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(54) **FAN MOTOR STRUCTURE**

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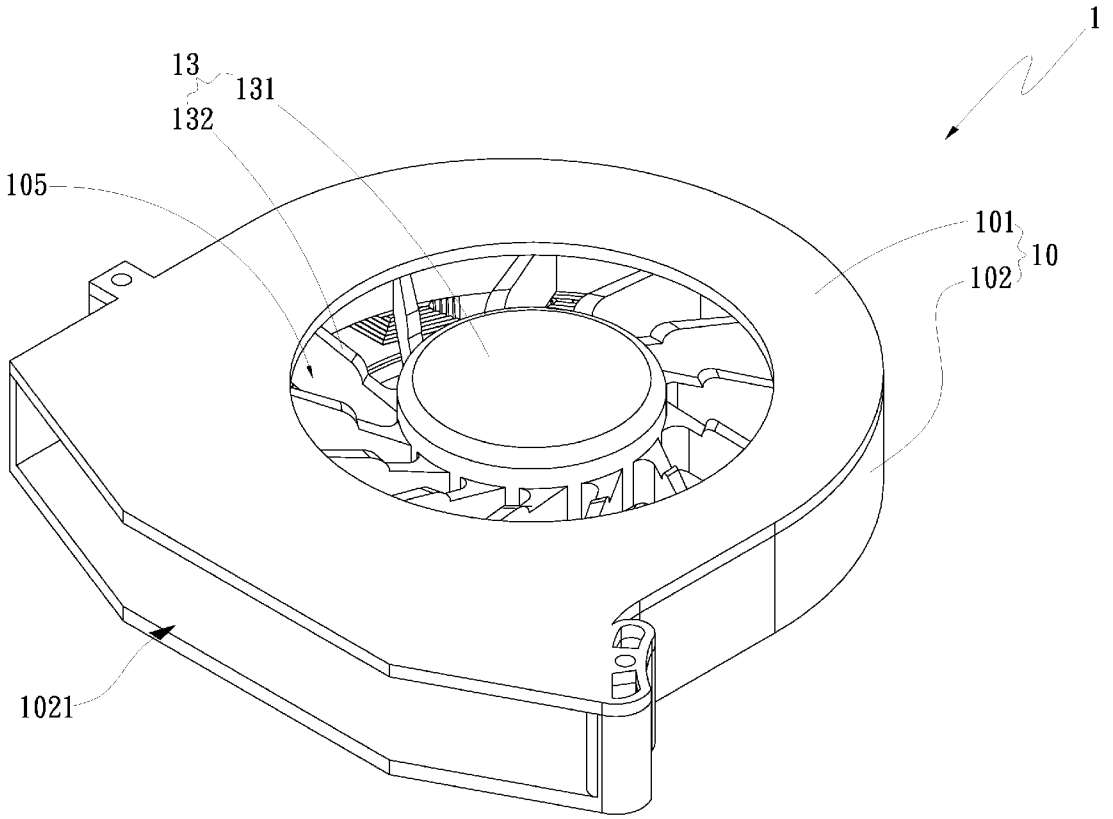
(57) **ABSTRACT**

A fan motor structure includes a fan frame, a rotor, at least one magnetic element, and a stator. The fan frame includes a frame body and a frame cover that are closed to each other to define a receiving space between them; and a shaft seat mounted on a bottom of the frame body to locate in the receiving space. The rotor includes a hub rotatably connected to the shaft seat, and a plurality of blades outward extended from an outer surface of the hub. The magnetic element is connected to each of the blades in a continuous manner or in a discontinuous manner. The stator is arranged in the receiving space between a bottom of the frame body and the blades. With the fan motor structure, a fan can have increased air intake, produce more air flows and be assembled with reduced time and labor.



