the scope of protection of the disclosure.

Claims

1. A combined volute blower structure, comprising a mounting plate (4) and at least two adjacent volute blowers mounted on the mounting plate (4), wherein one volute blower in the two adjacent volute blowers is provided with a middle air outlet positioned between the two adjacent volute blowers, and compared with the other volute blower, the volute blower with the middle air outlet is positioned in front in a front-back direction perpendicular to the mounting plate.

2. The combined volute blower structure as claimed in claim 1, comprising three volute blowers, wherein the three volute blowers comprise a third volute blow-

er (3), second volute blower (2) and first volute blower (1) sequentially provided from bottom to top; and the second volute blower is provided with a second volute blower air outlet blowing air upwards and/or downwards, and compared with the first volute blower (1) and the third volute blower (3), the second volute blower is positioned in front in the front-back direction.

3. The combined volute blower structure as claimed in claim 2, wherein the first volute blower (1) is provided with a first volute blower air outlet (18) blowing air upwards; the third volute blower (3) is provided with a third volute blower air outlet (39) blowing air downwards; and the second volute blower is provided with a second volute blower first air outlet (28) blowing air upwards and a second volute blower second air outlet (29) blowing air downwards.

4. The combined volute blower structure as claimed in claim 2, wherein a first blower mounting part (41), second blower mounting part (42) and third blower mounting part (43) for correspondingly mounting the first volute blower (1), the second volute blower (2) and the third volute blower (3) are provided on the mounting plate (4) respectively, wherein the second blower mounting part is provided in a manner of protruding towards the front of the mounting plate (4) relative to the first blower mounting part (41) and the third blower mounting part (43).

5. The combined volute blower structure as claimed in claim 2, wherein an inner surface of a rear wall of the second volute blower air outlet is a plane, and an extended surface of the plane is not intersected with a volute and/or volutes of the first volute blower and/or the third volute blower opposite to the second volute blower air outlet.

6. The combined volute blower structure as claimed in claim 5,wherein the second volute blower air outlet obliquely extends towards a direction far away from a volute of the second volute blower (2) in a direction from back to front.

7. The combined volute blower structure as claimed in claim 6, wherein the second volute blower is provided with a second volute blower first air outlet (28) blowing air upwards and a second volute blower second air outlet (29) blowing air downwards; an inner surface (282) of a rear wall of the second volute blower first air outlet is an inclined surface or an arched surface, and an extended surface of the inclined surface or an extended surface (2821) of a tangent surface of the arched surface is not intersected with the volute of the first volute blower (1); and an inner surface (292) of a rear wall of the second volute blower second air outlet is an inclined surface or an arched surface, and an extended surface of the inclined surface or an extended surface (2921) of a tangent surface of the arched surface is not intersected with the volute of the third volute blower (3).

8. The combined volute blower structure as claimed in claim 7, wherein
a first flow guide part (280) parallel to the mounting plate (4) is provided at least on a front wall of a third air outlet (28) of a bidirectional volute blower; and/or a second flow guide part (290) parallel to the mounting plate (4) is provided at least on a front wall of a fourth air outlet (29) of the bidirectional volute blower.

9. The combined volute blower structure as claimed in claim 8, wherein the first flow guide part (280) is a sleeve extending upwards, and the second flow guide part (290) is a sleeve extending downwards.

10. A vertical air conditioner, comprising a housing, the housing being provided with a top air outlet positioned in the top and a bottom air outlet positioned in the bottom; also comprising a main body air duct provided in the housing, the main body air duct being communicated with the top air outlet and the bottom air outlet respectively; and further comprising the combined volute blower structure as claimed in any one of claims 1-9, wherein the combined volute blower structure is provided in the housing, and supplies air to the top air outlet and/or the bottom air outlet through the main body air duct.

