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Inventor(s)	Jung; Jin Gun et al.

Brushless direct current blower motor having stator with heat dissipating structure

Abstract

A blower motor according to the present invention includes a stator assembly **1** including a stator core **10**, an upper insulator **11** coupled to an upper portion of the stator core **10**, and a lower insulator **12** coupled to a lower portion of the stator core **10**; a rotor assembly **2** rotating around the stator assembly **1**; a stator block **3** to which the stator assembly **1** is coupled; a printed circuit board **4** located at a lower portion of the stator block **3**; and a motor cover **5** coupled to the stator block **3.**

Inventors: **Jung; Jin Gun (Busan, KR), Moon; Chi Won (Busan, KR), Kim; Seokmin (Busan, KR)**

Applicant: **Hyoseong Electric, Co., Ltd.** (Busan, KR)

Family ID: **1000008767794**

Assignee: **Hyoseong Electric, Co., Ltd. (Busan, KR)**

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Primary Examiner: Iwarere; Oluseye

Assistant Examiner: Chang; Minki

Attorney, Agent or Firm: Revolution IP, PLLC

Background/Summary

BACKGROUND OF THE INVENTION

Technical Field

(1) The present invention relates to a blower motor used in an air conditioning system for a vehicle, etc. More specifically, the present invention relates to a blower motor applying a stator assembly with a novel structure, thereby making the blower motor compact and light weight, and also preventing overheating of the motor.

Background Art

(2) In general, vehicles need to introduce hot or cool air thereinto to control the temperature or humidity inside the vehicles, and the air for controlling the temperature and humidity is circulated by rotation of a blower fan. The blower fan is driven by a blower motor.

(3) The blower motor includes a rotor, a stator and a housing accommodating the stator and the rotor. When current is applied to a coil wound around the stator core, the rotor is rotated by

electromagnetic interaction with the stator, thereby rotating a fan assembly installed in a rotating shaft of the rotor, to perform air conditioning.
(4) Korean Patent No. 10-1755881 discloses a structure in which a stepped portion is formed in the surface in contact with the heat sink so that air introduced into the blower motor is concentrated to devices mounted on the printed circuit board, which are the main heating source, so as to effectively dissipate heat of the devices. This prior art mentions a structure for cooling heat generated from the devices, but does not mention how to handle heat generated from the stator.
(5) Accordingly, the present inventors suggest a blower motor with a novel structure capable of effectively cooling heat generated from a stator assembly and a printed circuit board, and minimizing the size and weight of the motor.

SUMMARY OF THE INVENTION

Task to be Solved

(6) It is an object of the present invention to provide a blower motor with a novel structure capable of effectively cooling heat generated from a stator assembly and a printed circuit board.
(7) It is another object of the present invention to provide a blower motor with a novel structure capable of reducing the size of the motor and lightening the weight thereof.
(8) The above and other inherent objects of the present invention may all be easily achieved by the description of the present invention described below.

Means for Solving Task

(9) The blower motor according to the present invention comprises a stator assembly **1** comprising a stator core **10**, an upper insulator **11** coupled to an upper portion of the stator core **10**, and a lower insulator **12** coupled to a lower portion of the stator core **10**; a rotor assembly **2** rotating around the stator assembly **1**; a stator block **3** to which the stator assembly **1** is coupled; a printed circuit board **4** located at a lower portion of the stator block **3**; and a motor cover **5** coupled to the stator block **3**.
(10) In the present invention, the stator core **10** may comprise a core base **101** having a cylindrical shape, a plurality of teeth **102** formed radially on an outer surface of the core base **101** at regular intervals, a central cylindrical body **103** located inside the core base **101** and having a central coupling hole **103**A thereinside, and a plurality of through holes **105** in a space between the core base **101** and the central cylindrical body **103**.
(11) In the present invention, the blower motor may further comprise a plurality of ribs **104** connecting an outer circumferential portion of the core base **101** and an inner circumferential portion of the central cylindrical body **103**.
(12) In the present invention, the upper insulator **11** may comprise an upper base **111** located at an upper portion of the core base **101**, upper teeth **112** for covering an upper portion of the teeth **102** for insulation, a first annular protrusion **113** protruding upwardly from the upper base **111**, and a second annular protrusion **114** having an upper central space **114**A and located at an upper portion of the central cylindrical body **103**.
(13) In the present invention, the blower motor may further comprise a plurality of flow passages **116** between the first annular protrusion **113** and the second annular protrusion **114**.
(14) In the present invention, the blower motor may further comprise a plurality of connection ribs **115** connecting the first annular protrusion **113** and the second annular protrusion **114**.
(15) In the present invention, preferably, an upper bearing B**1** is inserted into the upper central space **114**A.
(16) In the present invention, a plurality of coil guides **117** may be formed protruding radially on an outer circumferential surface of the first annular protrusion **113** at regular intervals.
(17) In the present invention, the lower insulator **12** may comprise a lower base **121** located at a lower portion of the core base **101**, lower teeth **122** for covering a lower portion of the teeth **102** for insulation, and a lower annular protrusion **123** protruding downwardly from the lower base **121**.
(18) In the present invention, the lower insulator **12** may further comprise an inner support **124** having a coupling space **124**A in the center and protruding toward the shaft from the lower base