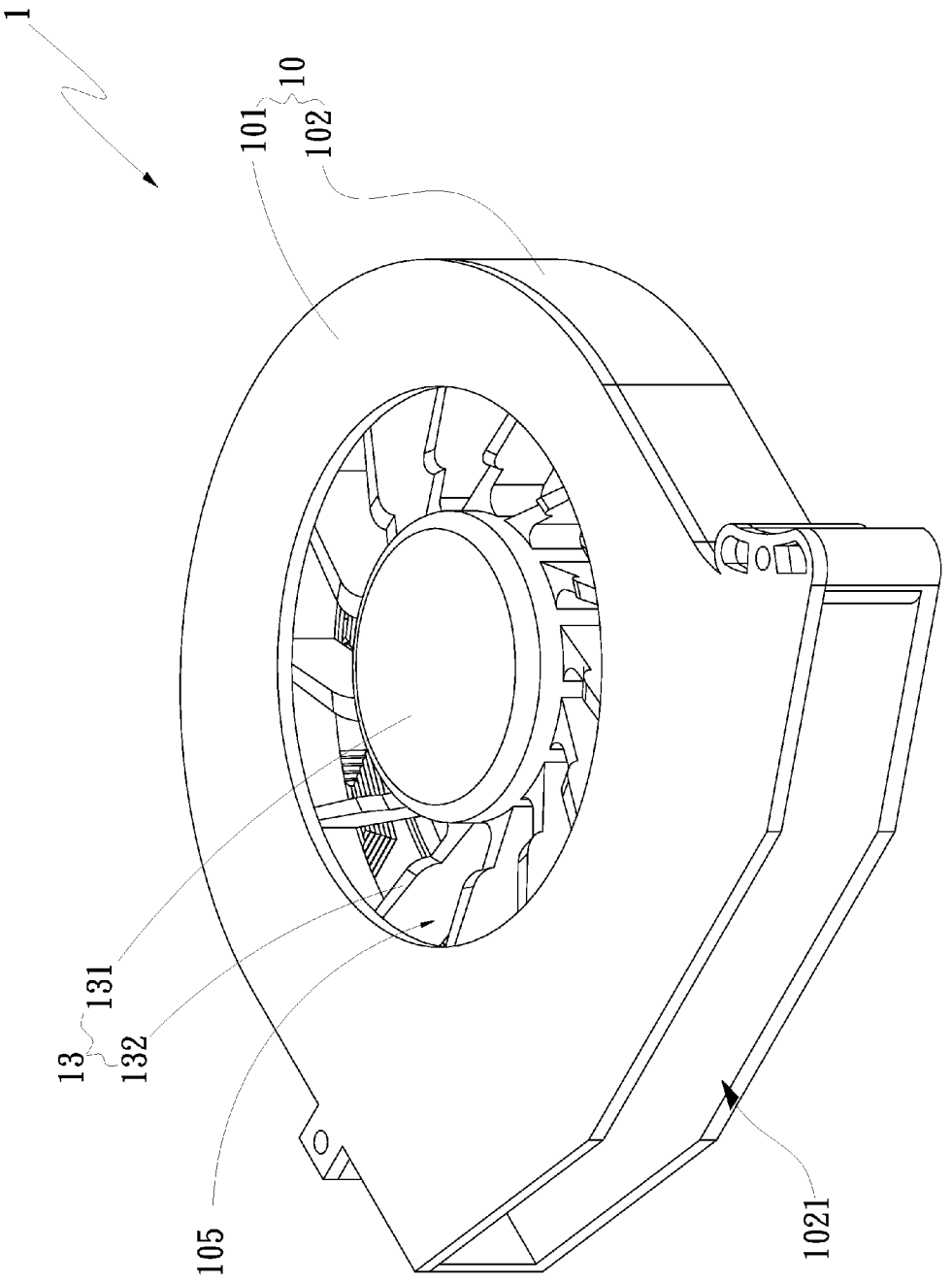


Fig. 1

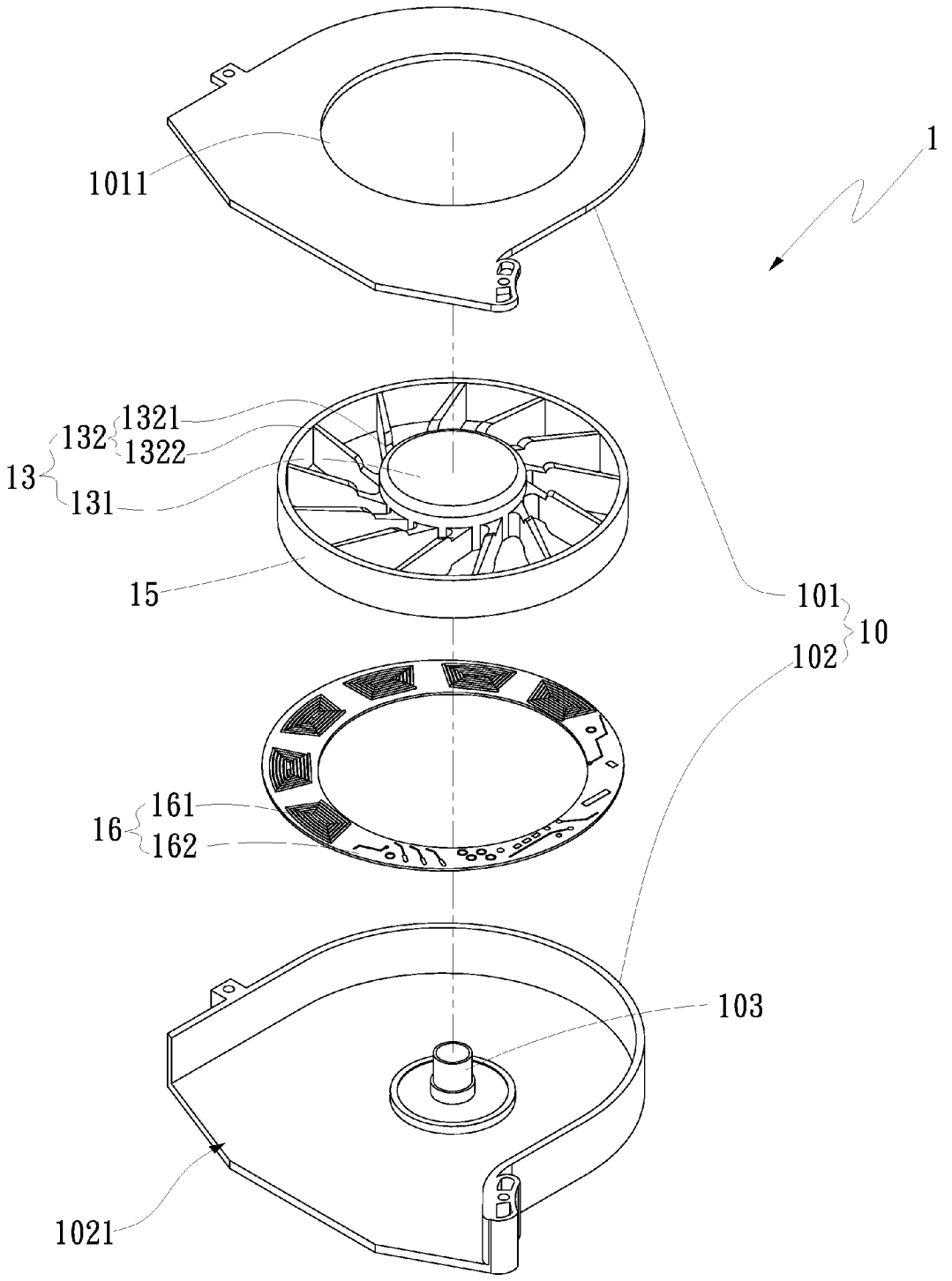


Fig. 2

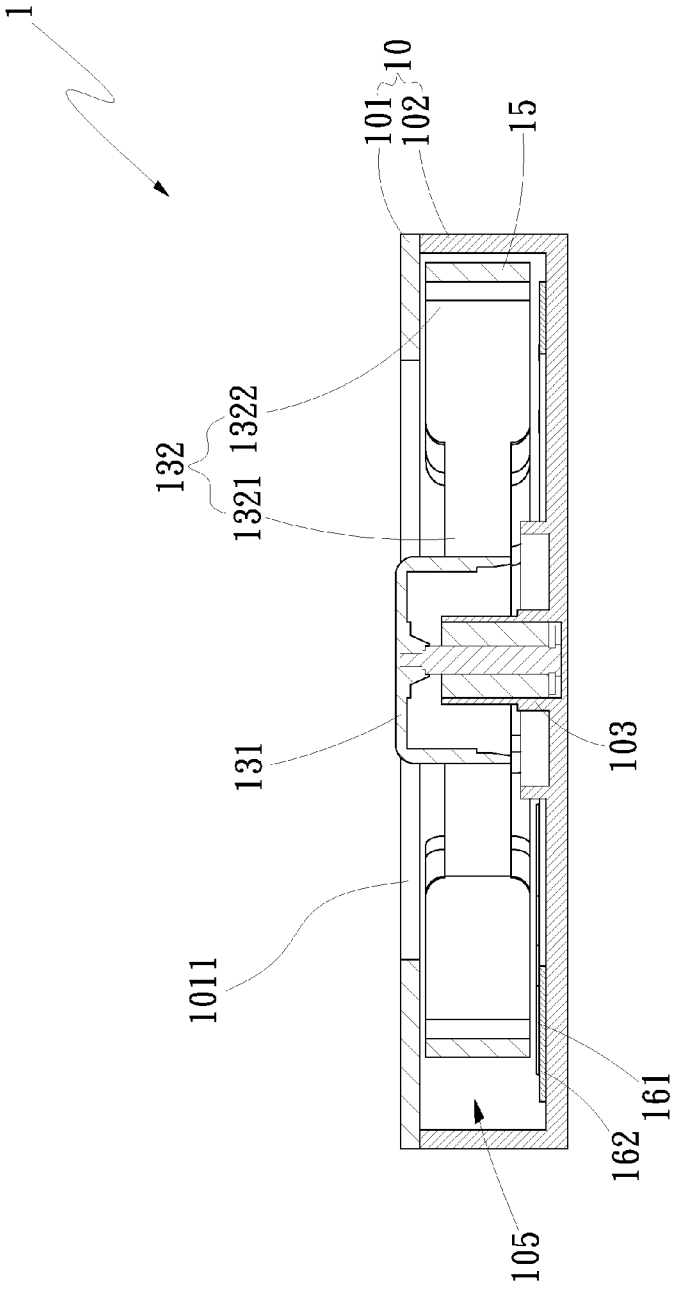


Fig. 3

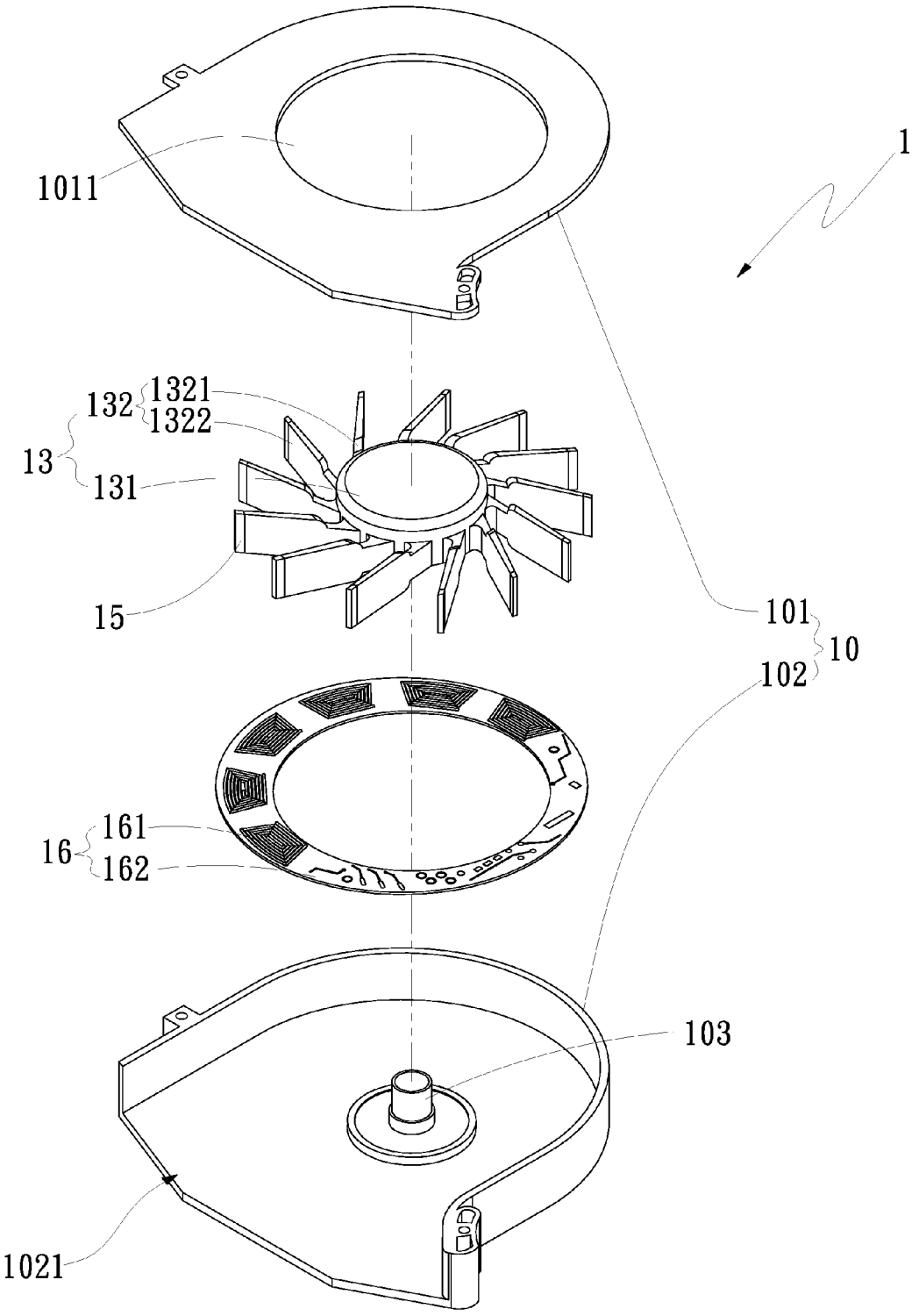


Fig. 4