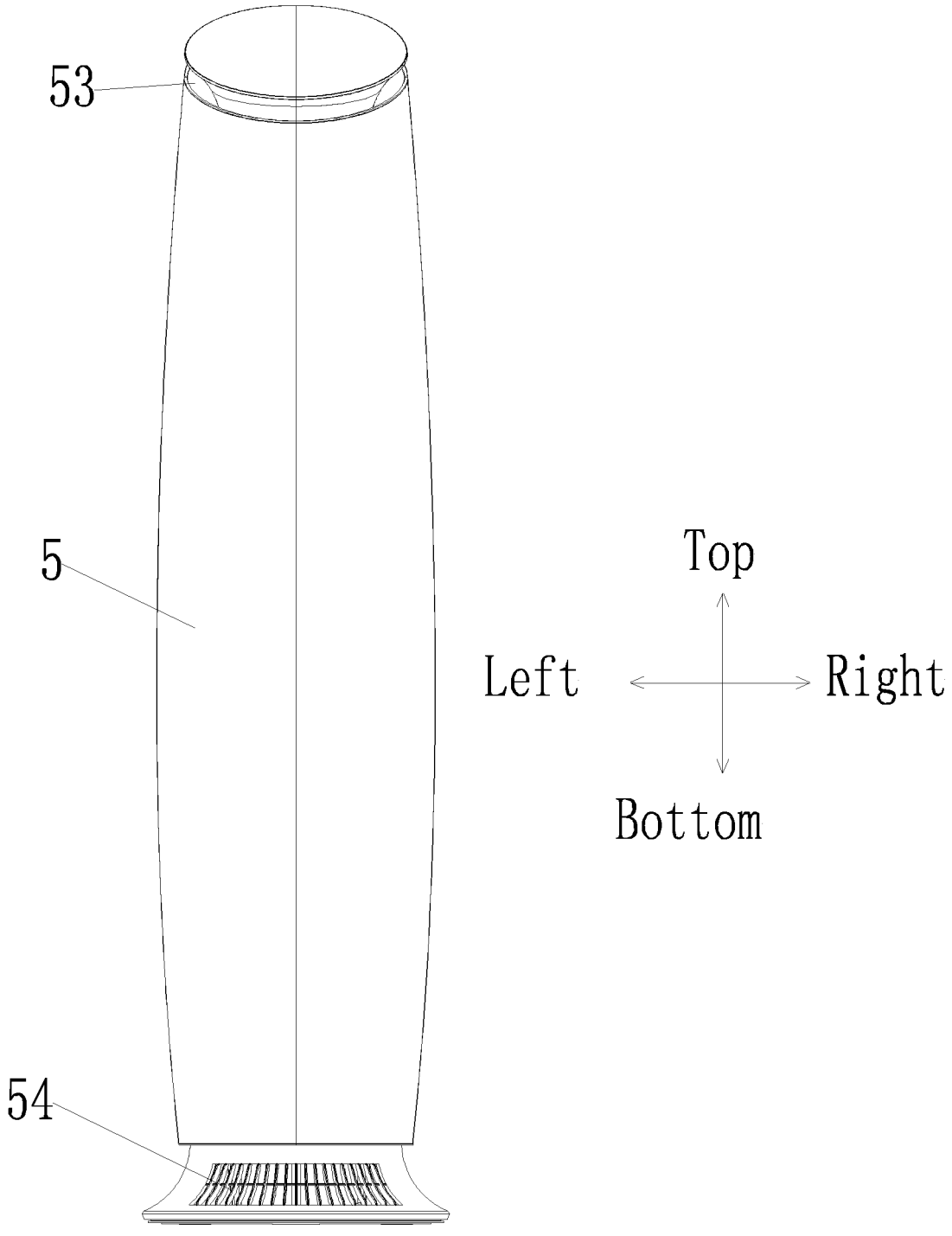

Fig. 1

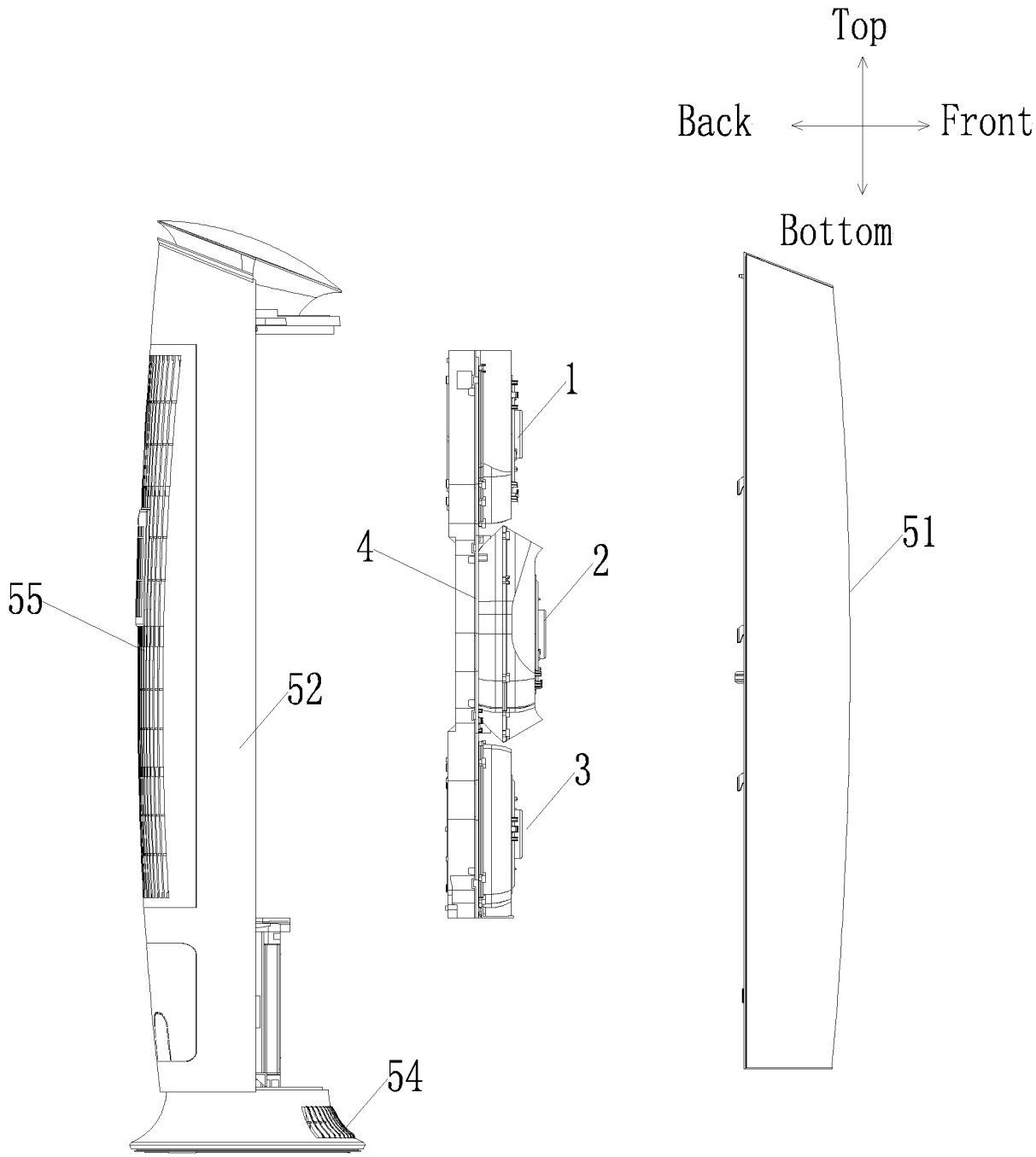

Fig. 2

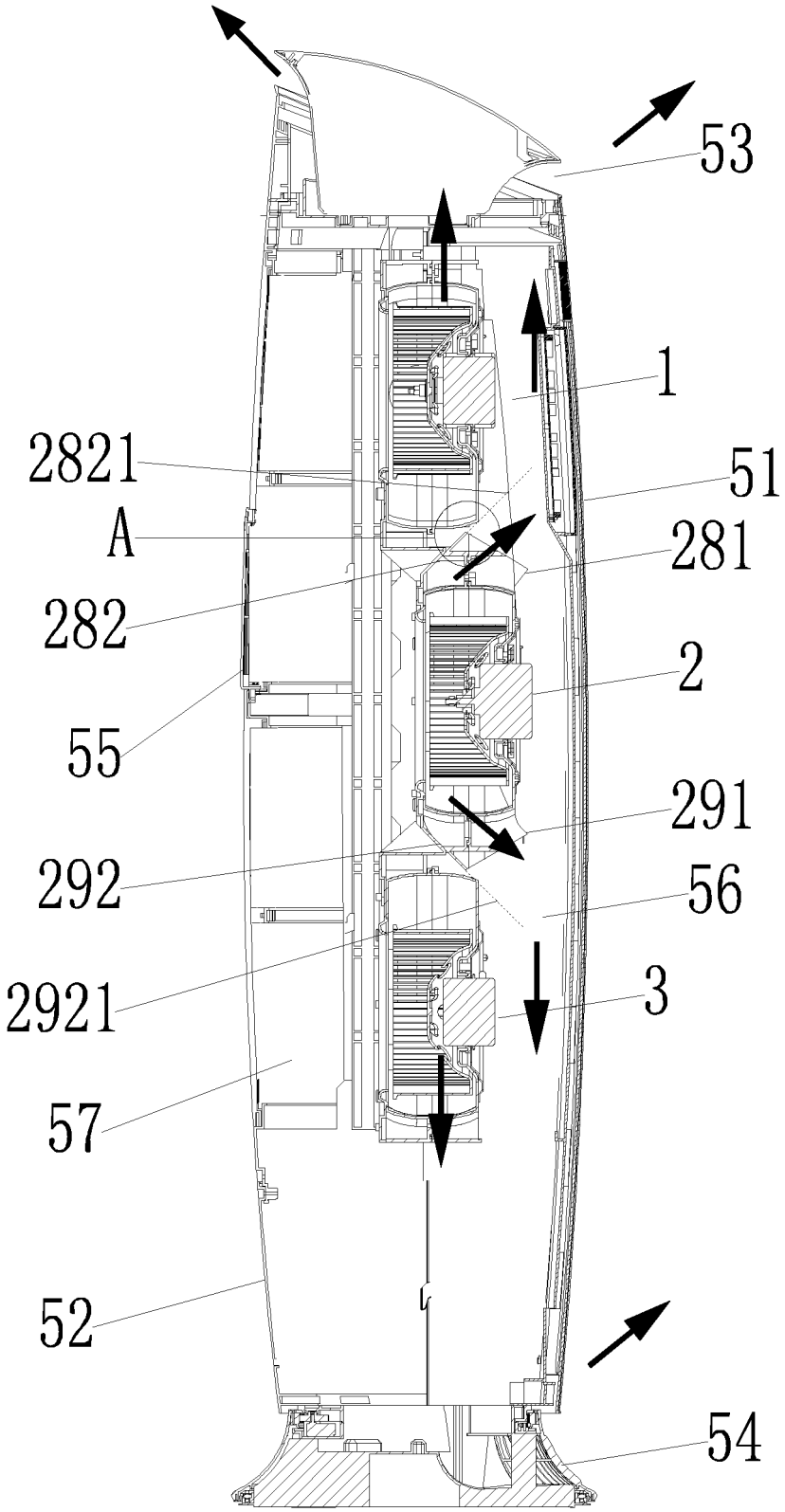

Fig. 3A