121.
(19) In the present invention, a coupling guide **125** may be formed protruding upwardly in the inner support **124** at regular intervals.
(20) In the present invention, the lower annular protrusion **123** may have at least one first terminal groove **123**A.
(21) In the present invention, the lower annular protrusion **123** may have at least one second terminal groove **123**B.
Effect of Invention
(22) The present invention has an effect of providing a blower motor with a novel structure capable of effectively cooling heat generated from a stator assembly and a printed circuit board, and reducing the size of the motor and lightening the weight thereof.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) FIG. **1** is a perspective view of a blower motor according to the present invention;
(2) FIG. **2** is a cut-away perspective view of the blower motor in FIG. **1** taken along line A-A′;
(3) FIG. **3** is an exploded perspective view of a blower motor according to the present invention;
(4) FIG. **4** is a bottom exploded perspective view of a blower motor according to the present invention;
(5) FIG. **5** is a perspective view of a stator core of a blower motor according to the present invention;
(6) FIG. **6** is a perspective view of a stator assembly of a blower motor according to the present invention; and
(7) FIG. **7** is a bottom perspective view of a stator assembly of a blower motor according to the present invention.
(8) Hereinafter, the present invention will be described in detail with reference to the accompanying drawings.
DETAILED DESCRIPTION OF THE INVENTION
(9) FIG. **1** is a perspective view of a blower motor according to the present invention. FIG. **2** is a cut-away perspective view of the blower motor in FIG. **1** taken along line A-A′. FIG. **3** is an exploded perspective view of a blower motor according to the present invention. FIG. **4** is a bottom exploded perspective view of a blower motor according to the present invention.
(10) Referring to FIGS. **1** to **4** together, the blower motor according to the present invention comprises a motor assembly **100**, a flange **200** and a damper plate **300**.
(11) The motor assembly **100** comprises a stator assembly **1**, a rotor assembly **2**, a stator block **3**, a printed circuit board **4**, and a motor cover **5**. The motor assembly **100** is seated on the flange **200**, and the damper plate **300** is coupled to the flange **200** to prevent the motor assembly **100** from dislodging.
(12) The stator assembly **1** comprises a stator core **10**, an upper insulator **11** and a lower insulator **12**. The stator core **10** has a core base **101** having a cylindrical shape and a plurality of teeth **102** formed radially on an outer surface of the core base **101** at regular intervals. The upper insulator **11** is coupled to an upper portion of the stator core **10**, and the lower insulator **12** is coupled to a lower portion of the stator core **10**. A coil C is wound around the teeth **102** according to a predetermined pattern. An end of the wound coil C is electrically connected to a first terminal T**1** and a second terminal T**2** protruding downwardly from the lower insulator **12**.
(13) The rotor assembly **2** comprises a shaft **21**, a rotor housing **22** having a cup shape, to which the shaft **21** is coupled and which rotates with the shaft **21**, and a plurality of magnets **23** attached along an inner wall of the rotor housing **22** at regular intervals. The rotor assembly **2** is installed to

enclose the stator assembly **1**, and is rotated by a changing magnetic field generated by the stator assembly **1**. The shaft **21** is rotatably supported by an upper bearing B**1** and a lower bearing B**2**. The upper bearing B**1** is installed in a central portion of the upper insulator **11**. The lower bearing B**2** is installed in a central portion of the stator block **3**.