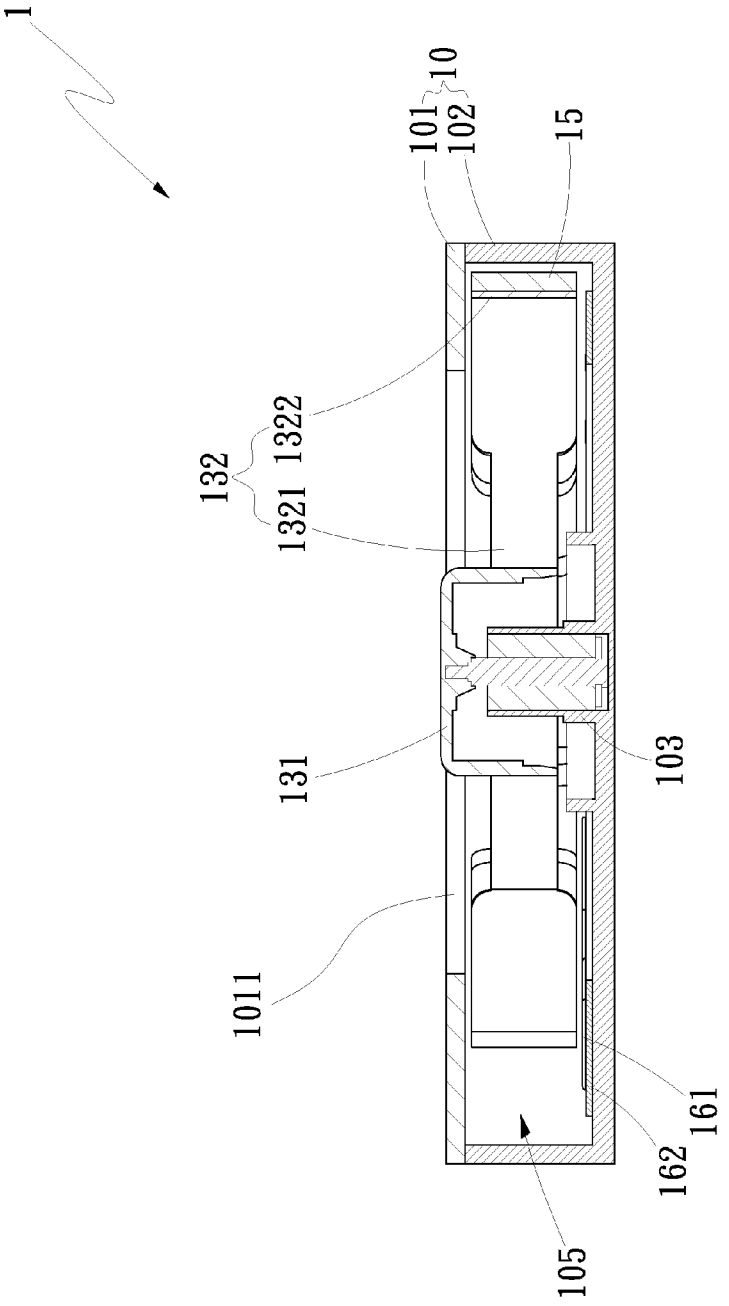


Fig. 5

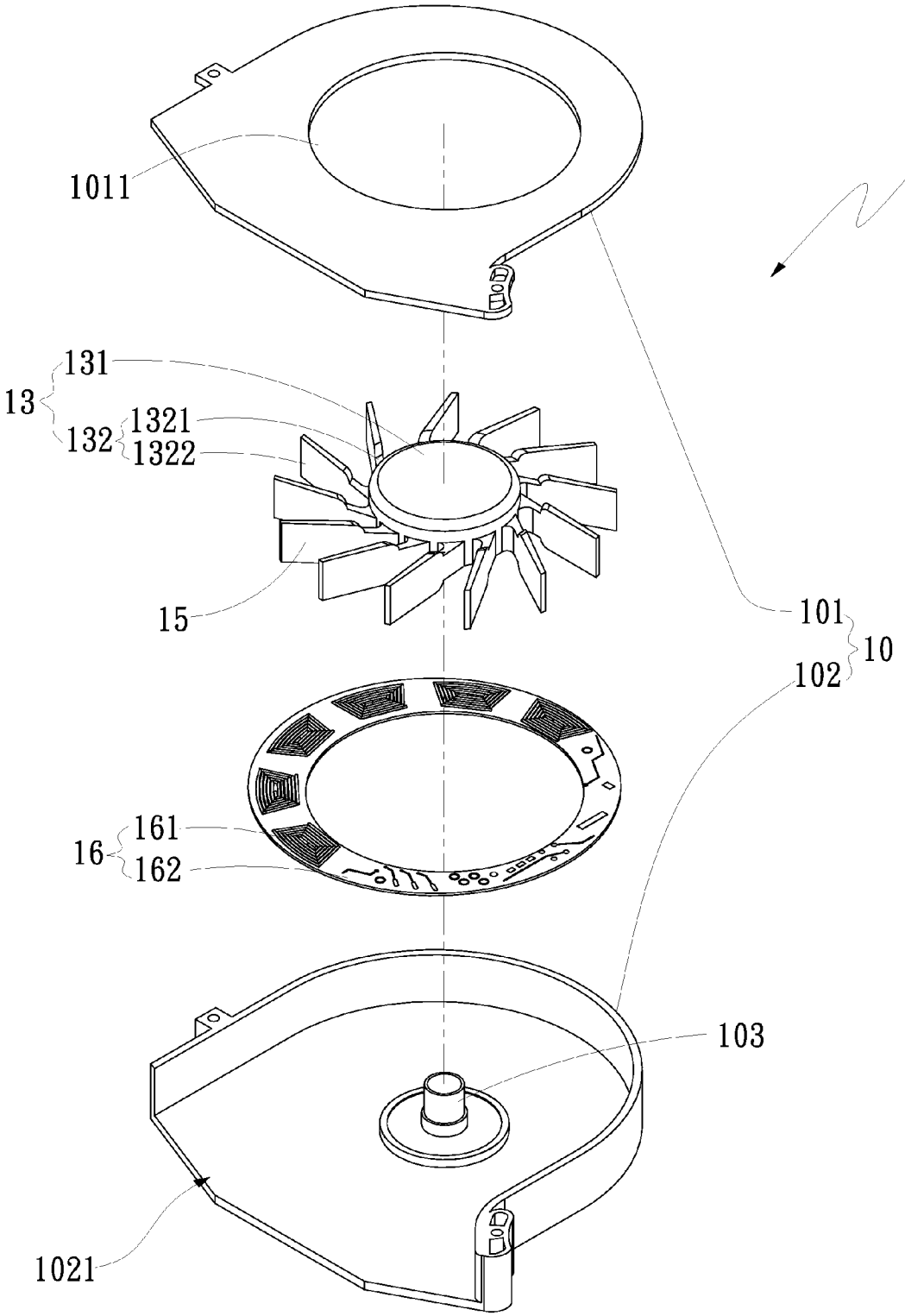


Fig. 6

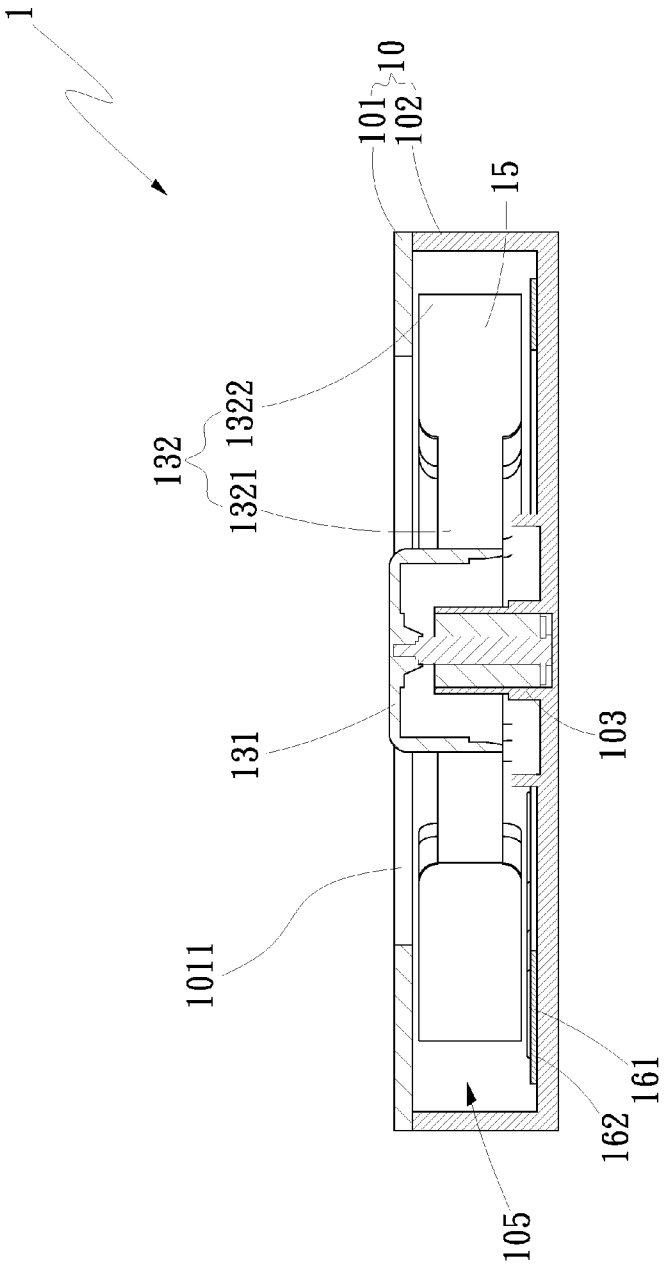


Fig. 7

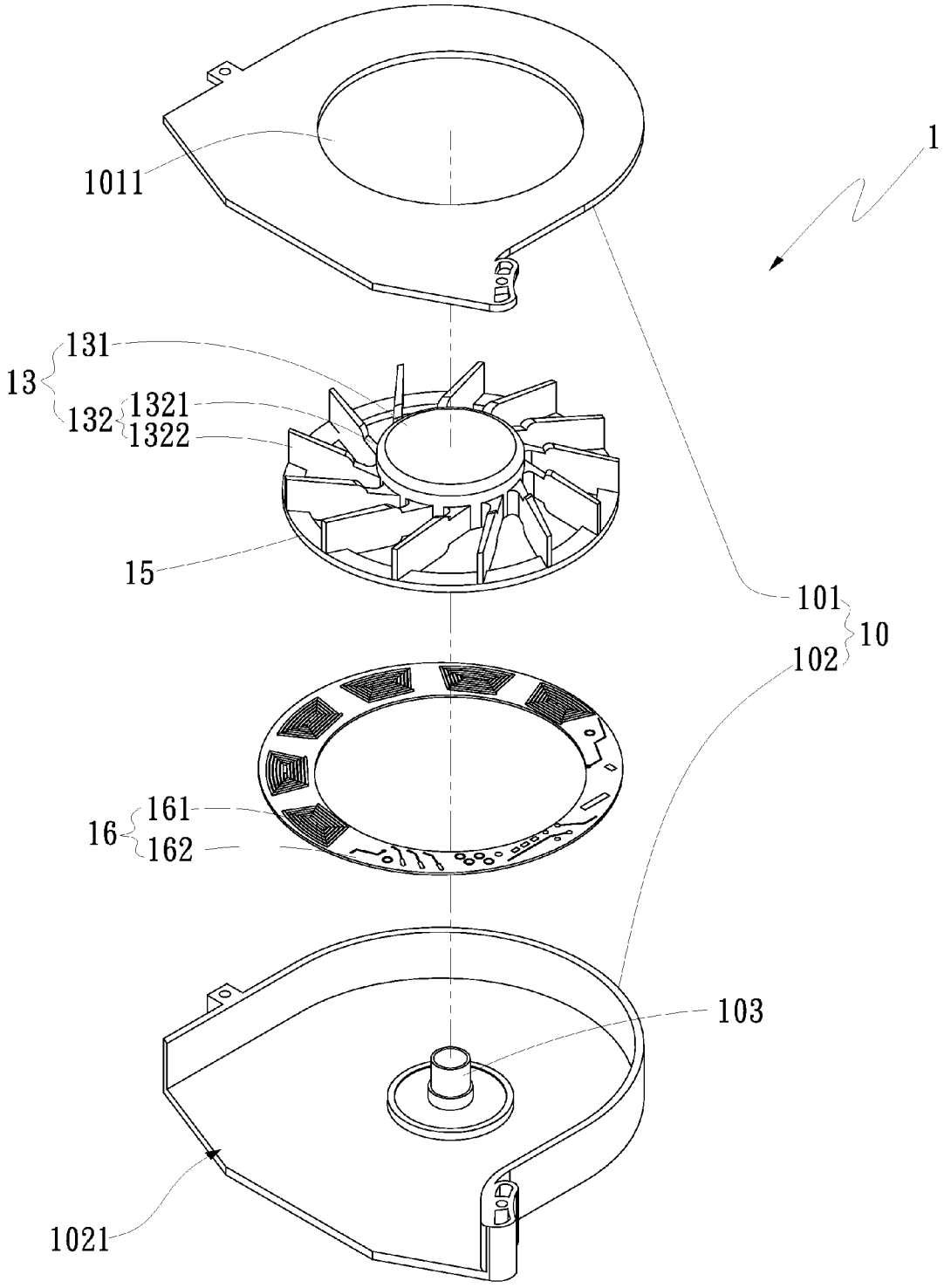


Fig. 8

