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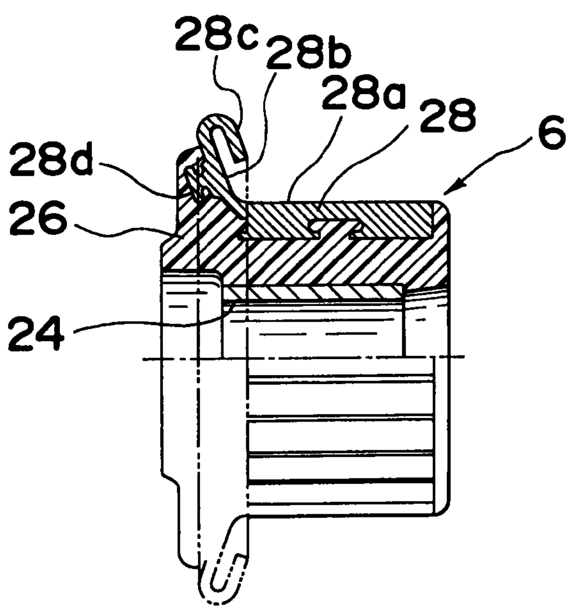
(54) Commutator and commutator motor

(57) A commutator motor includes a carrier, an armature mounted in the carrier and having a rotary shaft, a commutator mounted in the carrier, and a field secured to the carrier so as to confront the armature. The commutator includes a cylindrical boss fixedly mounted on the rotary shaft, a molding material secured to the cylindrical boss, and a plurality of commutator segments secured to the molding material. Each of the commutator segments has a brush-sliding surface with which a brush assembly mounted on the carrier is held in contact, and also has an extension extending generally radially outwardly therefrom. The extension has a free end turned backward to define a generally U-shaped hook for holding a winding therein in a radially spaced relationship from the brush-sliding surface.

Fig.2



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a commutator motor for use in a domestic appliance and also to a commutator mounted in the commutator motor.

Description of Related Art

Domestic vacuum cleaners are in wide practical use today, and there is an increasing demand for those having a high suction power, resulting in a similar demand for a powerful electric motor for use therein. To enhance the suction power of a domestic vacuum cleaner, it is required that losses in an electric motor used therein are reduced for the increase of the rotational speed of the electric motor.

The losses of the electric motor include a copper loss and a core or iron loss in each of a field and an armature. Of the two losses, the copper loss occupies a greater weight. Because the copper loss is produced by heat generation caused by the resistance of windings around the field and the armature, reducing the resistance of the windings is most effective to reduce the copper loss. To this end, it is necessary to enlarge the diameter of the windings.

Furthermore, to increase the rotational speed of the electric motor for the increase of the suction power of the domestic vacuum cleaner, the electric motor is required to have a commutator of a sufficient breaking strength against rotation. To this end, it is necessary to reduce the weight of commutator segments or to reduce the diameter of the commutator to reduce the centrifugal force exerting upon the commutator segments.

Figs. 5 and 6 depict a commutator 50 employed in a conventional commutator motor. As shown therein, the commutator 50 comprises a cylindrical boss 52 into which a rotary shaft of an armature (not shown) is press-fitted, a molding material 54 secured to the cylindrical boss 52, and a plurality of commutator segments 56 securely mounted on the molding material 54. The commutator segments 56 have respective outer surfaces 56 forming a contact or sliding surface with a brush assembly (not shown). Each of the commutator segments 56 is generally in the form of an oblong electrically-conductive plate having one end formed with a tongue 56b extending outwardly therefrom in an axial direction thereof. The tongue 56b is turned backward to define a hook with a free end thereof overlying above and spaced from the brush-sliding surface 56a a distance substantially equal to the diameter of that portion of a wire or winding 58 which would eventually be encompassed by and connected, by fusing, to the hook.

As shown in Fig. 6, the connection of the tongues 56b to the associated windings 58 requires a predetermined circumferential distance B between the neighboring windings 58 and, hence, requires a sufficient circumferential distance between the neighboring tongues 56b. To this end, although it is conceivable to narrow the width of each tongue 56b itself, the strength thereof is reduced. Accordingly, the outer diameter of the commutator 50, i.e., the diameter of the brush-sliding surface 56a is determined to ensure a sufficient circumferential distance between the neighboring tongues 56b.