(14) The stator assembly **1** is coupled to an upper portion of the stator block **3**, and the printed circuit board **4** is located at a lower portion of the stator block **3**. The stator block **3** comprises a plate **30** having a circular shape, a hollow protrusion **31** protruding upwardly from a central portion of the plate **30**, a protruding coupler **32** protruding radially from a periphery of the plate **30** at regular intervals, a through hole **33** formed through vertically around the hollow protrusion **31** of the plate **30**, through which the first and second terminals T**1**, T**2** pass, an insulating member **34** for closing the through hole **33**, and a device groove **35** for receiving a portion in which some devices mounted on the printed circuit board **4** protrude. Preferably, the plate **30** is made of aluminum, which has high electrical and thermal conductivity.

(15) The stator assembly **1** is coupled to the hollow protrusion **31** of the stator block **3**. The lower bearing B**2** rotatably supporting the shaft **21** is coupled to an inner space **31**A inside the hollow protrusion **31**.

(16) The printed circuit board **4** comprises a substrate **40** on which various devices are mounted, and a connector **41** installed on one side of the substrate **40** to be connected to an external power source. The first and second terminals T**1**, T**2** are electrically connected to the substrate **40**. The circuits on the substrate **40** are physically and electrically connected to the plate **30** of the stator block **3**, which allows the circuits to be grounded.

(17) The motor cover **5** comprises a cover body **50** having a cup shape, a connector coupling part **51** opening a portion of one side the cover body **50**, a packing part **52** along an upper periphery of the cover body **50**, a plurality of damper parts **53** protruding upwardly from an upper periphery of the cover body **50** at regular intervals, a central protrusion **54** protruding upwardly from a lower central portion of the cover body **50**, and a central groove **54**A forming an inner space of the central protrusion **54** in a lower center of the cover body **50**.

(18) The connector **41** is coupled to the connector coupling part **51**. The packing part **52** made of a material such as rubber is formed around the cover body **50** and the connector coupling part **51**. Accordingly, the inner space of the motor cover **5** is sealed from the outside in a state where the motor cover **5** is coupled to the stator block **3**, thereby blocking the introduction of moisture from a lower portion of the motor cover **5**.

(19) The damper part **53** made of a material such as rubber protrudes upwardly from a periphery of the cover body **50**. The protruding coupler **32** of the stator block **3** is coupled to the damper part **53**. Accordingly, the position and number of the protruding coupler **32** are set to be the same as the position and number of the damper part **53**. The damper part **53** is located in a damper seating part **203** of the flange **200** to perform decoupling such that vibration generated from the motor assembly **100** is not transmitted to the flange **200**.

(20) The central protrusion **54** is located in the inner space **31**A of the stator block **3**, such that an upper surface of the central protrusion **54** supports a lower end of the shaft **21** when the shaft **21** of the rotor assembly **2** is press fitted into the lower bearing B**2**. At this time, a jig (not illustrated) is located in the central groove **54**A, which is an inner space of the central protrusion **54**, such that the upper surface of the central protrusion **54** supports the lower end of the shaft **21**.

(21) The flange **200** comprises a flange body **201** having a hole in the center, into which the motor assembly **100** is inserted, an upper protrusion **202** having an annular shape protruding upwardly along a periphery of the hole into which the motor assembly **100** is inserted, a damper seating part **203** formed in the shape of a groove at a position corresponding to the damper part **53**, and a coupling protrusion **204** formed in the shape of a protrusion on a lower portion of the flange body **201** at a position corresponding to a locking part **302** of the damper plate **300**.

(22) A portion of the rotor assembly **2** is located inside the upper protrusion **202** to rotate. The

damper part **53** of the motor cover **5** is seated on the damper seating part **203** having a groove shape. The damper part **53** is a buffering member made of a material such as rubber to absorb vibration generated from the motor assembly **100**. The damper part **53**, which is seated on the damper seating part **203** of the flange **200**, reduces vibration generated from the motor assembly **100**.

