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.
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 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 a fan motor structure of the present invention according to a first embodiment thereof;

[0015] FIG. 3 is 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 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 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 frame internally defining a receiving space and having a shaft seat located at a center of the receiving space;
- a motor 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 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 define the receiving space in between; 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 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.