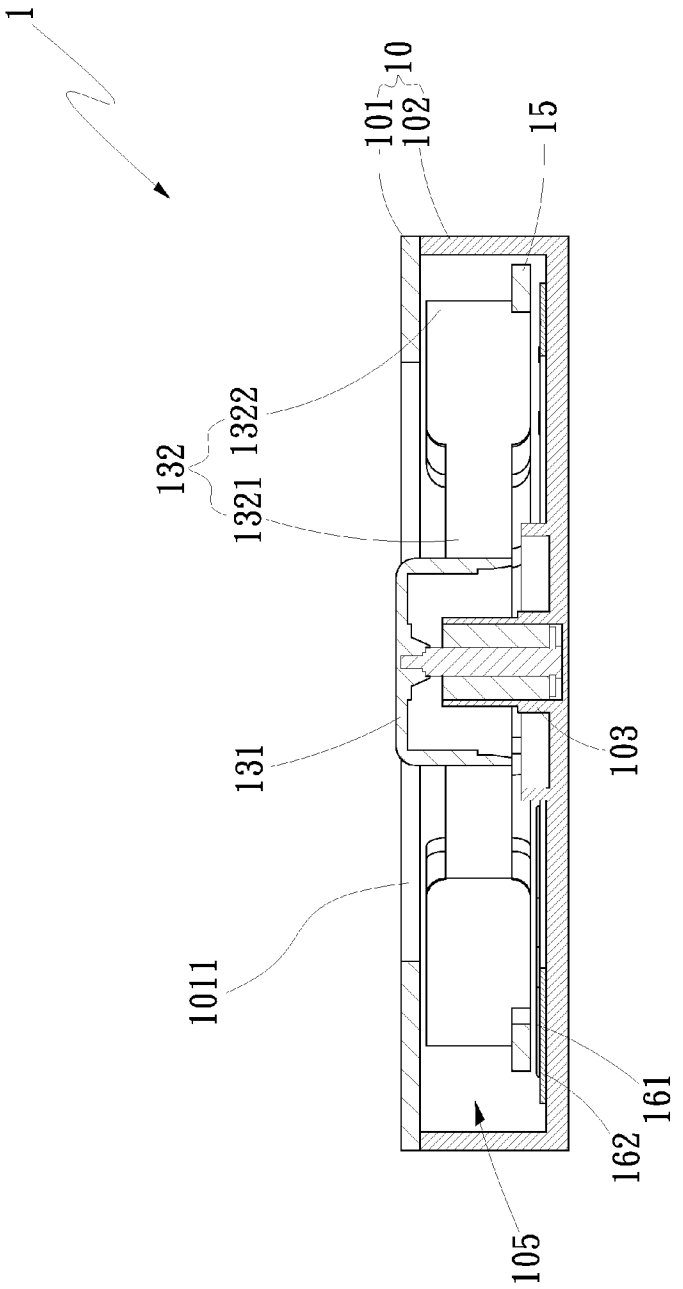


Fig. 9

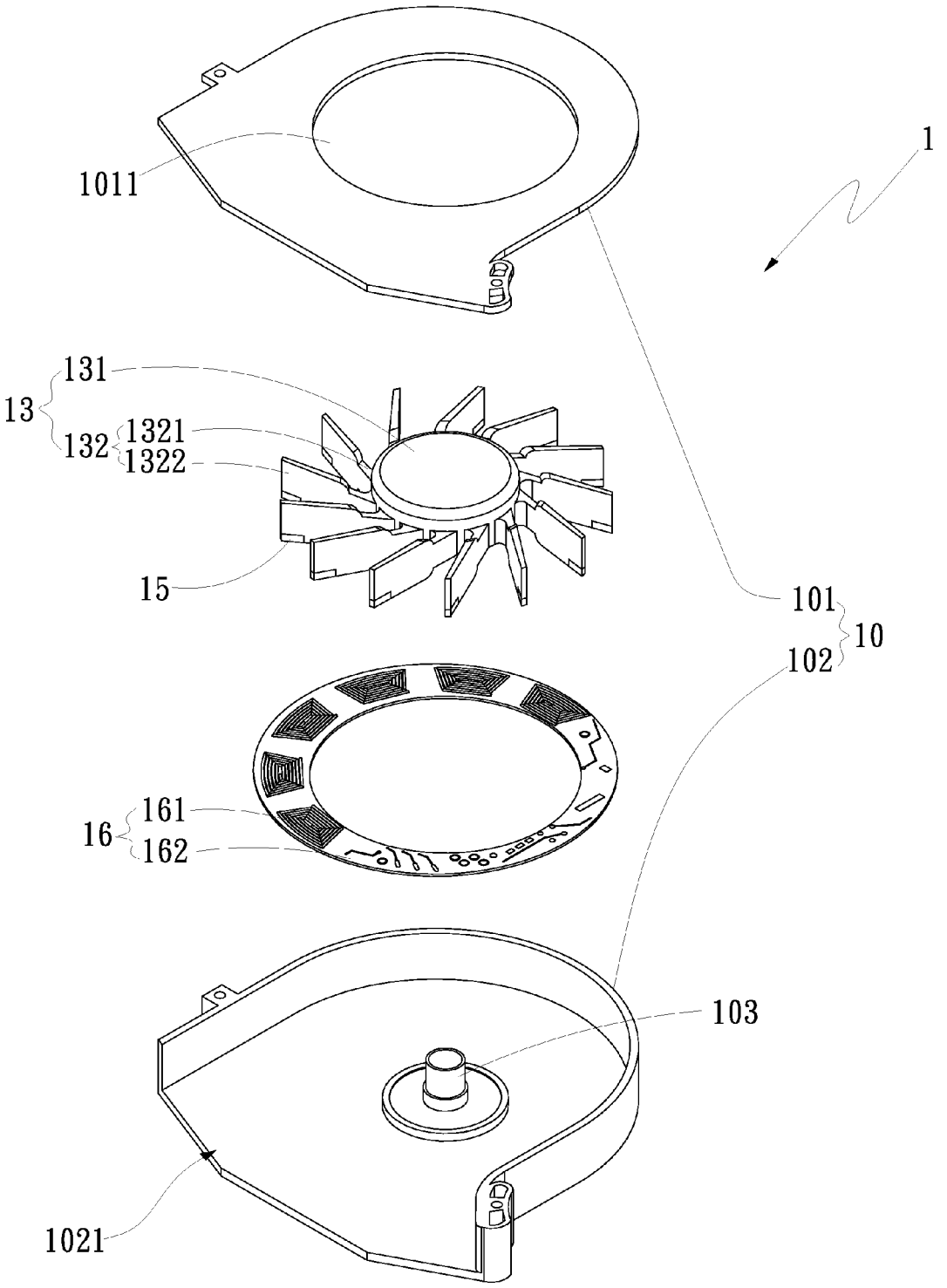


Fig. 10

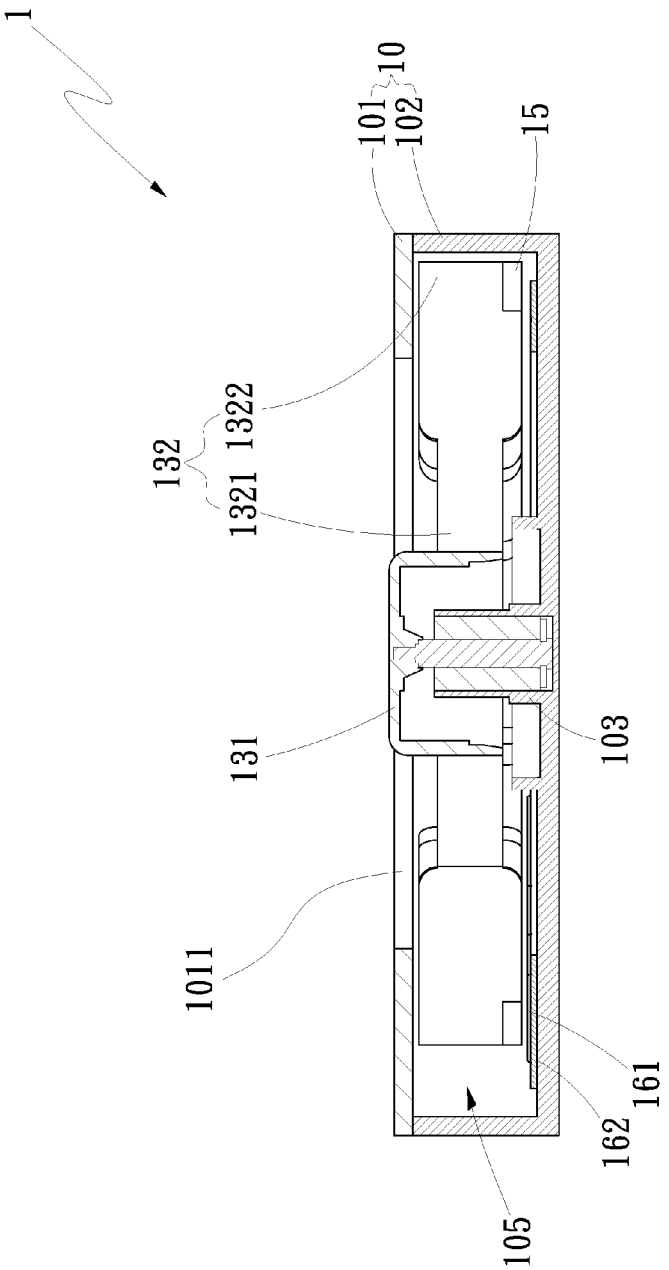


Fig. 11

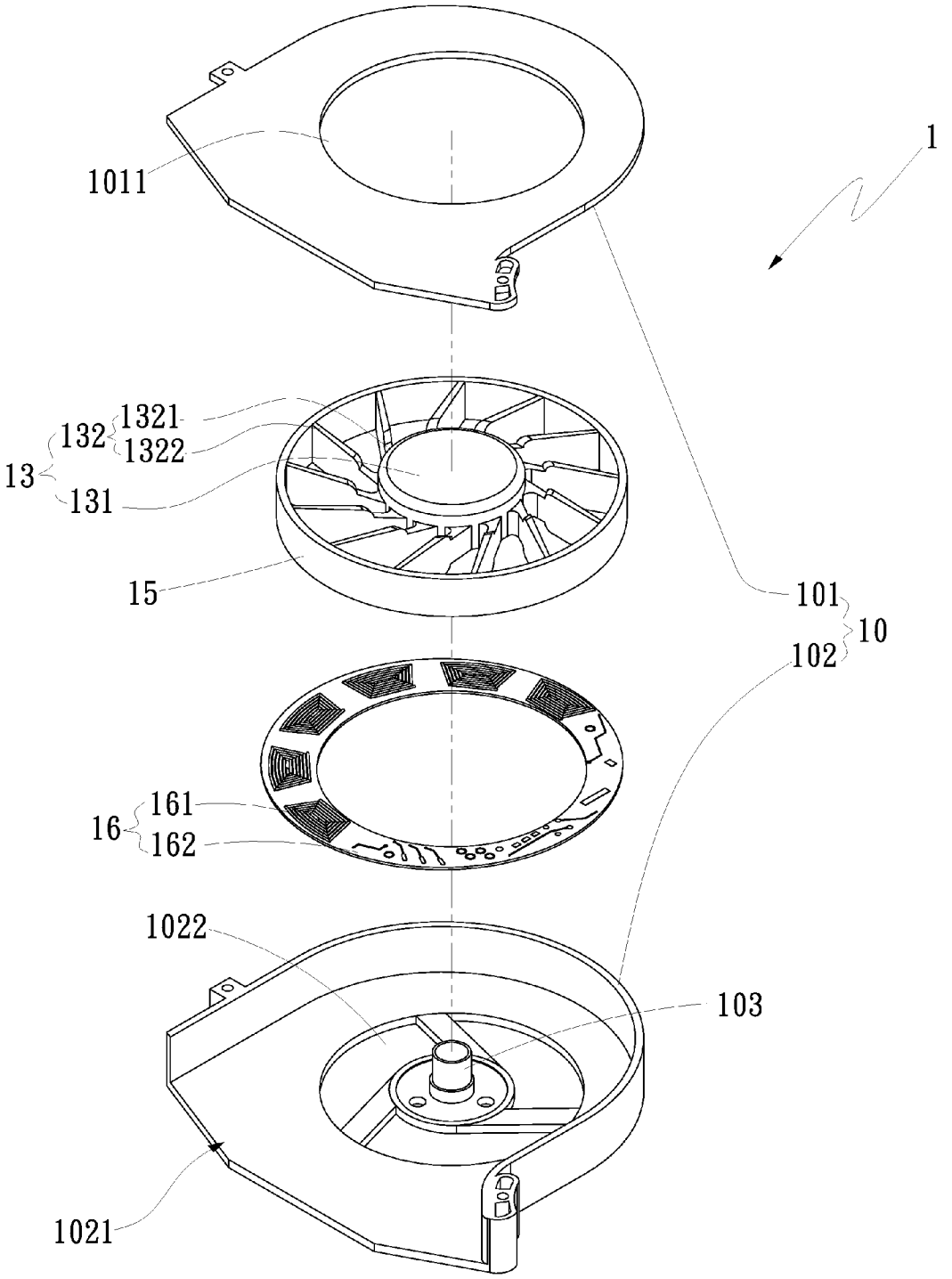

1
1011
1321
132
1322
