United States Patent

Bayer

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[54] **CARBON BRUSH FOR USE IN ELECTRIC MOTORS**

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[51] **Int. Cl.**.....**H02k 13/00**

[58] **Field of Search**.....310/219, 229, 239–242, 310/245–249

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[57] **ABSTRACT**

An elongated brush body has a trailing end face and a leading end face which contacts a rotating collector. A recess extends from the trailing towards the leading end face and is provided with a bottom surface which is domed in direction away from the leading end face and towards the trailing end face.

13 Claims, 5 Drawing Figures

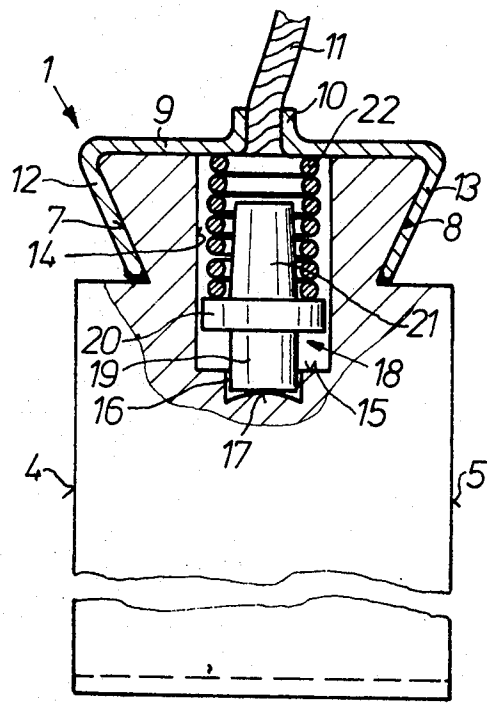

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Fig.1

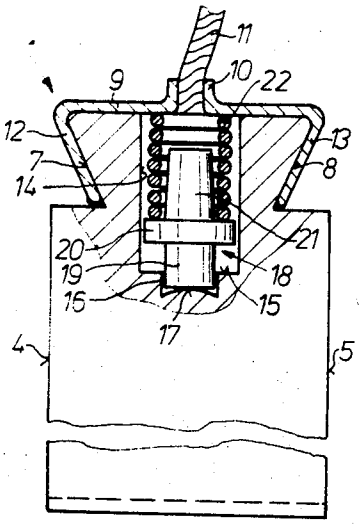


Fig.2

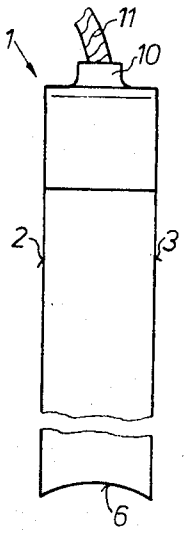


Fig.3

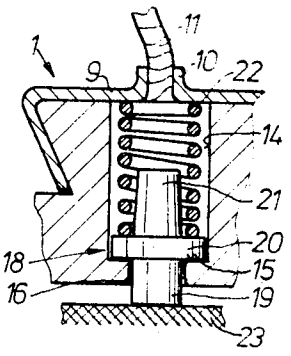


Fig.4

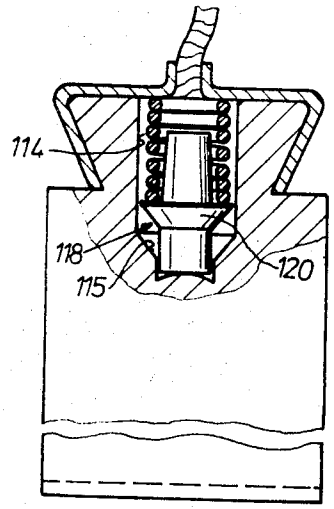
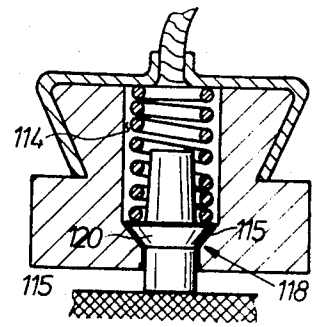


Fig.5



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CARBON BRUSH FOR USE IN ELECTRIC MOTORS

A pressure member of insulating material is slidably accommodated in the recess, and it is as well as the recess are stepped so that they are respectively provided with a stop and a shoulder which will abut when the pressure member moves towards the leading end face by a predetermined distance. A biasing spring urges the pressure member in that direction so that its forward end face abuts against the bottom surface of the recess but with the stop and shoulder remaining out of abutment until such time as the leading end face of the brush body, upon wearing away due to engagement with the rotating collector, reaches the level of the bottom surface and penetrates into the recess whereupon the pressure member emerges from the recess almost instantaneously and moves into abutment with the collector, thereby lifting the brush body off the collector.