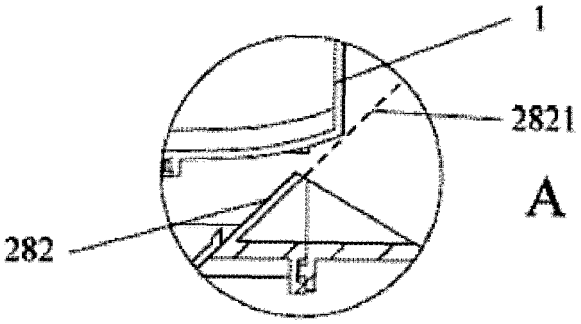

Fig. 4

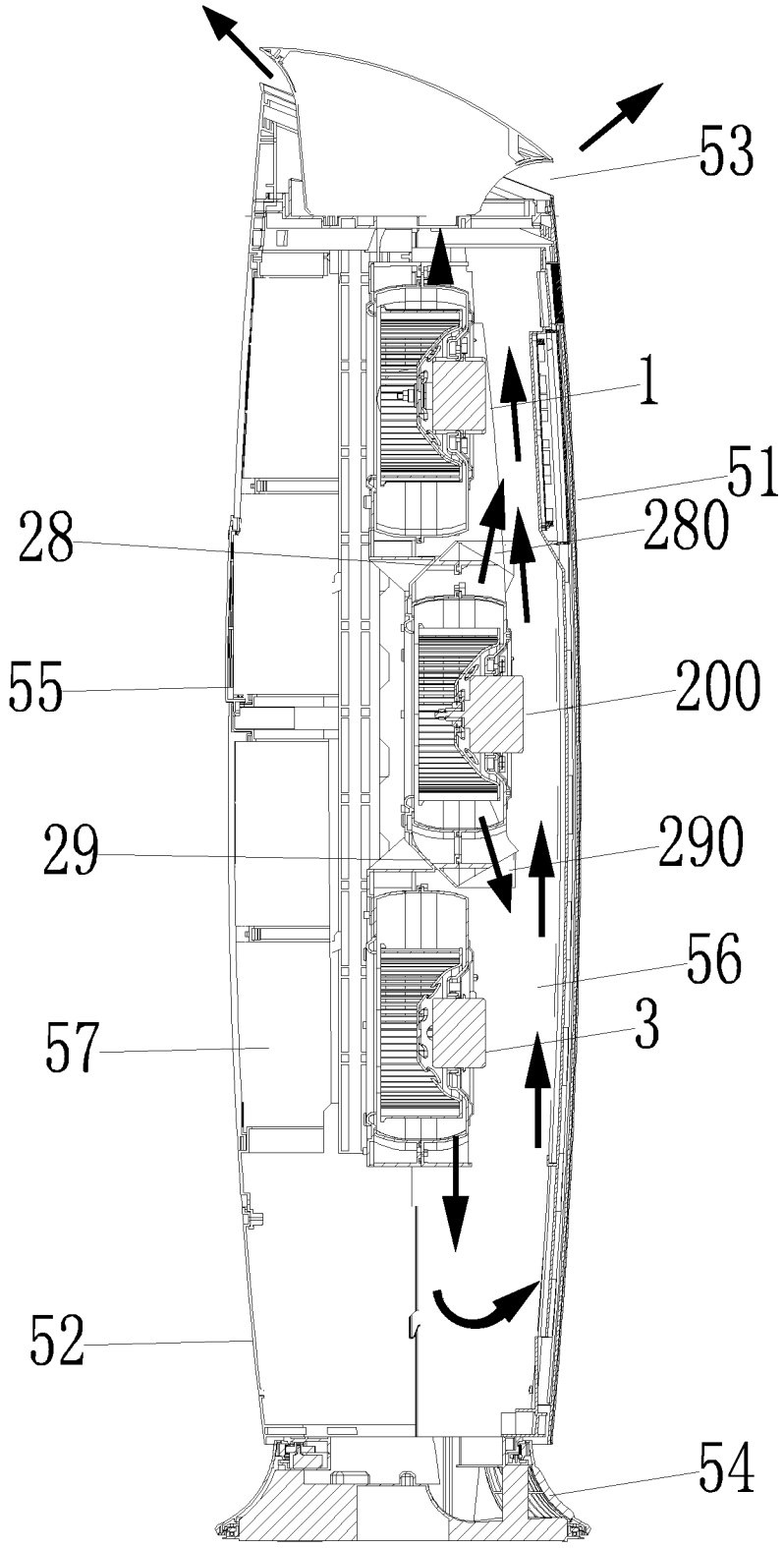

Fig. 3B

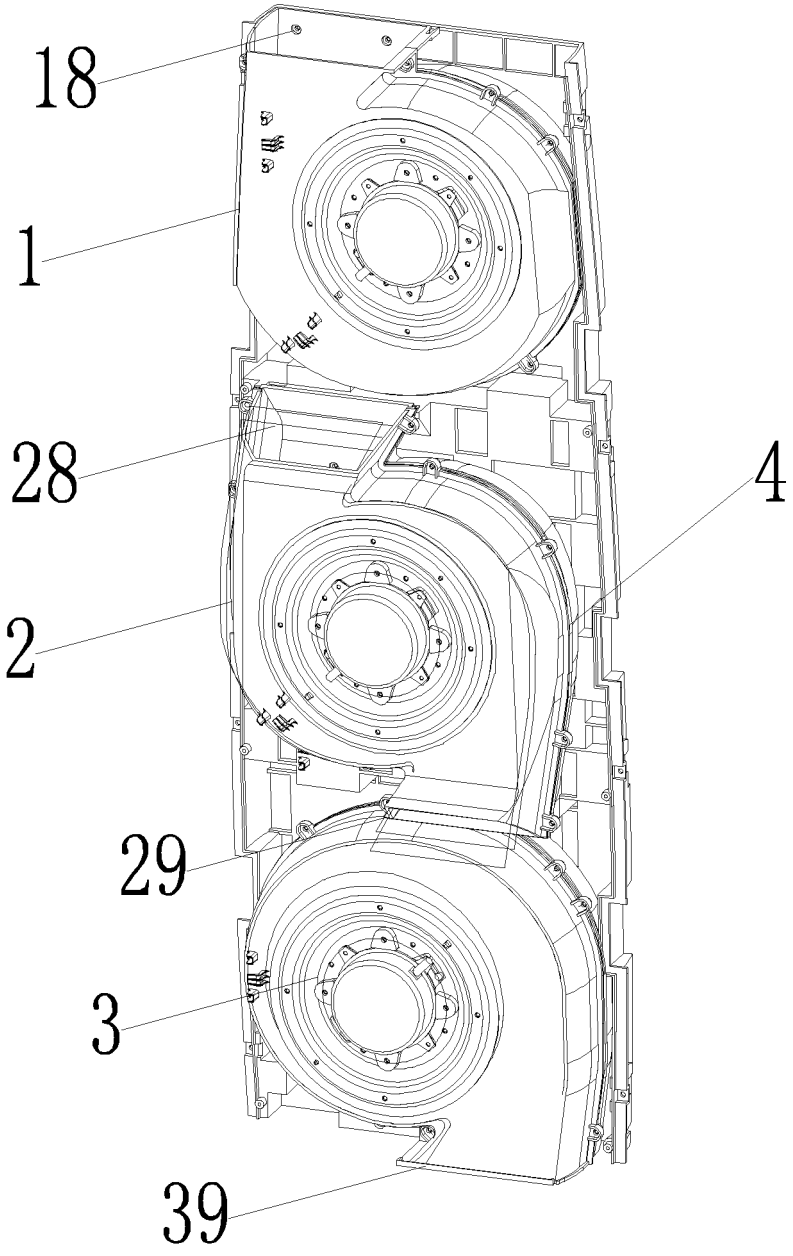

Fig. 5

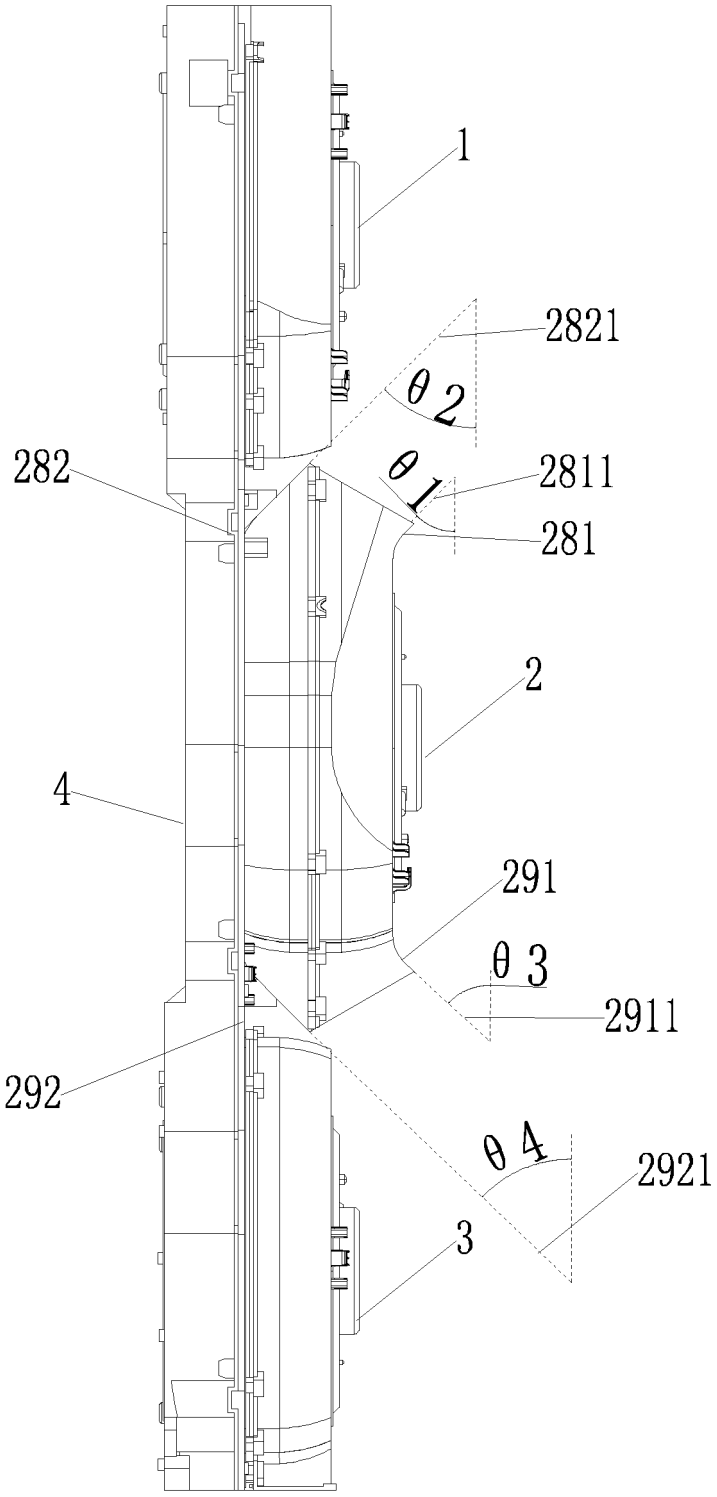

