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BRUSH HOLDER FOR ELECTRIC COMMUTATOR MACHINE

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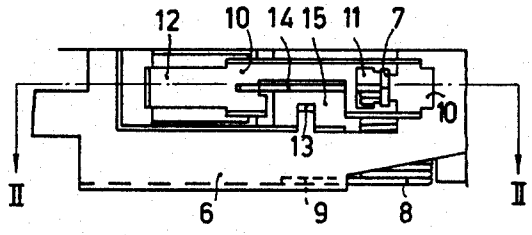

FIG.1

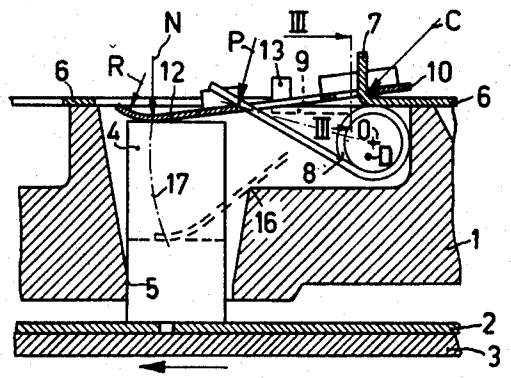

FIG.2

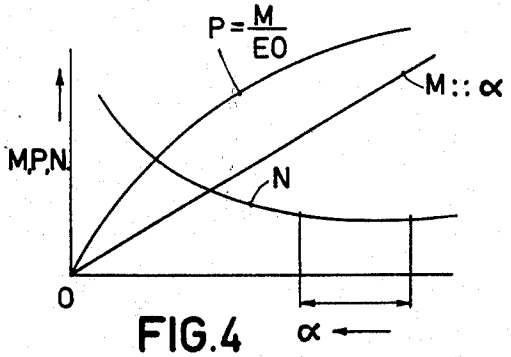

FIG.4

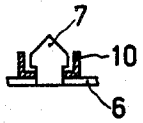

FIG.3

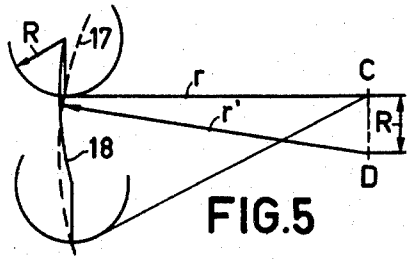

FIG.5

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BRUSH HOLDER FOR ELECTRIC COMMUTATOR MACHINE

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5 Claims. (Cl. 310—246)

This invention relates to electric commutator machines of low power, more particularly electric motors for dry-shaving and like apparatus, which comprise brushes fitted in a bearing carrier of insulating material; one side of the brushes engaging a supporting surface of the bearing carrier against which the brush is forced by rotation of the commutator and a resilient element being provided in the bearing carrier for biasing each brush against a commutator.

It is desirable that the position of the brushes relative to the commutator should vary to the least possible extent as the brushes wear away, and that the spring pressure on the brushes be as constant as possible as the brushes become worn.

According to the invention, the resilient element, preferably a helical spring, co-acts with a pressure piece one end of which is pivotable about a fixed point on the bearing carrier and in a plane at right angles to the commutator. The other end of the pressure piece is curved as a segment of a circle, the point of tangency between the brush and the curve of the pressure piece being off center and closer to the supported side of the brush than the non-supported side. In accordance with the invention the spring pressure on the brush remains substantially constant with brush wear and the brush positions relative to the commutator remains substantially constant.

In one embodiment of the invention the center of the curve of the pressure pieces is so chosen that the geometric position of the point of the tangency between the brush and the pressure piece defines a slightly curved plane with decreasing length of the brush, which plane is also closer to the supported face of the brush, i.e., the face forced against the brush holder or biasing piece, than to its non-supported face. On the one hand, the wearing brush is thus prevented from tilting and, on the other hand, the pressure piece may embed itself in the brush due to initial sparking occurring therebetween and substantially remain in said indentation or embedded relation so that the contact area between the pressure piece and the brush is somewhat increased.

