Aug. 13, 1957 M. A. BAKER 2,802,960

BRUSH HOLDER ASSEMBLY

Filed Sept. 23, 1955

Fig. 1.

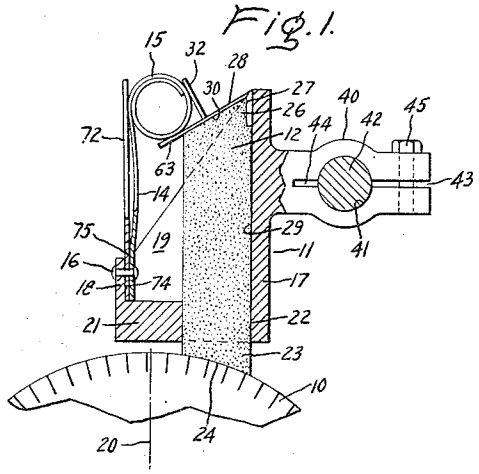


Fig. 3.

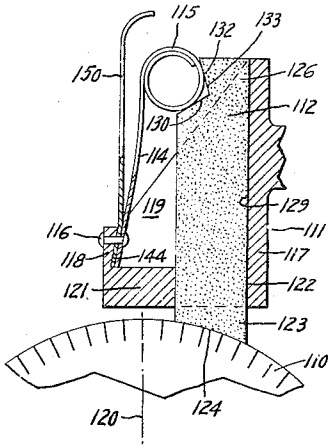


Fig. 2.

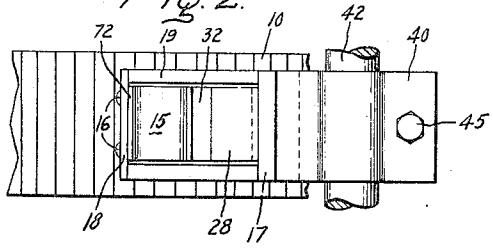


Fig. 4.

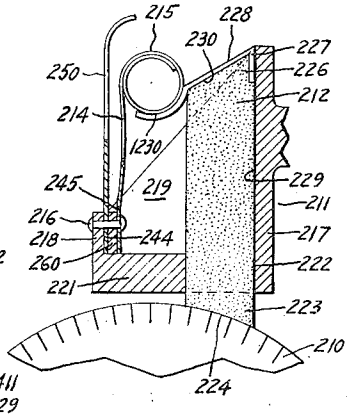


Fig. 6.

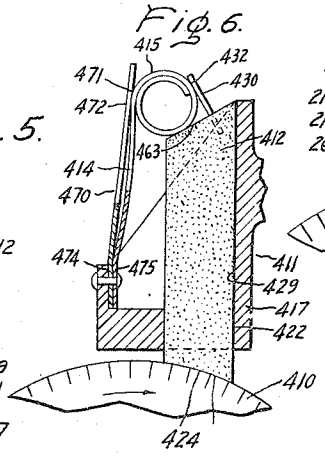
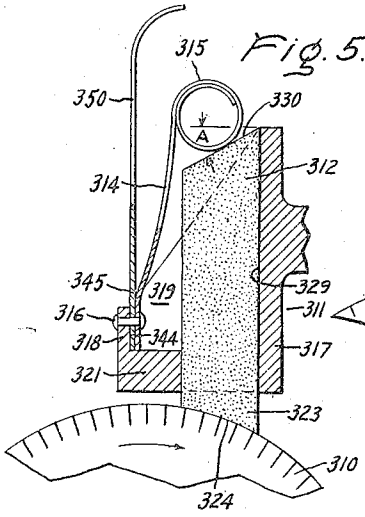


Fig. 5.



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BRUSH HOLDER ASSEMBLY

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17 Claims. (Cl. 310—246)

This invention relates to dynamo-electrical machinery and more particularly to brush assemblies for use on electrical motors and generators.

The use of a coiled compression spring for maintaining motor and generator brush contact is known in the art. Previously, brush holders incorporating coiled compression springs which are pre-stressed prior to assembly and have one end attached to fixed members with the distal ends terminating in a spiral coil adapted to engage the outer ends of the brushes have been suggested. This type of spring has been acceptable due to its inherent property of exerting a force on brushes which is substantially constant throughout the life of brushes, even though the brushes are long when installed and their length is decreased by wear until they are worn extremely short.

This type of spring as heretofore applied to brushes of the type discussed may apply a force to the brush in a manner which may cause the brush to be drawn away from the brush holder reaction surface by the force of the commutator thereon. The effect of the movement of the brush away from the reaction surface may result in brush chatter, sparking at the commutator, or rapid brush wear.