Fig. 6

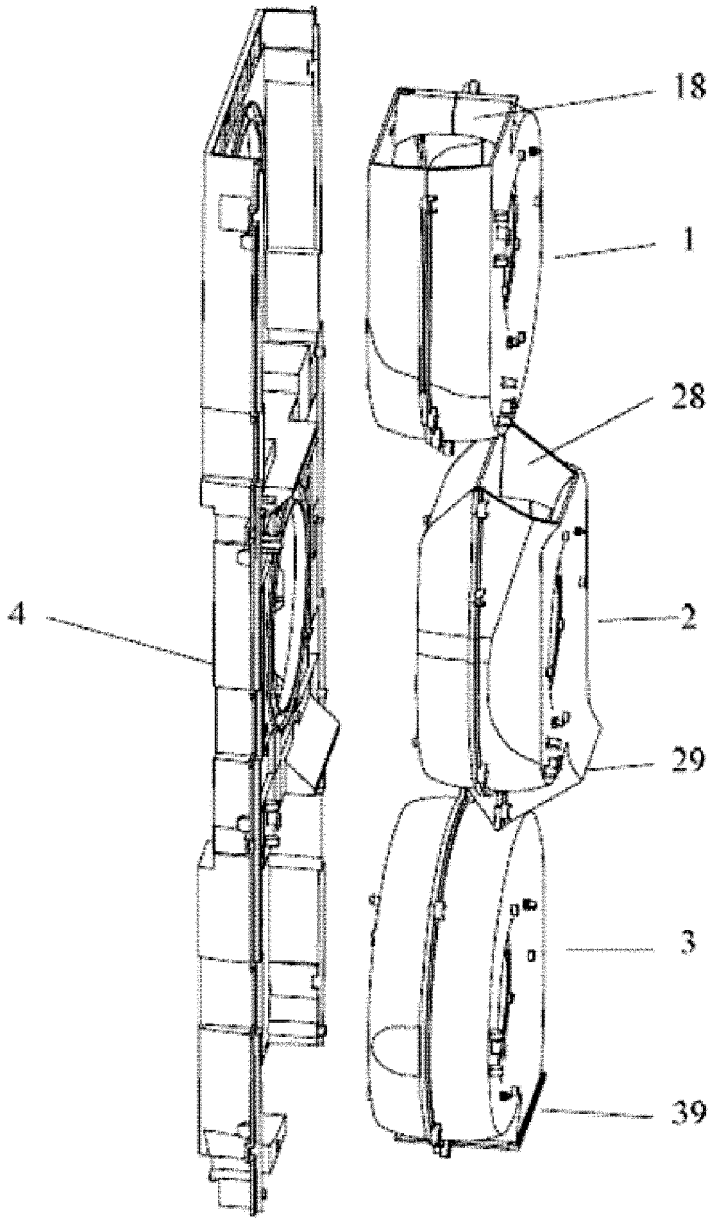

Fig. 7

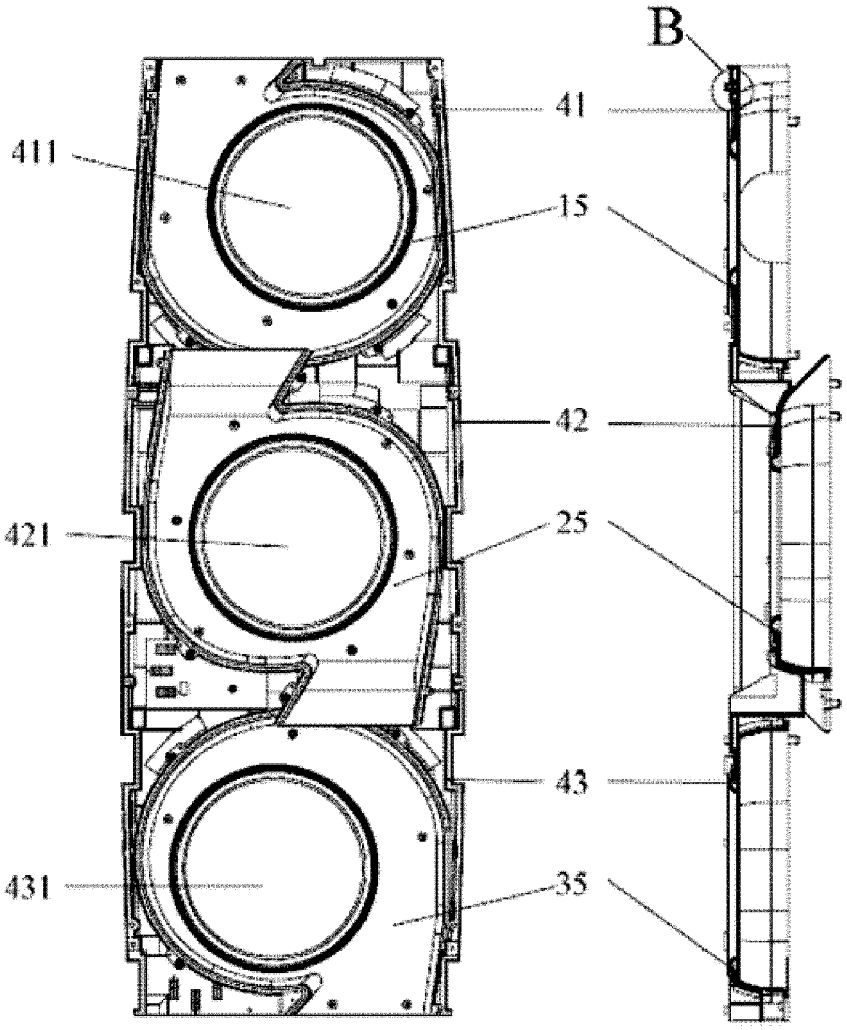

Fig. 8

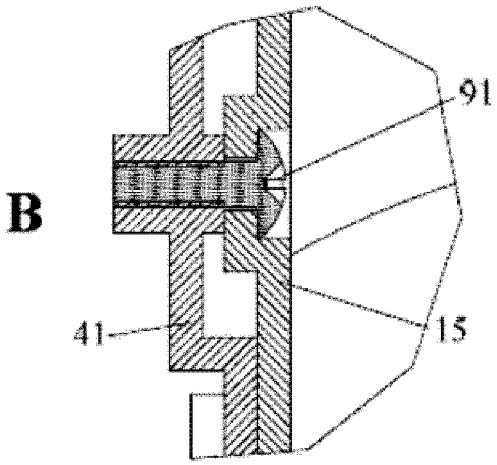

Fig. 8B