BACKGROUND OF THE INVENTION

The present invention relates generally to a carbon brush for use with electric motors, and more particularly to an improved carbon brush which is intended to prevent damage to electric motors that could occur under certain circumstances.

The use of carbon brushes with electric motors is too well known to require detailed description. It is also known that as carbon brushes wear away, they can damage the collector of the electric motor therewith associated when the wearing-away process goes beyond a certain extent. To avoid the possibility of damage under these circumstances it is known to provide a carbon brush with an arrangement which lifts the brush off the collector when the brush has been worn away to such an extent that it must be replaced to prevent damage to the collector.

This concept behind the prior art is valid; however, the prior art constructions do not satisfactorily fulfill this concept. It is known from the prior art to provide the trailing face of the carbon brush body, that is the one which is remote from the leading face contacting the collector, with the recess which extends towards but short of the leading face, and has a bottom wall located in that region of the brush beyond which wearing-away must not proceed because of the danger of damage to the associated collector. A pressure member is located in this recess and its leading surfaces is urged against the bottom of the recess by a suitable biasing spring. The bottom wall of the recess itself converges forwardly in the direction towards the leading end face of the carbon brush body, that is it has a somewhat conically tapering configuration such as that produced by forming a bore with a spiral drill. The narrowest point of the forwardly converging bottom wall thus is also the point which is foremost, that is closest to the leading end face of the brush body. If, now, the brush body has worn away until it reaches the recess, initially a pinhole will open where the wear line intersects with the leading tapered end of the bottom wall of the recess. As wear further continues, this hole increases in size until it is large enough for the end of the pressure member to pass through and move into engagement with the collector to thereby lift the carbon brush off the same.

It has been said before that these prior-art constructions are not satisfactory. The reason will be simple to understand: These constructions do not precisely

determine the moment at which the pressure member can move out of the recess and into engagement with the collector. Because the size of the hole increases only gradually as wear progresses on the carbon brush body, difficulties can arise which may prevent satisfactory emergence of the front end portion of the pressure member from the recess. It can for instance occur that the pressure member may become jammed in the hole as the latter just comes up in its dimensions to the diameter of the pressure member itself. Thus, the pressure member may not be capable of moving into engagement with the collector and the danger exists that an electric arc may develop between the carbon brush and the collector, destroying the latter.

A further disadvantage of the prior-art constructions is the configuration of the closure plate or closure member which closes the open end of the recess at the trailing end of the carbon brush body. Conventionally it is either located within the recess itself and held by part of the compacted carbon, or it is soldered to the trailing end face of the carbon brush body. Neither construction is entirely satisfactory for this member which constitutes an abutment for the biasing means which biases the pressure member to operative position.

SUMMARY OF THE INVENTION

The present invention therefore has as its general object to provide an improved carbon brush of the type under discussion.

More particularly it is an object of the present invention to provide such an improved carbon brush which is not possessed of the aforementioned disadvantages outlined above with respect to the prior art.

Still more particularly the present invention has as one of its objects to provide an improved carbon brush of the type under discussion in which—when wear of the carbon brush body has progressed to a predetermined extent—the pressure member will rapidly and with great reliability emerge from its recess and will lift the worn carbon brush body out of engagement with the collector.

Still another object of the invention is to provide an improved closure member constituting an abutment for the biasing means.

In pursuance of the above objects, and others which will become apparent hereafter, one feature of the invention resides in a carbon brush for use in electric motors which, briefly stated, comprises in one embodiment an elongated brush body having a leading end face adapted to contact a rotating collector, and a trailing end face. A recess extends from the trailing towards the leading end face and has a bottom surface. A pressure member is slidably accommodated in the recess and has a forward end surface, with both surfaces being so configurated that in response to wearing-away of the leading end face to the level of the bottom surface, the forward end surface will become exposed over its entire cross-sectional area substantially at once. Biasing means acts upon the pressure member and urges the forward end surface into abutment with the bottom surface.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation,

together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a partly sectioned elevation illustrating a carbon brush according to one embodiment of the invention;

FIG. 2 is a side-elevational view of the embodiment in FIG. 1;

FIG. 3 illustrates the carbon brush of FIG. 1 in one condition;

FIG. 4 is a view similar to FIG. 1 but illustrating a further embodiment of the invention; and

FIG. 5 is a view similar to FIG. 3 but illustrating the carbon brush of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing now the drawing in detail, and firstly the embodiment illustrated in FIGS. 1–3, it will be seen that the carbon brush body itself is identified with reference numeral 1 and in conventional form has essentially the outline of an elongated rectangle. It has two parallel major surfaces 2 and 3, and two parallel minor surfaces 4 and 5 which connect the major surfaces, all surfaces extending longitudinally of the brush body 1. Also in conventional manner the leading end face 6 of the body 1 is configurated as a fragment of a hollow cylindrical surface, as illustrated in FIG. 2.