To prevent the pressure piece from contacting the commutator when the brush has worn completely, an abutment is provided for the pressure piece which prevents its further movement.

In accordance with the invention, the pressure piece has a cross-section which is preferably partly U-shaped, the upright-sides of the U being removed at the curved end, while in one of the upright walls, on one side and correspondingly in the body, an aperture is provided through which the end of the spring may be brought to bear on the pressure piece, thus providing the required rigidity of the pressure piece.

Another feature of the invention, permits simple mounting of the pressure piece and a low cost pivot therefore. To this end the body of the pressure piece is provided with a second aperture having two different dimensions in the transverse direction or width of the pressure piece. The larger dimensions of this aperture being located nearer the curved end of the pressure piece and receiving an upright tongue of the bearing carrier provided with a cut on each side, the transverse dimension of the tongue above the cut being equal to the larger dimension of the aperture and the transverse dimension of the tongue at the cut being equal to the smaller dimension of the aperture, while the height of the cut is slightly greater than the thickness of the material of the pressure piece.

In order that the invention may be readily carried into effect it will now be described in detail, by way of example, with reference to the accompanying drawing showing a presently preferred embodiment thereof, together with several explanatory graphs.

FIG. 1 is a plan view of a brush holder according to the invention;

FIG. 2 is a sectional view taken along the line II–II of FIG. 1 viewed in the direction of the arrow;

FIG. 3 is a sectional view taken along the line III–III of FIG. 2 likewise viewed in the direction of the arrow;

FIG. 4 is a graph showing the relationship between the angle α of the spring, and the moment of the spring, the force directly exerted by the spring and the pressure on the brush;

FIG. 5 shows the path of movement or localization of the point of contact between the brush and pressure piece with decreasing length of the brush.

The drawing shows a bearing carrier **1** of suitable known insulating material, and commutator segments **2** secured on an insulating substratum **3**. The commutator is assumed to be displaced in the direction indicated by the arrow (FIG. 2). Included in the bearing carrier **1** is a carbon brush **4** one face of which engages a supporting surface **5** of the bearing carrier so that the brush is supported in the direction indicated by the arrow upon displacement of the commutator. The bearing carrier carries a plate **6** of electrically conductive material having a tongue **7** which, as shown in FIG. 3, comprises a narrow portion and a broad portion. A helical spring **8** lies in a cavity of the bearing carrier **1**. One end **9** of the helical spring engages the plate **6**. A pressure piece **10** is slid onto the tongue **7**, which is possible because the pressure piece, which has a U-shaped cross-section, has an aperture **11** (FIG. 1) in its body having a largest dimension slightly exceeding the large dimension of the tongue **7** (FIG. 3) and the smallest dimension of which is equal to the smaller dimension of this tongue. The pressure piece **10** is thus held in position by the tongue **7**, but is pivotable about the tongue to a limited extent. The pressure piece **10** has a curved end **12** which bears on the brush **4**. The radius of the curved end is indicated by R. The plate **6** also carries a projection **13** engaging one end **9** of the spring **8**; its other end **14** of the spring passes through an aperture **15** in the pressure piece and thus presses the latter onto the brush **4**. Lastly, the bearing carrier is provided with an abutment **16** which is engaged by the pressure piece **10** before the brush **4** is completely worn away.

FIG. 4 is a graph showing, on the axis of ordinates, the moment M of the spring, the force P at which the end **14** of the spring presses on the pressure piece **10**, and the force N at which the curved end **12** of the pressure piece presses on the brush **4** and showing, on the axis of abscissae the angle α of the spring, i.e., the angle between the ends **9** and **14** of the spring. The line M in the graph is a straight line, which means that the moment of the spring is proportional to the spring angle α. The force P at which the end **14** of the spring presses on the pressure piece **10** is, however, shown as a curved line, which is evident when considering that P is equal to M/EO where EO represents the distance between the point where the force P is applied to the pressure piece **10** and the center of the spring and this distance decreases as the brush wears away. The relationship between the force N and the spring angle α is represented by a slightly curved line N. It appears from the graph that this line

N is substantially flat through the distance of the actually active angle α of the spring so that the active pressure on the brush is substantially constant, even when the brush is worn.