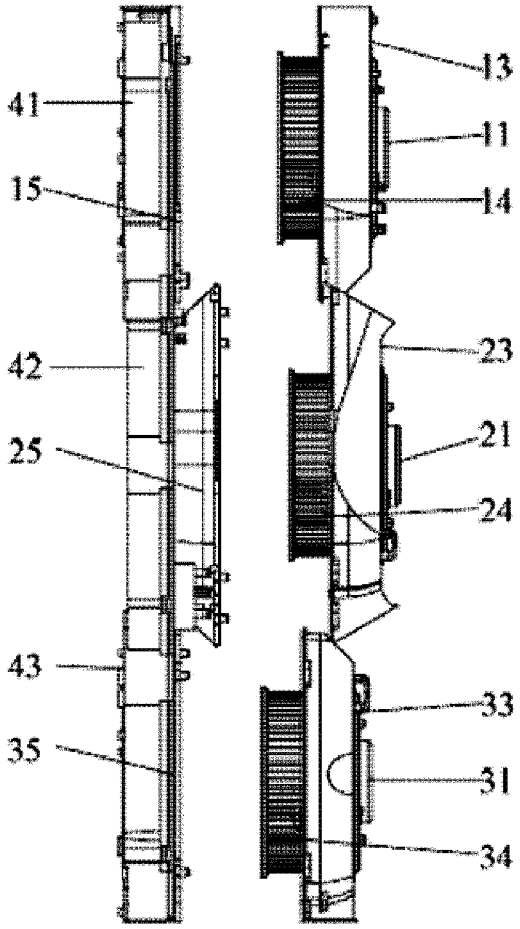

Fig. 9

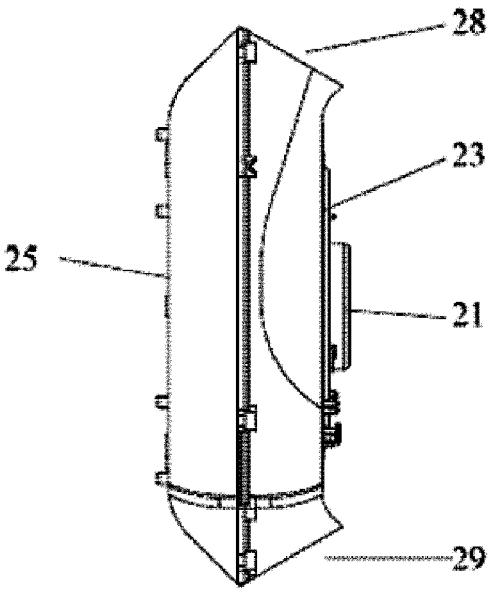

Fig. 10

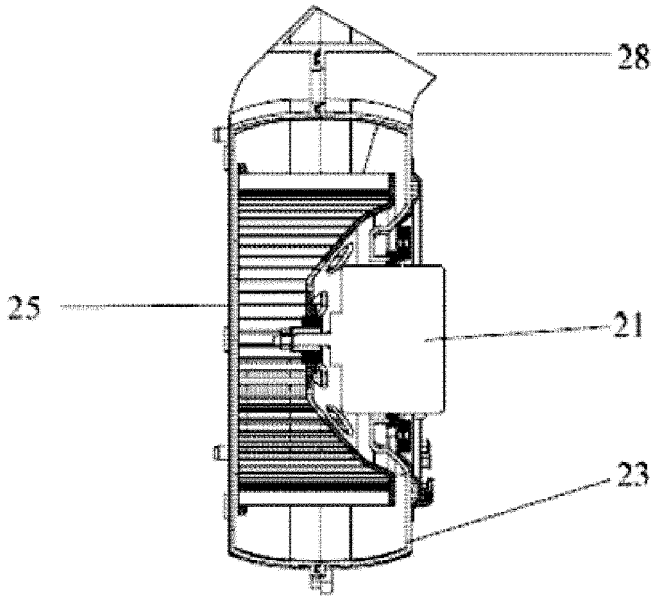

Fig. 11

