plurality of rotor magnets 130 is arranged at equal spaces in the circumferential direction having central axis L as the center and is fixed by adhesive, for example.

[0013]

Rotor magnets 130, as shown in FIG. 14, are formed of rotor magnets 131 whose outer side is magnetized to the north pole and rotor magnets 132 whose outer side is magnetized to the south pole. Magnets 131 and magnets 132 are alternately arranged in the circumferential direction. Further, as shown in FIG. 13, rotor magnets 130 are fixed on cylinder 122 of rotor holder 120 such that the inner-circumference plane of rotor magnets 130 faces the tip section of stator core 112 via a narrow gap in the radial direction. Besides, adhesion layer 124 is formed on the inner-circumference plane of cylinder 122 of rotor holder 120.

Citation List

[0014]

Patent Literature

PTL 1: Japanese Unexamined Patent Application Publication No. 2010-98783

SUMMARY

[0015]

In such a blower device with a conventional brushless DC motor mounted, a plurality of rotor magnets 131, 132 is bonded to rotor holder 120, i.e., the rotor yoke. Fixing magnets by adhesive causes wide variation in adhesion strength. Further, the adhesion strength tends to degrade with time. If bonded rotor magnets 131, 132 drop off and make contact with stator core

112, it can cause abnormal noise; further, friction caused by the contact between them can be an excessive load on the motor. The conventional structure has the problem above.

[0016] The present disclosure solves the pending problem above. The present disclosure provides a brushless DC motor capable of keeping normal operation even if a bonded magnet comes off. It also provides a blower device having the brushless DC motor above. The present disclosure includes an outer-rotor-type brushless DC motor comprising: a stator core around which a coil is wound; a shaft fixed to a central position of the stator core; a bearing whose inner ring is fixed to the shaft; a rotor yoke fixed to an outer ring of the bearing and comprising: a plurality of magnets disposed on an inner-circumference plane facing the stator core of the rotor yoke in a circumferential direction; and a first holding ring disposed in a circumferential direction of the magnets and comprising:
a protrusion for holding a first end of the shaft in an axial direction; and
a second holding ring disposed in the circumferential direction of the magnets and comprising: a protrusion for holding a second end facing the first end of the shaft in the axial direction a clearance between the protrusion of the first holding ring and the protrusion of the second holding ring , which are disposed so as to be faced to each other

[0017] The structure of the present disclosure has a stator core around which a coil is wound, a shaft fixed to the central position of the stator core, a bearing whose inner ring is fixed to the shaft, and a rotor yoke fixed to an outer ring of the bearing. The rotor yoke has a plurality of magnets on its inner-circumference plane in a circumferential direction so as to face the stator core. Further, the structure has a first holding ring and a second holding ring in the circumferential direction of the magnets. The first holding ring has a protrusion that holds a first end of the shaft in the axial direction. The second holding ring has a protrusion that holds a second end facing the first end of the shaft in the axial direction.

[0018] If a magnet comes off a fixed position (regardless of with use or with no use of adhesive), the aforementioned structure prevents the magnets from making contact with the stator core, so that the motor keeps normal rotating operation.

BRIEF DESCRIPTION OF DRAWINGS

[0019]

CLAIMS

1. An outer-rotor-type brushless DC motor comprising:
a stator core around which a coil is wound;
a shaft fixed to a central position of the stator core;
a bearing whose inner ring is fixed to the shaft;
a rotor yoke fixed to an outer ring of the bearing and comprising: a plurality of magnets disposed on an inner-circumference
plane facing the stator core of the rotor yoke in a circumferential direction; and
a first holding ring disposed in a circumferential direction of the
magnets and comprising:
a protrusion for holding a first end of the shaft in an axial
direction; and
a second holding ring disposed in the circumferential direction
of the magnets and comprising:
a protrusion for holding a second end facing the first end
of the shaft in the axial direction
a clearance between the protrusion of the first holding
ring and the protrusion of the second holding ring , which are disposed so as to be faced to each other.

2. The brushless DC motor according to claim 1, wherein
each of the first holding ring and the second holding ring has a
ring section, a bottom of a hollow-disc shape integrally formed with the ring section toward an outer circumferential direction of the ring section, and the protrusion protruding from the bottom toward an axial direction of the ring section,
the bottom suppresses the magnets from moving in an axial
direction of the shaft, and
the protrusion suppresses the magnets from moving in the circumferential direction of the magnets.

3. The brushless DC motor according to claim 2, wherein
the protrusion has a cross section of a triangle, one side of the
triangle is fitted with an inner circumference of the bottom so as to be disposed close to the inner circumference of the bottom, remaining two sides other than the one side have an urging structure by which different two magnets of the magnets are urged against the inner-circumference plane of the rotor yoke, and
the urging structure suppresses the magnets from moving in a
direction of a center of the ring and in the circumferential direction of the magnets.

4. The brushless DC motor according to claim 1, wherein
each of the magnets has a structure in which an outer circumference surface forms a curved face having a same curvature with the inner-circumference plane of the rotor yoke and an inner-circumference surface forms a flat face, by which a thin-walled section is formed at both ends in the circumferential direction of the magnets, and
the protrusion urges the thin-walled section against the inner circumference plane of the rotor yoke.

5. The brushless DC motor according to claim 1, wherein
the magnets have a length in an axial direction of the shaft longer than a length of a facing plane of the stator core that faces the magnets in the axial direction of the shaft, and
the protrusion that forms the first holding ring and the protrusion that forms the second holding ring are disposed so as not to face the facing plane.

6. The brushless DC motor according to claim 2, wherein the first holding ring has an opposite-protrusion that protrudes in an axial direction of the ring section and in a direction opposite from the protrusion, and the opposite-protrusion presses the bottom of the first holding ring against the magnets when the rotor yoke and a rotor cover are fixed to each other.

7. The brushless DC motor according to claim 2, wherein the second holding ring has a second opposite-protrusion that protrudes in an axial direction of the ring section and in a direction opposite from the protrusion, and the second opposite-protrusion presses the bottom of the second holding ring against the magnets when the rotor yoke and a rotor cover are fixed to each other.

8. The brushless DC motor according to claim 7, wherein
the rotor cover has a push section that makes contact with the second opposite-protrusion, and
the push section presses, via the second opposite-protrusion, the bottom of the second holding ring against the magnets.

9. The brushless DC motor according to claim 2, wherein
at least any one of the first holding ring and the second holding ring has an anti-drop section that further outwardly protrudes from an outer circumference of the bottom, and
the anti-drop section firmly presses an outer-circumference end of the anti-drop section against the inner-circumference plane of the rotor yoke so that the first holding ring or the second holding ring is held by the rotor yoke.

10. A blower device comprising the brushless DC motor according to any one of claim 1 through claim 9.