(23) The damper plate **300** has an annular body **301** having a ring shape, a plurality of locking parts **302** protruding upwardly from a periphery of the annular body **301** at regular intervals, and a plurality of protrusion guides **303** protruding toward the shaft **21** from a periphery of the annular body **301** at regular intervals. The locking part **302** has a locking hole **302**A, and the locking hole **302**A is coupled to the coupling protrusion **204**. The locking hole **302**A may be modified to have a protrusion shape, and the coupling protrusion **204** may be modified to have a hole or groove shape. The protrusion guide **303** supports the motor cover **5** to prevent the motor assembly **100** from dislodging downwardly.

(24) FIG. **5** is a perspective view of a stator core **10** of a blower motor according to the present invention.

(25) As illustrated in FIG. **5**, the stator core **10** of the blower motor according to the present invention comprises a core base **101** having a cylindrical shape with a hollow interior, a plurality of teeth **102** formed radially from an outer periphery of the core base **101**, a central cylindrical body **103** located inside the core base **101** and having a central coupling hole **103**A thereinside, a plurality of ribs **104** connecting an outer circumferential portion of the core base **101** and an inner circumferential portion of the central cylindrical body **103**, and a plurality of through holes **105** in a space between the core base **101** and the central cylindrical body **103**. The stator core **10** is manufactured by continuously forming a thin electrical steel sheet by press punching and laminating the same.

(26) A coil C is wound around each of the teeth **102** while being insulated by the upper and lower insulators **11**, **12**. The hollow protrusion **31** of the stator block **3** is press fitted and coupled to the central coupling hole **103**A inside the central cylindrical body **103**. The plurality of through holes **105** provides air passages to dissipate heat generated from the stator core **10**, etc.

(27) FIG. **6** is a perspective view of a stator assembly **1** of a blower motor according to the present invention. FIG. **7** is a bottom perspective view of a stator assembly **1** of a blower motor according to the present invention.

(28) Referring to FIGS. **6** and **7** together, the stator assembly **1** of the blower motor according to the present invention comprises a stator core **10**, an upper insulator **11** coupled to an upper portion of the stator core **10**, and a lower insulator **12** coupled to a lower portion of the stator core **10**.

(29) The upper insulator **11** comprises an upper base **111** located at an upper portion of the core base **101** of the stator core **10**, upper teeth **112** for covering an upper portion of the teeth **102** for insulation, a first annular protrusion **113** protruding upwardly from the upper base **111**, a second annular protrusion **114** having an upper central space **114**A and located at an upper portion of the central cylindrical body **103**, a plurality of connection ribs **115** connecting the first annular protrusion **113** and the second annular protrusion **114**, and a plurality of flow passages **116** between the first annular protrusion **113** and the second annular protrusion **114**.

(30) An upper bearing B**1** is coupled in the upper central space **114**A. According to the present invention, the upper bearing B**1** is coupled to the upper insulator **11** of the stator assembly **1**. This structure may exclude the use of other components for coupling the upper bearing B**1**, which makes the motor compact and light weight.

(31) The flow passage **116** is formed to be in vertical communication with the through hole **105** of the stator core **10**, which helps cooling heat generated from the stator core **10**, etc.

(32) A coil guide **117** protrudes radially from an outer circumferential surface of the first annular protrusion **113** at regular intervals. The coil guide **117** allows the coil C wound around the upper teeth **112** not to deviate from the original position.