On the other hand, in order to increase the power of a domestic appliance such as, for example, a domestic vacuum cleaner, it is necessary to increase the wire diameter to reduce the copper loss. The increase of the wire diameter requires an increase of the circumferential distance between the neighboring tongues 56b, which in turn requires an increase of the outer diameter thereof and, hence, an increase of the diameter of the brush-sliding surface 56a. Such increases result in an increase of the centrifugal force exerting upon the commutator segments 56, thus lowering the strength of the commutator 50, and also result in an increase of the brush-sliding loss if the rotational speed of the commutator is the same as the conventional one.

The above problems interfere with the increase of the power of the domestic appliance by the increase of the rotational speed.

SUMMARY OF THE INVENTION

The present invention has been developed to overcome the above-described disadvantages.

It is accordingly an objective of the present invention to provide an improved commutator capable of reducing the copper loss by connecting increased-diameter commutator windings thereto.

Another objective of the present invention is to provide the commutator of the above-described type which can reduce the brush-sliding loss and has a strength sufficient to endure an increased rotational speed.

A further objective of the present invention is to provide a commutator motor employing the above commutator.

In accomplishing the above and other objectives, the commutator according to the present invention includes a cylindrical boss fixedly mounted on a rotary shaft, a molding material secured to the cylindrical boss, and a plurality of commutator segments secured to the molding material. Each of the commutator segments has a brush-sliding surface held in contact with the brush assembly and also has an extension extending generally radially outwardly therefrom. The extension has a free end turned backward to define a generally U-shaped hook for holding a winding therein in a radially spaced relationship from the brush-sliding surface.

Advantageously, the extension is bent at a root thereof continuous to the brush-sliding surface.

It is preferred that the extension has a projection formed on one surface thereof opposite to the brush-sliding surface for anchoring thereof into the molding material.

The extension may have a radially extending flat area and an axially extending flat area continuous to the radially extending flat area. In this case, the projection is formed on one surface of the axially extending flat area.

On the other hand, the commutator motor according to the present invention includes a carrier, an armature mounted in the carrier and having a rotary shaft, a commutator of the above-described construction, a field secured to the carrier so as to confront the armature, and a brush assembly mounted on the carrier and held in contact with the brush-sliding surface.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objectives and features of the present invention will become more apparent from the following description of a preferred embodiment thereof with reference to the accompanying drawings, throughout which like parts are designated by like reference numerals, and wherein:

Fig. 1 is an elevational view, partially in section, of a commutator motor according to the present invention;
Fig. 2 is an elevational view, partially in section, of a commutator mounted in the commutator motor of Fig. 1;
Fig. 3 is a side view of a portion of the commutator of Fig. 2, particularly showing some of hooks formed on free ends of commutator segments mounted on the commutator of Fig. 2;
Fig. 4 is a view similar to Fig. 2, but showing a modification thereof;
Fig. 5 is a view similar to Fig. 2, but showing a conventional commutator; and
Fig. 6 is a view similar to Fig. 3, but showing the conventional commutator of Fig. 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, there is shown in Fig. 1 a commutator motor M embodying the present invention. The commutator motor M shown therein includes an armature A and a field F confronting the armature A.

The armature A comprises a rotary shaft 2, an armature core 4 securely mounted on the rotary shaft 2, and windings 8 placed around the armature core 4 with an insulation layer 10 interposed between the armature core 4 and the windings 8. A commutator 6 is securely mounted on the rotary shaft 2 so as to be juxtaposed with the armature core 4, and is connected to the windings 8. Two bearings 11 are fixedly mounted on opposite ends of the rotary shaft 2. On the other hand, the field F comprises a field core 12 and windings 14 placed around the field core 12 with an insulation layer 16 interposed between the field core 12 and the windings 14.

During assembling, the field F is first press-fitted into a first bracket 18 employed as a carrier on which a brush assembly 22 is mounted, and the armature A is then inserted into the field F so that the brush assembly 22 may be brought into contact with the commutator 6. The armature A and the field F are covered with a second bracket 20 which is in turn screwed to the first bracket 18.

As shown in Fig. 2, the commutator 6 comprises a generally cylindrical boss 24 into which the rotary shaft 2 is press-fitted, a molding material 26 securely mounted on the cylindrical boss 24, and a plurality of commutator segments 28 circumferentially equidistantly arranged on and held by the molding material 26. Each of the commutator segments 28 is in the form of an oblong electrically-conductive plate, which has a brush-sliding surface 28a formed on the outer surface thereof and held in sliding-contact with the brush assembly 22, and also has an extension 28b bent at the root thereof continuous to the brush-sliding surface 28a to extend generally radially outwardly of the commutator segment 28. The extension 28b has a free end 28c turned backward and downwardly to define a generally U-shaped hook 28c for holding one of the windings 8 therein in a radially spaced relationship from the brush-sliding surface 28a. The extension 28b has a projection 28d formed on one surface thereof opposite to the brush-sliding surface 28a for anchoring thereof into the molding material 26.