13
131
15
101
10
102
161
16
162
1022
103
1021

Fig. 12

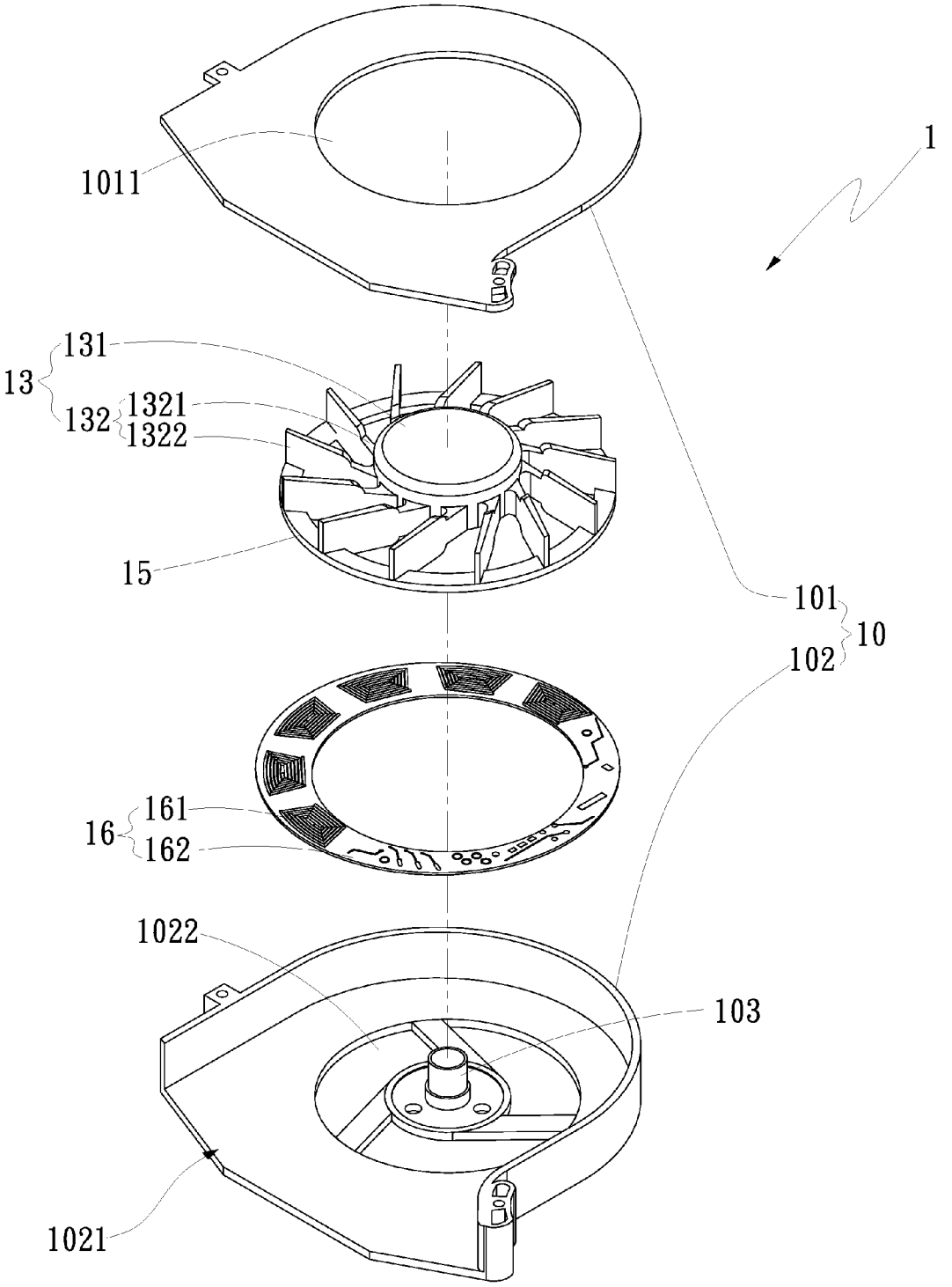

1
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Fig. 13

FAN MOTOR STRUCTURE

FIELD OF THE INVENTION

[0001] The present invention relates to a fan motor structure, and more particularly to a fan motor structure that enables a thin fan to produce more air flows and be assembled with reduced time and labor.