The trailing end portion of the body 1 is configurated as most clearly visible from FIGS. 1 and 2. More specifically, the surfaces 4 and 5 are provided with inclined facets 7 and 8 which converge in direction towards the leading end face 6 from the trailing end face of the body 1. A closure and abutment plate or member 9 may be made of sheet brass or the like, and is provided with an upwardly extending collar 10 surrounding an opening through which an electrical conductor 11 passes which is soldered into this opening. The lateral ends 12 and 13 of this closure member 9 are downwardly angled as shown in FIGS. 1 and 2, in such a manner that they abut against the facets 7 and 8 to which they are solder-connected. Thus, these portions 12 and 13 form with the facets 7 and 8 a substantially dove-tailed connection.

A recess 14 extends into the brush body 1 from the trailing end towards the leading end face 6 thereof. It is essentially cylindrical in configuration and is provided in its forward end with a stepped portion 16 which is relatively short and has a smaller diameter than the remainder of the recess 14, with the juncture between them defining a step or shoulder 15. According to the invention the bottom surface 17 of the portion 16 is domed in direction towards the leading end face of the body 1, which is to say that its outer circumferential marginal zone is located axially forward of its middle or center zone, as clearly evident from FIG. 1.

A pressure member 18 consisting of electrically insulating material is loosely slidably accommodated in the recess 14. Its lower cylindrical portion 19 is located in the portion 16 of the recess 14, and the slightly rearwardly tapering portion 21 is located in the remainder of the recess 14. At the juncture between the portions 19 and 21 there is a cylindrical stop or bead 20 which projects outwardly and is adapted to cooperate with the shoulder 15 from which it is, however, normally spaced in direction towards the trailing end face of the body 1, as illustrated in FIG. 1. Biasing means is provided, here illustrated in form of a helical pressure spring 22 which surrounds the portion 21 and bears with its opposite ends upon the stop 20 and the plate 9, respectively.

FIG. 1 illustrates the brush according to the present invention as it appears when it is new or at least when it is not yet significantly worn. In FIG. 3, however, I have illustrated the appearance of the brush when it has worn to the extent permissible without causing the danger of damage to the cooperating collector 23 which is diagrammatically shown in FIG. 3 for purposes of orientation. It will be seen that now the leading end face 6 of the body 1 has been worn away so that it has reached the forwardly located circumferential marginal zones of the bottom face 17 in the recess 14. Evidently, as the material wears away a breakthrough will occur along an annular line corresponding to the foremost portion of the recess 14, constituted by the marginal circumferential zone of the bottom face 17. Thus, a small substantially disk-shaped portion of material which is rearwardly domed, breaks loose and is flung off by the rotating collector 23. This permits the pressure spring 22 to downwardly or forwardly displace the pressure member 18 almost instantaneously, until the stop 20 and shoulder 15 engage one another whereby the portion 19 of the member 18 projects forwardly beyond the leading end face 6 of the worn brush 1 and abuts against the surface of the collector 23, thereby lifting the brush off the collector. The possibility of jamming of the member 18 in the recess 14 is thereby reliably prevented because when the recess becomes exposed, it becomes exposed almost instantaneously over its entire cross-sectional area with the bottom face 17 disappearing in its totality almost at once.

The embodiment illustrated in FIGS. 4 and 5 essentially resembles that of FIGS. 1–3. It differs from that embodiment only in that the pressure member 118 is provided with a stop or bead 120 which tapers conically in the direction towards the leading end face of the carbon brush body. Correspondingly, the abutment surface on the shoulder 115 also tapers in the same sense. This provides for an improved guidance function for the member 118 as the same moves to its extended position shown in FIG. 5.