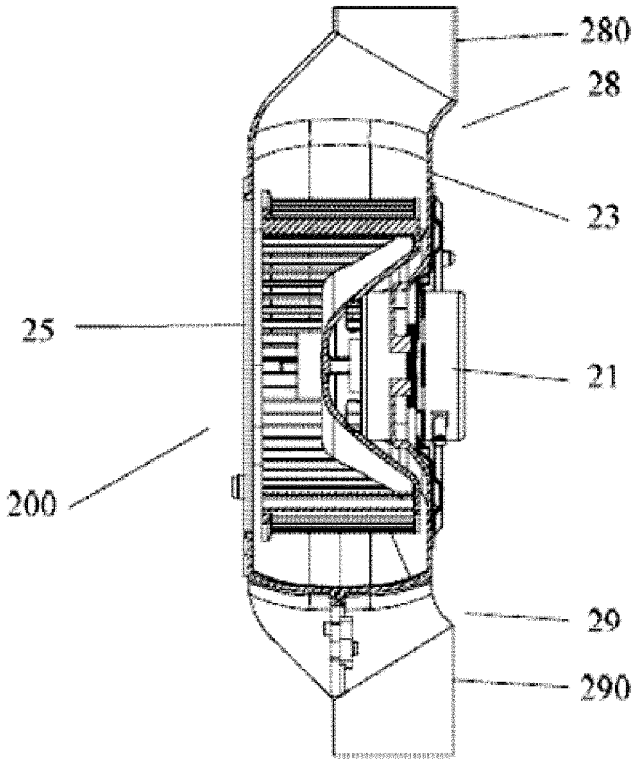

Fig. 12

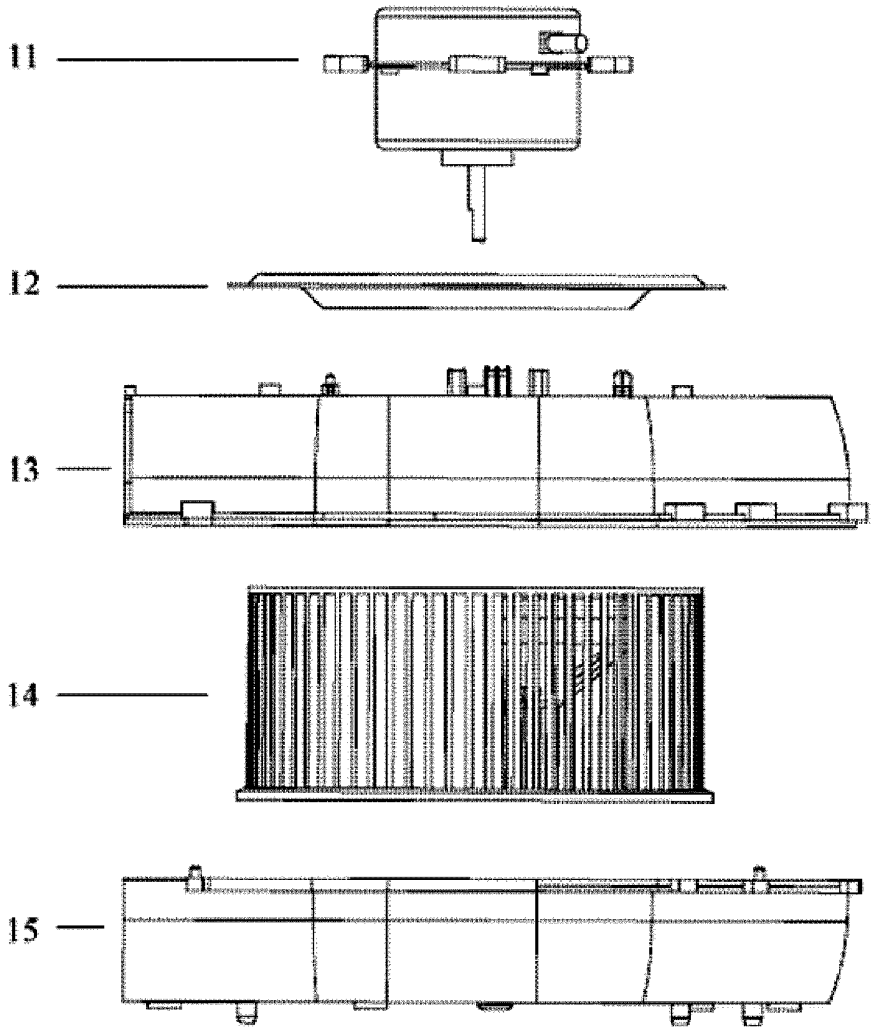

Fig. 13

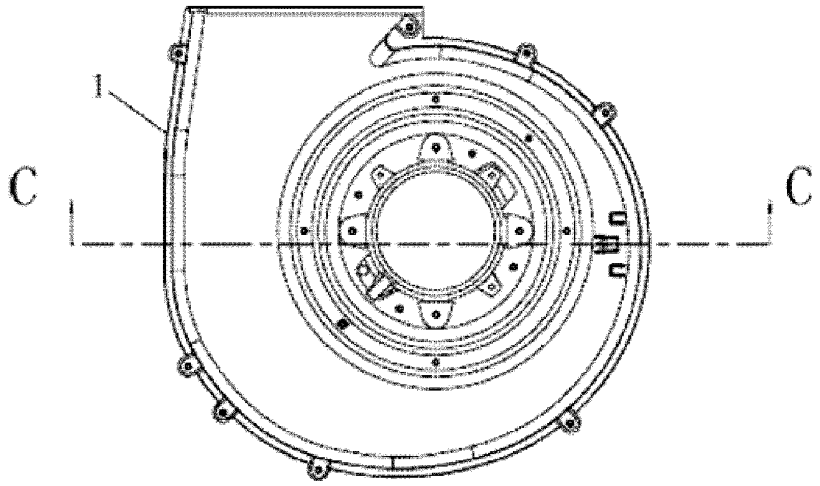

Fig. 14

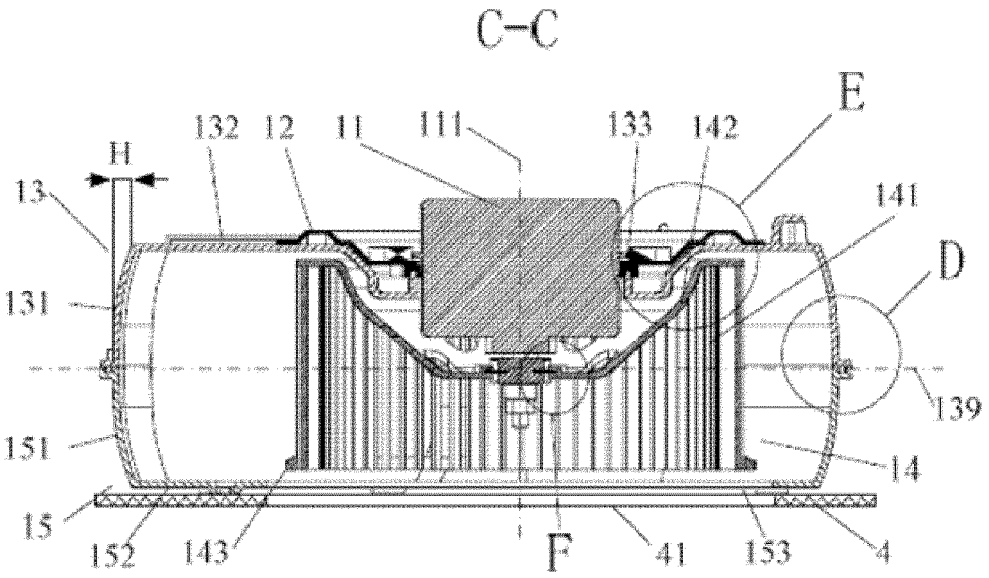
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Fig. 15

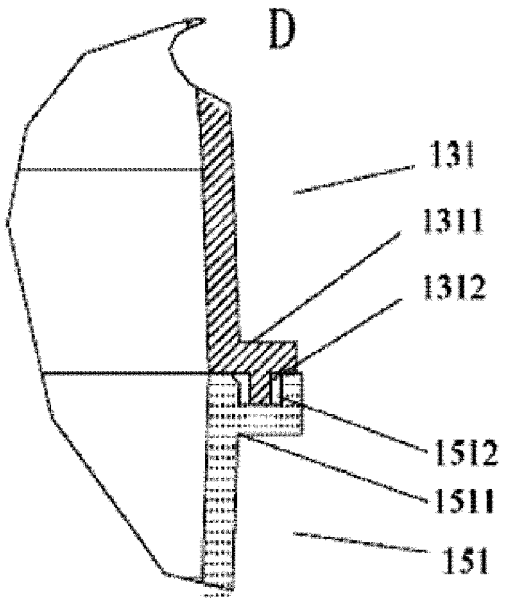
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Fig. 16