BACKGROUND OF THE INVENTION

[0002] The currently available electronic products, such as notebook computers, have more and more reduced dimensions, particularly the largely reduced thickness thereof. In response to the slim type electronic products, the fans for removing the heat produced by the electronic products must also have reduced thickness.

[0003] A conventional thin fan mainly includes a fan frame, a bearing cup, a stator fitted around the bearing cup, and a rotor having a hub and a plurality of blades. The hub of the rotor is rotatably connected to the bearing cup, and the stator is located at an inner side of the hub. Therefore, in manufacturing the fan, the hub of the rotor must have an inner diameter larger than an outer diameter of the stator for the stator to locate in the hub. As a result, the area of an air inlet provided on the fan frame is sacrificed, i.e. the air inlet is reduced in area, and the air volume that can be drawn into the fan frame via the air inlet is reduced. Accordingly, the air flows that can be produced to blow out of the fan via an air outlet on the fan frame are also low.

[0004] A solution for the currently available thin fan to increase the air intake volume and the produced air flows is to increase the rotational speed of the fan. While the fan with increased rotational speed can achieve the purpose of producing more air flows, the effect is low and the high rotational speed would adversely produce noise.

[0005] Moreover, at present, there is not any satisfying solution for further reducing the overall thickness of the thin fan while increasing the air intake and the produced air flows. This is because, with the conventional thin fan design, the stator must be reduced in height by decreasing the number of the silicon steel plates thereof to enable further reduced overall fan thickness. However, the stator with reduced number of silicon steel plates still has a certain degree of height, and the fan with reduced silicon steel plates can not have effectively increased rotational speed.

[0006] In brief, the prior art thin fan has the following disadvantages: (1) failing to produce increased air flows; (2) unable to have further reduced overall thickness; and (3) requiring increased time and labor to assemble.

[0007] It is therefore tried by the inventor to develop an improved fan motor structure to overcome the drawbacks in the prior art thin fan.

SUMMARY OF THE INVENTION

[0008] A primary object of the present invention is to provide a fan motor structure that enables a thin fan to produce more air flows and be assembled with reduced time and labor.

[0009] Another object of the present invention is to provide a fan motor structure that enables a thin fan to have largely reduced overall thickness.

[0010] A further object of the present invention is to provide a fan motor structure that can minimize the vibration and noise produced during fan operation.

[0011] To achieve the above and other objects, the fan motor structure according to the present invention includes a fan frame, a rotor, at least one magnetic element, and a stator. The fan frame includes a frame body and a frame cover that are closed to each other to define a receiving space between them; and a shaft seat mounted on a bottom of the frame body to center in the receiving space. The rotor includes a hub and a plurality of blades outward extended from an outer surface of the hub; and the hub is rotatably connected to the shaft seat. The magnetic element is connected to each of the blades in a continuous or a discontinuous manner. The stator is arranged in the receiving space between a bottom of the frame body and the blades to axially correspond to the magnetic element. With the above-designed fan motor structure, a fan can produce more air flows while reduce vibration and noise during operation thereof, and can have largely reduced overall thickness and be assembled with reduced time and labor.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The structure and the technical means adopted by the present invention to achieve the above and other objects can be best understood by referring to the following detailed description of the preferred embodiments and the accompanying drawings, wherein

[0013] FIG. **1** is an assembled perspective view of a fan motor structure according to the present invention;

[0014] FIG. **2** is an exploded perspective view of the fan motor structure of the present invention according to a first embodiment thereof;

[0015] FIG. **3** an assembled sectional view of FIG. **2**;

[0016] FIG. **4** is an exploded perspective view of a first variant of the fan motor structure according to the first embodiment of the present invention;

[0017] FIG. **5** is an assembled sectional view of FIG. **4**;

[0018] FIG. **6** is an exploded perspective view of a second variant of the fan motor structure according to the first embodiment of the present invention;

[0019] FIG. **7** is an assembled sectional view of FIG. **6**;

[0020] FIG. **8** is an exploded perspective view of the fan motor structure of the present invention according to a second embodiment thereof;

[0021] FIG. **9** is an assembled sectional view of FIG. **8**;

[0022] FIG. **10** is an exploded perspective view of a variant of the fan motor structure according to the second embodiment of the present invention;

[0023] FIG. **11** is an assembled sectional view of FIG. **10**;

[0024] FIG. **12** is an exploded perspective view of the fan motor structure of the present invention according to a third embodiment thereof; and

[0025] FIG. **13** is an exploded perspective view of a variant of the fan motor structure according to the third embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0026] The present invention will now be described with some preferred embodiments thereof and with reference to the accompanying drawings. For the purpose of easy to understand, elements that are the same in the preferred embodiments are denoted by the same reference numerals.

[0027] Please refer to FIGS. **1** and **2** that are assembled and exploded perspective views, respectively, of a fan motor structure **1** according to a first embodiment of the present

invention, and to FIG. **3** that is an assembled sectional view of FIG. **2**. As shown, the fan motor structure **1** according to the present invention includes a fan frame **10**, a rotor **13**, at least one magnetic element **15**, and a stator **16**. The fan frame **10** includes a frame cover **101** and a frame body **102**, which are closed to each other to together define a receiving space **105** in between them. And, a shaft seat **103** is provided on a bottom of the frame body **102**. The frame cover **101** has a first air inlet **1011** communicating with the receiving space **105**. The frame body **102** is provided at a lateral side with an air outlet **1021** communicating with the first air inlet **1011** and the receiving space **105**. The rotor **13** is received in the receiving space **105**.

[0028] The shaft seat **103** is located at a center of the receiving space **105**. That is, the shaft seat **103** is centered on the bottom of the frame body **102** to axially extend into the receiving space **105** for the rotor **13** to rotatably connect thereto.

[0029] The rotor **13** includes a hub **131** and a plurality of blades **132** outward extended from and spaced along an outer surface of the hub **131**. Each of the blades **132** has a fixed end **1321** fixedly connected to the outer surface of the hub **131**, and a free end **1322** outward extended from the fixed end **1321**. The first air inlet **1011** on the frame cover **101** has a diameter larger than that of the hub **131** to thereby provide an increased air-intake area and accordingly, enable more air to flow into the fan frame **10**.

[0030] Please refer to FIGS. **2** and **3**. The at least one magnetic element **15** is a magnet or a type of magnetic powder being provided on the blades **132**. In the illustrated first embodiment, the magnetic element **15** is a continuous magnetic annular member connected to the free ends **1322** of the blades **132** in a continuous manner. However, it is understood the present invention is not limited thereto and, in practical implementation of the present invention, a user may change the manner of associating the magnetic element **15** with the blades **132** according to actual need.

[0031] For example, in a first variant of the first embodiment of the present invention as shown in FIGS. **4** and **5**, there is more than on magnetic element **15**, and the number of the magnetic elements **15** matches that of the blades **132**. That is, the magnetic elements **15** are separately provided on the free ends **1322** of the blades **132** in a discontinuous manner. In other words, the magnetic elements **15** are integrally formed on the free ends **1322** of the blades **132** by way of injection molding.

[0032] Alternatively, in a second variant of the first embodiment of the present invention as shown in FIGS. **6** and **7**, the magnetic element **15** and the blades **132** are integrally formed by way of injection molding, so that the blades **132** are magnetic blades. Or, in a further variant of the first embodiment not shown in the drawings, the magnetic element **15**, the blades **132** and the hub **131** are integrally formed by way of injection molding to provide a magnetic rotor.

[0033] The magnetic element **15** is located axially corresponding to windings **161** on the stator **16**, so that the windings **161** can be excited via magnetic induction. With the magnetic element **15** integrally formed on the free ends **1322** of the blades **132**, the blades **132** may have enhanced structural strength to enable increased motor torque and to reduce vibration and noise due to deflection of the blades **132**.