The point, where the pressure piece engages the brush lies to the left of the center line of the brush so that tilting of the brush is prevented. In FIG. 5 the rounding of the pressure piece is indicated by R and the center of rotation of the pressure piece 10 about the tongue 7 by C. It appears from this figure that the geometric position of the tangent between the pressure piece and the brush, with the brush wearing away, instead of being the arc of circle 18 having a radius r^1, drawn from C, is an arc of circle 17 having a radius r, drawn from point D, wherein D lies directly below point C, while the distance between C and D is equal to R. By a suitable choice of R, the pressure point may thus always lie to the left of the center line of the brush so that, as the brush wears tilting cannot occur. When the brush has worn to an extent such that further use is no longer desirable, the pressure piece engages the abutment 16 so that the pressure on the brushes is eliminated.

It thus appears that the location of the line 17 is largely dependent upon the curvature of the end of the pressure piece and that line 17 is curved very slightly during the brush wear while from FIG. 4 it appeared that the force N on the brush is substantially constant. Uniform wearing of the brush is thus obtained. Sparking and hence greater wear of the brush usually occurs at the run-off point, that is, the point where contact between the brush and the commutator is interrupted. Due to the location of the line 17, the brush surface engaging the commutator is as large a surface as possible even with maximum brush wear. The construction described affords still another advantage. The current is supplied to the commutator through the pressure piece 10 so that sparking initially occurs at the point of contact of the pressure piece with the brush. As a result the curved portion of the pressure piece becomes embedded in the surface of the brush so that the contact therebetween is greatly increased and transition decreased, since the curved portion of the pressure piece, due to its small displacement relative to the brsuh will lie in substantially the same embedding cavity, only very slightly elongated with brush wear.

The mounting of the assembly is simple. First the spring 8 is laid in the appropriate cavity; then the end 9 of the spring is brought behind the projection 13 and now the carbon brush 4 is placed in position, whereafter the pressure piece 10 is slid onto the tongue 7 and lastly the spring 14 is brought onto the pressure piece, which is thus brought into correct engagement with the brush.

What is claimed is:

1. In a low power electric motor the combination comprising a bearing carrier of insulating material having apertures for receiving brushes, a brush in each said aperture engaging one wall thereof, a second aperture in said bearing carrier connected with said brush aperture, a helical spring in said second aperture, a pressure piece hingedly connected at one end with said bearing carrier and overlying said helical spring, one leg of said helical spring engaging said pressure piece for urging the other end of said pressure piece against said brush, said other end of said pressure piece being curved away from said brush and engaging said brush at a point of tangency between the center line of said brush and said wall of said bearing carrier.

2. A motor according to claim 1 wherein the radius of curvature of the other end of said pressure piece is chosen to define a slightly curved plane defined by movement of the point of tangency between said pressure piece and associated brush as said brush wears.

3. A motor according to claim 1 wherein the corner of said bearing carrier defined by said intersecting apertures engages said pressure piece for limiting movement thereof.

4. A motor according to claim 1 wherein said pressure piece is provided with an opening between the ends thereof and said one leg of said helical spring passing through said opening for engaging said pressure piece.

5. A motor according to claim 1 wherein means for hingedly connecting said pressure piece and said bearing carrier comprises a generally T shaped tongue connected with said bearing carrier, a pair of connected apertures adjacent said one end of bearing piece, one of said pair of apertures being dimensioned to receive said cross bar of said T shaped tongue and the other of said apertures being dimensioned to receive the said T shaped tongue and hingedly secure said pressure on said tongue.

No references cited.

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