Fig. 3 depicts some of the hooks 28c by and to which associated windings 8 are encompassed and connected by fusing. As shown therein, even if the windings 8 has a relatively large diameter, a sufficient circumferential distance C is ensured between the neighboring windings 8 because the hooks 28c for firmly holding associated windings 8 are spaced a distance greater than the winding diameter from the brush-sliding surface 28a. In other words, the windings 8 held by the associated hooks 28c are spaced a distance outwardly from the brush-sliding surface 28a.

According to the above-described construction, the provision of the extension 28b can enlarge the circumferential distance between the neighboring hooks 28c without enlarging the diameter of the brush-sliding surface 28a. Accordingly, the windings 8 having a diameter greater than the conventional one can be placed around the armature core 4 with the necessary strength maintained, thus resulting in a reduction in the copper loss of the motor M. Furthermore, because the diameter of the brush-sliding surface 28a can be reduced, not only can the strength of the commutator 6 be increased as a whole, but also the circumferential speed of the brush-sliding surface 28a can be reduced, resulting in a reduction in the brush-sliding loss. Because of this, the rotational speed of the commutator 6 can be increased, and the domestic appliance can be powered up.

In addition, because each commutator segment 28 has an extension 28b bent at the root thereof continuous with the brush-sliding surface 28a, the hook 28c formed on the free end of the extension 28b can be readily spaced a distance outwardly from the brush-sliding surface 28a without reducing the strength of the entire commutator 6. Also, the anchoring of the extension 28b by the projection 28d formed on one surface thereof opposite to the brush-sliding surface 28a ensures a sufficient strength for the hook 28c even if a relatively large centrifugal force acts on the hook 28c due to an enlarged radial distance thereof relative to the brush-sliding surface 28a.

Fig. 4 depicts a commutator 6A in a modified form. The commutator 6A shown therein has a plurality of commutator segments 28 each in the form of an oblong electrically-conductive plate. Each commutator segment 28 has a brush-sliding surface 28a defined on the outer surface thereof and held in sliding-contact with the brush assembly 22, and also has an extension 28b, like the commutator segment shown in Fig. 2. The extension 28b is bent at the root thereof continuous with the brush-sliding surface 28a to extend generally radially outwardly of the commutator segment 28, to thereby define a radially extending flat area 28e. The extension 28b is further bent at an intermediate portion thereof to define an axially extending flat area 28f continuous to the radially extending flat area 28e. The free end of the extension 28b is turned backward to define a generally U-shaped hook 28c for holding one of the windings 8 therein in a radially spaced relationship from the brush-sliding surface 28a. The extension 28b has a projection 28d formed on one surface of the axially extending flat area 28f thereof opposite to the brush-sliding surface 28a for anchoring thereof into the molding material 26.

The commutator 6A of the above-described construction offers substantially the same effects as those offered by the commutator 6 shown in Fig. 2.

Although the present invention has been fully described by way of examples with reference to the accompanying drawings, it is to be noted here that various changes and modifications will be apparent to those skilled in the art. Therefore, unless such changes and modifications otherwise depart from the spirit and scope of the present invention, they should be construed as being included therein.

Claims

1. A commutator for use in a commutator motor having an armature, a field and a brush assembly, said armature having a rotary shaft, said commutator comprising:

   a cylindrical boss fixedly mounted on the rotary shaft;

   a molding material secured to said cylindrical boss; and

   a plurality of commutator segments secured to said molding material, each of said commutator segments having a brush-sliding surface held in contact with the brush assembly and also having an extension extending generally radially outwardly therefrom, said extension having a free end turned backward to define a generally U-shaped hook for holding a winding therein in a radially spaced relationship from the brush-sliding surface.

2. The commutator according to claim 1, wherein said extension is bent at a root thereof continuous to the brush-sliding surface.

3. The commutator according to claim 1, wherein said extension has a projection formed on one surface thereof opposite to the brush-sliding surface for anchoring thereof into said molding material.

4. The commutator according to claim 3, wherein said extension has a radially extending flat area and an axially extending flat area continuous to the radially extending flat area, and wherein said projection is formed on one surface of the axially extending flat area.