[0034] Further, in implementing the present invention, the magnetic element **15** can be an independent element and be connected to the free ends **1322** of the blades **132** by bonding, adhering, inserting, snapping, or clamping the magnetic element **15** thereto.

[0035] As can be seen in FIGS. **2** and **3**, the stator **16** is arranged in the fan frame **10** between the bottom of the frame body **102** and the blades **132** to correspond to the magnetic element(s) **15**. The stator **16** includes the aforesaid windings **161** and a circuit board **162**. The circuit board **162** is located on the bottom of the frame body **102** of the fan frame **10** relative to the shaft seat **103**. A plurality of electronic elements (not shown) is inserted on the circuit board **162**. The electronic elements, such as capacitors, silicon-controlled rectifiers (SCRs), control chips, transistors and the like, are located on a part of the circuit board **162** on one side facing toward the frame cover **101**, and are electrically connected to the circuit board **162**. The windings **161** are wound on another part of the circuit board **162** also on the side facing toward the frame cover **101**, and are electrically connected to the circuit board **162**.

[0036] By arranging the stator **16** outside the blades **132**, i.e. in the receiving space **105** instead of in the hub **131**, the diameter of the hub **131** can be reduced to minimize the space between the shaft seat **103** and the hub **131**. As a result, the space or the air-intake area defined by the first air inlet **1011** can be increased correspondingly to allow more air to flow into the fan frame **10** via the first air inlet **1011**.

[0037] With the design of the fan motor structure **1** of the present invention, the blades **132** may have increased structural strength, the volume of produced air flows can be increased, the motor torque and the motor operation stability can be upgraded, and the vibration and noise produced during the fan operation can be minimized.

[0038] In manufacturing the fan motor structure **1** of the present invention, since the stator **16** is arranged in the fan frame **10** between the bottom of the frame body **101** and the blades **132**, a user may adjust the height of the shaft seat **103** and of the hub **131** according to the required overall fan thickness, so as to obtain an optimal thin fan and achieve the effects of minimized assembling time and labor, easy production and lowered manufacturing cost.

[0039] Please refer to FIGS. **1** and **8** that are assembled and exploded perspective views, respectively, of a fan motor structure **1** according to a second embodiment of the present invention, and to FIG. **9** that is an assembled sectional view of FIG. **8**. As shown, the fan motor structure **1** according to the second embodiment is generally structurally similar to the first embodiment, except that the magnetic element **15** is connected to the blades **132** between the fixed ends **1321** and the free ends **1322** thereof. That is, in the second embodiment, the magnetic element **15** is a continuous magnetic annular member continuously circumferentially extending between the fixed ends **1321** and the free ends **1322** of the blades **132**. However, it is understood the present invention is not restricted thereto.

[0040] For example, in a variant of the second embodiment of the present invention as shown in FIGS. **10** and **11**, there is more than on magnetic element **15**, and the number of the magnetic elements **15** matches that of the blades **132**. That is, the magnetic elements **15** are separately provided on the blades **132** between the free ends **1322** and the fixed ends **1321** thereof in a discontinuous manner.

[0041] When the magnetic elements **15** are integrally formed with the blades **132** to locate between the free ends **1322** and the fixed ends **1321** thereof, the blades **132** may

have enhanced structural strength to enable increased motor torque and to reduce vibration and noise due to deflection of the blades **132**.

[0042] Alternatively, in implementing the present invention, the magnetic element(s) **15** may be independent element (s) and be connected to the blades **132** between the free ends **1322** and the fixed ends **1321** thereof by bonding, adhering, inserting, snapping, or clamping the magnetic element(s) **15** thereto.

[0043] FIGS. **1** and **12** are assembled and exploded perspective views, respectively, of a fan motor structure **1** according to a third embodiment of the present invention, and to FIG. **13** that is an assembled sectional view of FIG. **12**. As shown, the fan motor structure **1** according to the third embodiment is generally structurally similar to the first and the second embodiment, except that the frame body **102** of the fan frame **10** is provided on one side opposite to the frame cover **101**, i.e. on the bottom of the frame body **101**, with a second air inlet **1022** surrounding the shaft seat **103** and axially aligning with the first air inlet **1011**. The second air inlet **1022** extends through the frame body **102** in a thickness direction thereof and communicates with the receiving space **105**, the first air inlet **1011** and the air outlet **1021**.

[0044] Compared to the prior art thin fan, a thin fan with the fan motor structure of the present invention has the following advantages: (1) having increased air intake and producing more air flows; (2) having further reduced overall thickness; (3) minimizing the vibration and noise produced during operation thereof; and (4) having blades with increased structural strength.

[0045] The present invention has been described with some preferred embodiments thereof and it is understood that many changes and modifications in the described embodiments can be carried out without departing from the scope and the spirit of the invention that is intended to be limited only by the appended claims.

What is claimed is:

1. A fan motor structure, comprising:

a fan frame internally defining a receiving space and having a shaft seat located at a center of the receiving space;

a rotor being rotatably connected to the shaft seat, and including a hub and a plurality of blades outward extended from and spaced along an outer surface of the hub;

at least one magnetic element being arranged on the blades; and

a stator being arranged in the receiving space between a bottom of the fan frame and the blades at a position corresponding to the magnetic element.

2. The fan motor structure as claimed in claim **1**, wherein the fan frame includes a frame cover and a frame body, which are closed to each other to together define the receiving space in between them; the frame cover having a first air inlet communicating with the receiving space; and the frame body being provided at a lateral side with an air outlet communicating with the first air inlet and the receiving space.

3. The fan motor structure as claimed in claim **2**, wherein the frame body is provided on a bottom facing the frame cover with a second air inlet, which communicates with the receiving space, the air outlet, and the first air inlet.

4. The fan motor structure as claimed in claim **2**, wherein the stator includes a plurality of windings and a circuit board; the circuit board being located on a bottom of the frame body, and the windings being wound on the circuit board to electrically connect to the circuit board.

5. The fan motor structure as claimed in claim **3**, wherein the stator includes a plurality of windings and a circuit board; the circuit board being located on the bottom of the frame body, and the windings being wound on the circuit board to electrically connect to the circuit board.

6. The fan motor structure as claimed in claim **4**, wherein each of the blades includes a fixed end and a free end outward extended from the fixed end; the fixed end being fixedly connected to the outer surface of the hub; and the magnetic element being a continuous annular member connected to the free ends of the blades in a continuous manner to axially correspond to the windings, so that the windings can be excited via magnetic induction.

7. The fan motor structure as claimed in claim **4**, wherein each of the blades includes a fixed end and a free end outward extended from the fixed end; the fixed end being fixedly connected to the outer surface of the hub; and the magnetic element being separately provided on each of the free ends of the blades in a discontinuous manner to axially correspond to the windings, so that the windings can be excited via magnetic induction.

8. The fan motor structure as claimed in claim **4**, wherein each of the blades includes a fixed end and a free end outward extended from the fixed end; the fixed end being fixedly connected to the outer surface of the hub; and the magnetic element being a continuous annular member connected to the blades between the free ends and the fixed ends thereof in a continuous manner to axially correspond to the windings, so that the windings can be excited via magnetic induction.

9. The fan motor structure as claimed in claim **4**, wherein each of the blades includes a fixed end and a free end outward extended from the fixed end; the fixed end being fixedly connected to the outer surface of the hub; and the magnetic element being separately provided on each of the blades between the free end and the fixed end thereof in a discontinuous manner to axially correspond to the windings, so that the windings can be excited via magnetic induction.

10. The fan motor structure as claimed in claim **1**, wherein the magnetic element is selected from the group consisting of a magnet and a type of magnetic powder.

11. The fan motor structure as claimed in claim **1**, wherein the magnetic element is integrally formed with the blades by way of injection molding.

12. The fan motor structure as claimed in claim **6**, wherein the magnetic element is connected to the free ends of the blades in a manner selected from the group consisting of bonding, adhering, inserting, snapping and clamping.

13. The fan motor structure as claimed in claim **8**, wherein the magnetic element is connected to the blades between the free ends and the fixed ends thereof in a manner selected from the group consisting of bonding, adhering, inserting, snapping and clamping.

14. The fan motor structure as claimed in claim **1**, wherein the magnetic element and the blades are integrally formed by way of injection molding to provide a plurality of magnetic blades.

* * * * *