(33) The lower insulator **12** comprises a lower base **121** located at a lower portion of the core base **101** of the stator core **10**, lower teeth **122** for covering a lower portion of the teeth **102** for insulation, a lower annular protrusion **123** protruding downwardly from the lower base **121**, and an inner support **124** having a coupling space **124**A in the center and protruding toward the shaft from the lower base **121**.
(34) The lower annular protrusion **123** has at least one first terminal groove **123**A and at least one second terminal groove **123**B. The first terminal T**1** is coupled to the first terminal groove **123**A, and the second terminal T**2** is coupled to the second terminal groove **123**B. An end of the coil wound around the stator assembly **1** is electrically connected to the first terminal T**1** and the second terminal T**2**. An end of the coil of each phase of the motor is electrically connected to the first terminal T**1**, and the coil connecting the neutral point of each phase is electrically connected to the second terminal T**2**. The number of the first terminals T**1** and the second terminals T**2** may vary depending on the specifications, number of phases, etc., of the motor. The first terminal groove **123**A and the second terminal groove **123**B may have a hole shape, instead of a groove shape, despite the names thereof.
(35) The hollow protrusion **31** of the stator block **3** is coupled in the coupling space **124**A which is an inner space of the inner support **124**. A coupling guide **125** (illustrated in FIG. **3**) protruding upwardly from the inner support **124** at regular intervals may be coupled to an inside of the flow passage **116** of the stator core **10**.
(36) It should be noted that the description of the present invention described above is merely an example for understanding the present invention, and is not intended to limit the scope of the present invention. It should be construed that the scope of the present invention is defined by the appended claims, and all modifications and alternations of the present invention fall within the protection scope of the present invention.

Claims

1. A blower motor comprising: a stator assembly (**1**) comprising a stator core (**10**), an upper insulator (**11**) coupled to an upper portion of the stator core (**10**), and a lower insulator (**12**) coupled to a lower portion of the stator core (**10**); a rotor assembly (**2**) rotating around the stator assembly (**1**); a stator block (**3**) to which the stator assembly (**1**) is coupled; a printed circuit board (**4**) located at a lower portion of the stator block (**3**); and a motor cover (**5**) coupled to the stator block (**3**), wherein the stator core (**10**) comprises a core base (**101**) having a cylindrical shape, a plurality of teeth (**102**) formed radially on an outer surface of the core base (**101**) at regular intervals, a central cylindrical body (**103**) located inside the core base (**101**) and having a central coupling hole (**103**A) thereinside, and a plurality of through holes (**105**) in a space between the core base (**101**) and the central cylindrical body (**103**); and wherein the upper insulator (**11**) comprises an upper base (**111**) located at an upper portion of the core base (**101**), upper teeth (**112**) for covering an upper portion of the teeth (**102**) for insulation, a first annular protrusion (**113**) protruding upwardly from the upper base (**111**), and a second annular protrusion (**114**) having an upper central space (**114**A) and located at an upper portion of the central cylindrical body (**103**).
2. The blower motor of claim 1, further comprising a plurality of ribs (**104**) connecting an outer circumferential portion of the core base (**101**) and an inner circumferential portion of the central cylindrical body (**103**).
3. The blower motor of claim 1, further comprising a plurality of flow passages (**116**) between the first annular protrusion (**113**) and the second annular protrusion (**114**).
4. The blower motor of claim 3, further comprising a plurality of connection ribs (**115**) connecting the first annular protrusion (**113**) and the second annular protrusion (**114**).
5. The blower motor of claim 1, wherein an upper bearing (B**1**) is inserted into the upper central space (**114**A).

6. The blower motor of claim 1, wherein a plurality of coil guides (**117**) are formed protruding radially on an outer circumferential surface of the first annular protrusion (**113**) at regular intervals.
7. The blower motor of claim 1, wherein the lower insulator (**12**) comprises a lower base (**121**) located at a lower portion of the core base (**101**), lower teeth (**122**) for covering a lower portion of the teeth (**102**) for insulation, and a lower annular protrusion (**123**) protruding downwardly from the lower base (**121**).
8. The blower motor of claim 7, wherein the lower insulator (**12**) further comprises an inner support (**124**) having a coupling space (**124**A) in the center and protruding toward the shaft from the lower base (**121**).
9. The blower motor of claim 8, wherein a coupling guide (**125**) is formed protruding upwardly in the inner support (**124**) at regular intervals.
10. The blower motor of claim 7, wherein the lower annular protrusion (**123**) has at least one first terminal groove (**123**A).
11. The blower motor of claim 10, wherein the lower annular protrusion (**123**) has at least one second terminal groove (**123**B).