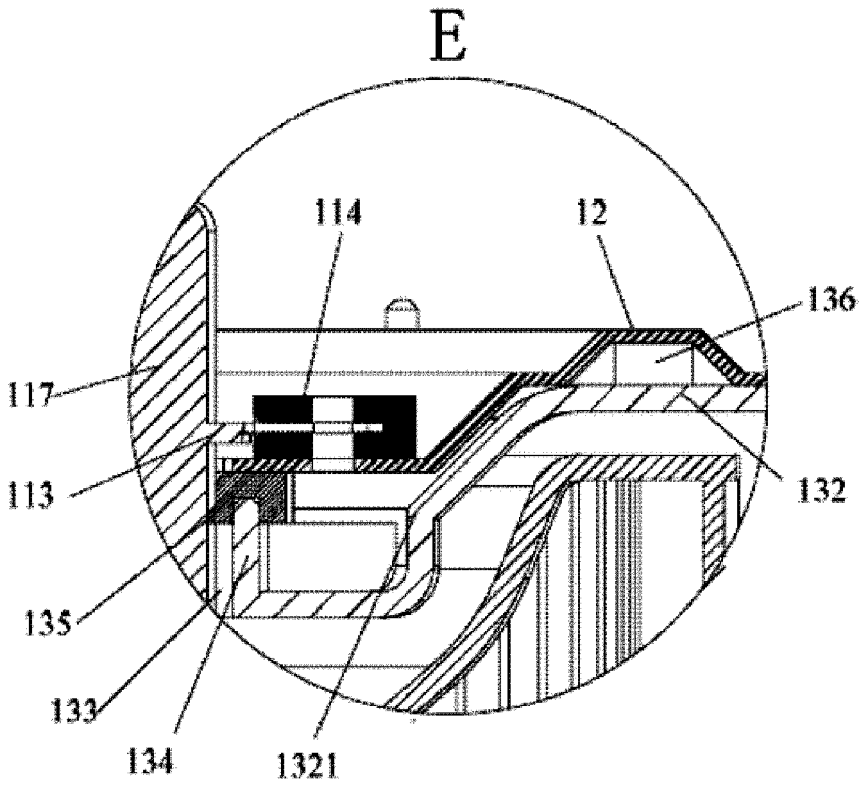

Fig. 17

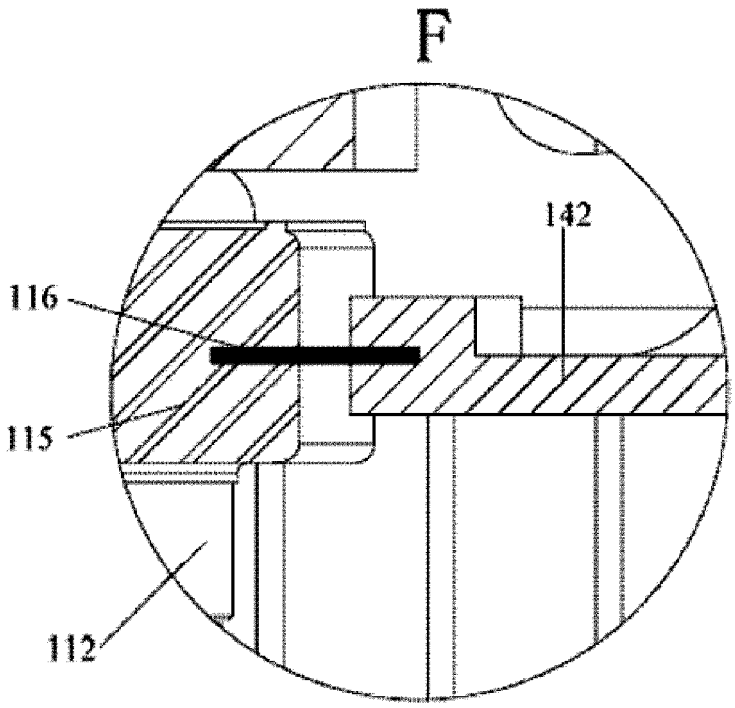

Fig. 18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2016/098213

A. CLASSIFICATION OF SUBJECT MATTER

F04D 25/08 (2006.01) i; F04D 25/16 (2006.01) i; F04D 29/42 (2006.01) i; F04D 29/44 (2006.01) i; F04D 29/66 (2006.01) i; F24F 1/00 (2011.01) 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)

F04D, 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)

CNABS; SIPOABS; CNTXT; VEN: volute, dislocation, stagger, scroll, fan, incline, disturb+, offset, protrus+, tower

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011308777 A1 (BERGQUIST TORRINGTON CO. et al.), 22 December 2011 (22.12.2011), description, paragraph 0031, and figure 6	1, 10
PX	CN 105156345 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI), 16 December 2015 (16.12.2015), claims 1-10, and figures 1-18	1-10
PX	CN 105156344 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI), 16 December 2015 (16.12.2015), description, paragraphs 0046-0087, and figures 1-18	1-10
PX	CN 105179273 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI), 23 December 2015 (23.12.2015), description, paragraphs 0046-0086, and figures 1-18	1-10
PX	CN 205089654 U (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI), 16 March 2016 (16.03.2016), description, paragraphs 0046-0086, and figures 1-18	1-10
PX	CN 205047467 U (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI), 24 February 2016 (24.02.2016), description, paragraphs 0046-0086, and figures 1-18	1-10
PX	CN 205047468 U (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI), 24 February 2016 (24.02.2016), description, paragraphs 0046-0086, and figures 1-18	1-10

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

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"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

"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

"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

"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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 November 2016 (17.11.2016)	**08 December 2016 (08.12.2016)**
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 **CHEN, Lili** Telephone No.: (86-10) **62085258**

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2016/098213

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 101813096 A (LG ELECTRONICS (TIANJIN) APPLIANCES CO., LTD.), 25 August 2010 (25.08.2010), the whole document	1-10
A	CN 104612990 A (ZHEJIANG SCI-TECH UNIVERSITY), 13 May 2015 (13.05.2015), the whole document	1-10
A	US 6830433 B2 (KAZ INC.), 14 December 2004 (14.12.2004), the whole document	1-10
A	CN 101929712 A (LG ELECTRONICS (TIANJIN) APPLIANCES CO., LTD.), 29 December 2010 (29.12.2010), the whole document	1-10
A	US 7059826 B2 (LASKO HOLDINGS INC.), 13 June 2006 (13.06.2006), the whole document	1-10

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2016/098213

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US 2011308777 A1	22 December 2011	WO 2011160047 A1	22 December 2011
		DE 112011102067 T5	02 May 2013
CN 105156345 A	16 December 2015	None	
CN 105156344 A	16 December 2015	None	
CN 105179273 A	23 December 2015	None	
CN 205089654 U	16 March 2016	None	
CN 205047467 U	24 February 2016	None	
CN 205047468 U	24 February 2016	None	
CN 101813096 A	25 August 2010	None	
CN 104612990 A	13 May 2015	None	
US 6830433 B2	14 December 2004	US 2004022631 A1	05 February 2004
CN 101929712 A	29 December 2010	None	
US 7059826 B2	13 June 2006	US 2005019155 A1	27 January 2005

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 201510579470 **[0001]**