The carbon brush according to the present invention can be produced very simply, and in particular it is easy to produce the abutment for the pressure spring acting upon the pressure member, due to the fact that there is the dovetail-shaped interengagement between the closure plate and the trailing portion of the body 1. Furthermore, due to the particular configuration of the bottom wall 17, the danger of delay in lifting-off of the carbon brush 1 from the collector 23 is avoided, and the provision of the shoulder and stop in the recess and on the pressure member precludes undesired projecting of the pressure member out of the recess beyond a certain extent, that is beyond the extent necessary to provide lifting-off of the carbon brush, and this in turn eliminates the danger of jamming or skewing of the pressure member between the carbon brush and the collector and thus avoids further possibilities of malfunctions.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in a carbon brush for use in electric motors, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can be applying current knowledge readily adapt it for various applications without omitting features that from the standpoint of prior art fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. A carbon brush for use in electric motors, comprising an elongated brush body having a leading end face adapted to contact a rotating collector, and a trailing end face; a stepped recess extending from said trailing towards said leading end face and having a wider first portion extending inwardly from said trailing end face, a narrower second portion extending inwardly from said first portion, a shoulder at the juncture of said portions, and a bottom surface domed in direction towards said trailing end face; a correspondingly stepped pressure member slidably accommodated in said recess and having first and second sections located in the respective portions, a stop, and a forward end surface, said surfaces being so configurated that in response to wearing away of said leading end face to the level of said bottom surface, said forward end surface will become exposed over its entire cross-sectional area substantially at once; biasing means acting upon said pressure member and urging said forward end surface into abutment with said bottom surface, said stop being normally spaced from said shoulder but being adapted to bear upon the same in response to exposure of said forward end surface and consequent forward displacement of said pressure member by said biasing means.

2. A carbon brush as defined in claim 1, said biasing means being a biasing spring accommodated in said recess; and further comprising cooperating abutment portions on said pressure member and in the region of said trailing end face and against which said biasing spring bears.

3. A carbon brush as defined in claim 1, said pressure member being composed of electrically insulating material.

4. A carbon brush as defined in claim 2, said pressure member having a cylindrical portion in the region of said trailing end face, and said spring being a helical spring surrounding said cylindrical portion.

5. A carbon brush as defined in claim 1, said brush body having a rear end portion provided with said trailing end face; and further comprising an abutment member for said biasing means overlying said trailing end face and embracing said rear end portion in clasping relationship.

6. A carbon brush as defined in claim 5, said rear end portion having a dove-tail shaped cross-section, and said abutment member being substantially C-shaped and embracing and clasping said rear end portion in interlocking engagement therewith.

7. A carbon brush as defined in claim 1, wherein said stop and shoulder are planar.

8. A carbon brush as defined in claim 1, wherein said stop and shoulder slightly converge in direction towards said bottom surface.

9. A carbon brush for use in electric motors, comprising an elongated brush body having a leading end face adapted to contact a rotating collector, and a rear end portion provided with a trailing end face; a stepped recess extending from said trailing towards said leading end face and having a wider first portion extending inwardly from said trailing end face, a narrower second portion extending inwardly from said first portion, a shoulder at the juncture of said portions, and a bottom surface domed in direction towards said trailing end face; a correspondingly stepped pressure member composed of electrically insulating material slidably accommodated in said recess and having a cylindrical first section and a second section located in the respective portions, a stop, and a forward end surface, said surfaces being so configurated that in response to wearing away of said leading end face to the level of said bottom surface, said forward end surface will become exposed over its entire cross-sectional area substantially at once; and an abutment member overlying said trailing end face and embracing said rear end portion in clasping relationship; a helical biasing spring accommodated in said recess, surrounding said cylindrical first section and bearing upon said abutment member and upon said pressure member and urging said forward end surface into abutment with said bottom surface, said stop being normally spaced from said shoulder but being adapted to bear upon the same in response to exposure of said forward end surface and consequent forward displacement of said pressure member by said biasing spring.

10. A carbon brush for use in electric motors, comprising an elongated brush body having a leading end face adapted to contact a rotating collector, and a rear end portion having a dove-tail shaped cross-section and provided with a trailing end face; a recess extending from said trailing towards said leading end face and having a bottom surface; a pressure member slidably accommodated in said recess and having a forward end surface, said surfaces being so configurated that in response to wearing away of said leading end face to the level of said bottom surface, said forward end surface will become exposed over its entire cross-sectional area substantially at once; biasing means; and an abutment member for said biasing means, said abutment member being substantially C-shaped and embracing and clasping said rear end portion in interlocking engagement therewith, said biasing means acting upon said pressure member and urging said forward end surface into abutment with said bottom surface.

11. A carbon brush as defined in claim 10, said recess being stepped and having a wider first portion extending inwardly from said trailing end face, a narrower second portion extending inwardly from said first portion, and a shoulder at the juncture of said portions; and wherein said pressure member is correspondingly

stepped and has first and second sections slidably located in the respective portions, and a stop normally spaced from said shoulder but adapted to bear upon the same in response to exposure of said forward end surface and consequent forward displacement of said pressure member by said biasing means.

12. A carbon brush as defined in claim 11, said bottom surface being domed in direction towards said trailing end face.

13. A carbon brush as defined in claim 12, wherein said forward end surface is at least substantially planar.

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