5. A commutator motor comprising:

   a carrier;

   an armature mounted in said carrier and having a rotary shaft;

   a commutator comprising:

   a cylindrical boss fixedly mounted on said rotary shaft;

   a molding material secured to said cylindrical boss; and

   a plurality of commutator segments secured to said molding material, each of said commutator segments having a brush-sliding surface and an extension extending generally radially outwardly therefrom, said extension having a free end turned backward to define a generally U-shaped hook for holding a winding therein;

   a field secured to said carrier so as to confront said armature;

   a brush assembly mounted on said carrier and held in contact with said brush-sliding surface; and

   the winding held by said generally U-shaped hook being spaced a distance from the brush-sliding surface.

6. The commutator motor according to claim 5, wherein said extension is bent at a root thereof continuous to the brush-sliding surface.

7. The commutator motor according to claim 5, wherein said extension has a projection formed on one surface thereof opposite to the brush-sliding surface for anchoring thereof into said molding material.

8. The commutator motor according to claim 7, wherein said extension has a radially extending flat area and an axially extending flat area continuous to the radially extending flat area, and wherein said projection is formed on one surface of the axially extending flat area.

Fig.1

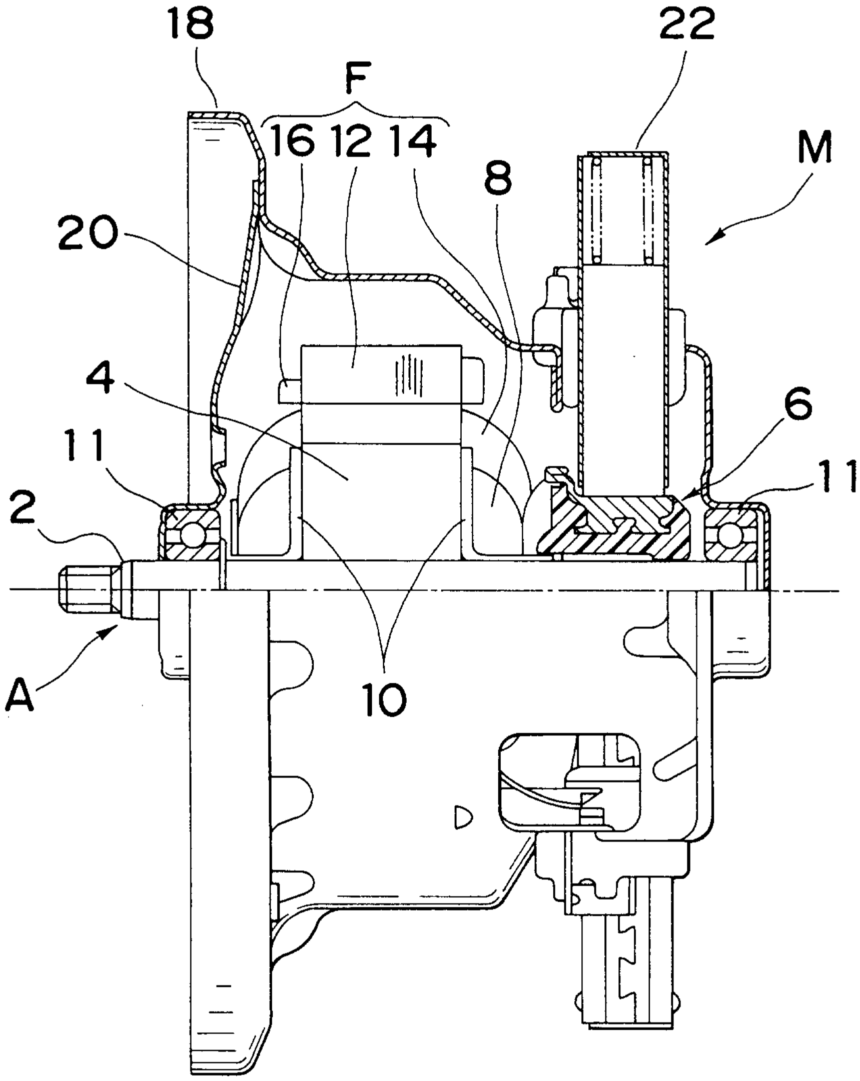

Fig.2

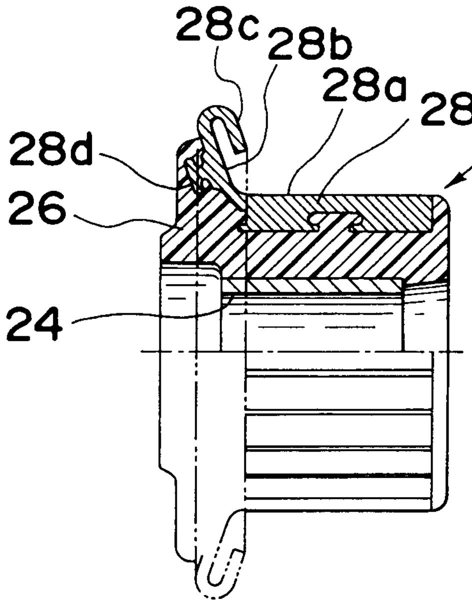

Fig.3

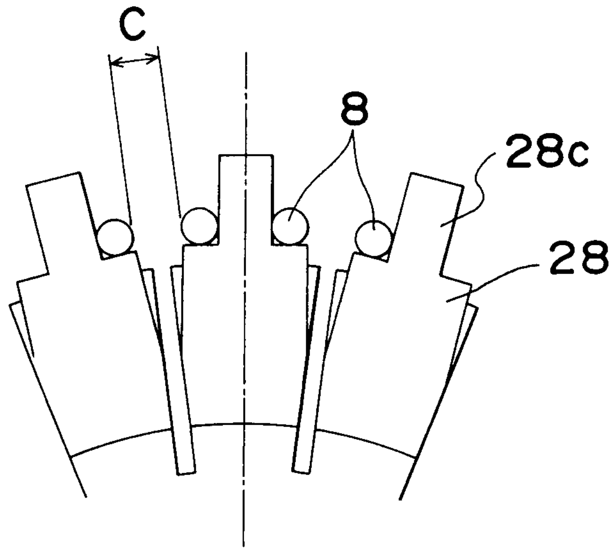

Fig.4

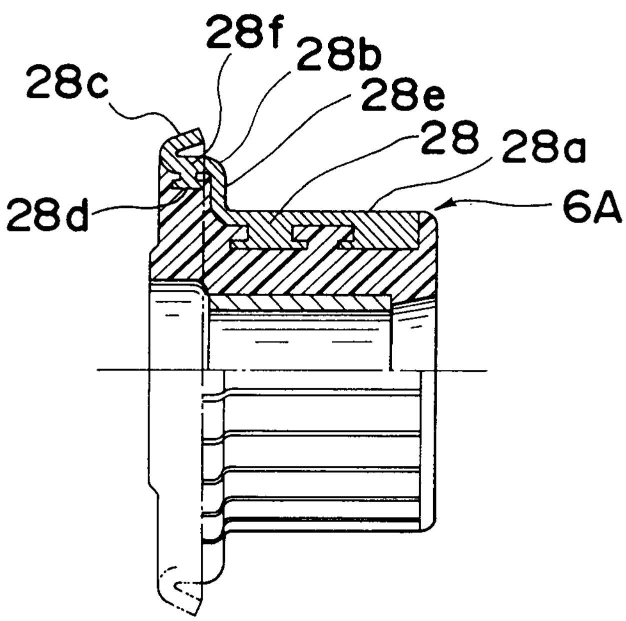

Fig.5 PRIOR ART

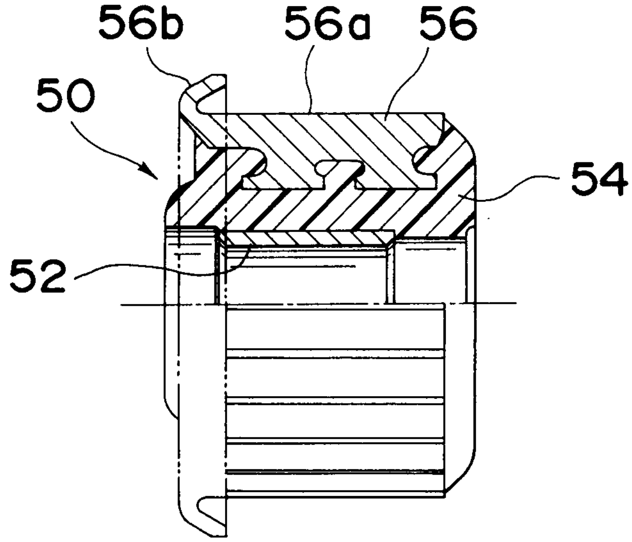

Fig.6 PRIOR ART