One feature of the present disclosure is a constant tension spring which applies a force to the brush at a point spaced from and on the side of the central axis of the brush remote from the reaction surface with the force having a sense inclined toward the commutator and toward the reaction surface. The resultant of the force applied by the spring and the frictional force of the rotating commutator on the opposite end of the brush produces a wedging action which holds the brush firmly against the reaction surface in either direction of rotation, thus inhibiting any tendency of the brush to chatter with the inherent undesirable results.

Furthermore, when springs are applied to brushes in the manner old in the art as aforesaid, the end engaging the brush has a tendency to creep across the surface of the end of the brush toward the reaction surface as the volute rolls up, until it reaches a point where it will slip. As it slipped, it would tend to pull the brush with it away from the reaction surface.

To overcome the tendency of the volute to creep over the surface of the brush, this invention discloses a restraining surface on the brush for engaging the spring. This surface may take the form of a flanged plate attached to the brush as disclosed in one embodiment or it may be a notch properly located to receive the brush end as disclosed in another embodiment herein. According to this invention, the restraining means could be any form of stop for the spring.

Under conditions of severe shock, brushes may jump out of the holder. To overcome this tendency and to prevent the brushes from jumping out of the holder, a keeper is disclosed. The keeper also prevents negligent operators from over-stressing the spring when replacing brushes, etc.

Another important feature of the present invention is an improved shape of spring which insures proper uniform pressure and force sense as the brush wears and, consequently, the brush helix re-rolls itself with the resulting tendency not to lose its tension. This action may be facilitated by an improved brush mounting disclosed herein as well as by a reinforcing element shown in combination with the spring.

Still another feature is a guard or keeper disposed parallel to the spring with a portion overlying the brush to keep the spring from jumping out and to protect the spring.

With the above and other advantages in view, the present invention consists of the combination and arrangement of parts hereinafter more fully described, illustrated in the accompanying drawing and more particularly pointed out in the appended claims, it being understood that changes may be made in the form, size, proportions, and minor details of construction without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawing:

Fig. 1 is a side elevational view partly in section of the improved brush holder and coiled spring assembly of this invention showing the reaction surface engaged by the brush;

Fig. 2 is a top view of the assembly shown in Fig. 1;

Fig. 3 is a side elevational view similar to Fig. 1 showing another embodiment of the invention;

Fig. 4 is a view similar to Figs. 1 and 2 of still another embodiment of the invention;

Fig. 5 is still another view similar to Figs. 1, 3 and 4 showing another embodiment of the invention; and

Fig. 6 shows another embodiment of the invention.

Referring now to the embodiment of the invention shown in Figs. 1 and 2, the commutator of a dynamo-electric machine such as a motor or generator is shown at **10**. The longitudinal axis of a brush **12** is disposed generally parallel to the vertical center line **20** of the commutator **10** and spaced on the leading side therefrom. The brush **12** will be provided with the usual pigtail or other suitable electrical connection to connect the brush **12** to a suitable electrical terminal conductor.

A brush casing **11** has ends **17** and **18** connected by side members **19** which join the end members **17** and **18** together and are also joined to a bottom **21**. The bottom **21** has an opening **22** therethrough adjacent the reaction surface to receive the lower end **23** of the brush **12**. A commutator engaging surface **24** of the brush **12** will be formed in a general contour to conform to the peripheral surface of the commutator **10**. The upper end **26** of the brush **12** is relieved at **27** and an outer plate **28** extends over the upper surface and bends over the outer leading edge corner and is attached thereto. The upper end **26** of the brush **12** terminates in a surface **30** preferably inclined at an angle to the transverse axis of the brush **12**.

The plate **28** is attached to the upper end of the brush **12** by a suitable means. A flange **32** is attached to the plate **28** at an intermediate point thereon and extends upwardly therefrom generally perpendicular thereto.

A bracket **40** is integrally attached to the brush casing **11** and has a bore **41** which receives a stud **42**. The stud **42** is rigidly attached to the fixed frame of the machine and insulated therefrom. The bracket **40** has a slot **43** cut therein which has a continuation **44** on the opposite side of the bore **41**. A bolt **45** threadably engages the end of the bracket **40**, clamping the bracket **40** to the stud **42** in the usual manner. This makes it possible to loosen the bolt **45** and thereby rotate the bracket **40** on the stud **42** to bring the brush **12** into

alignment with respect to the commutator **10** and, at the same time, the bracket **40** may be slid along the stud **42** to properly locate the brush **12** relatively to the axis of the commutator **10**.

A spring **14** is substantially a constant pressure spring and is made of a material flat in cross section and prestressed along its length so as to naturally assume a free self-winding volute coil **15** of a diameter which will nest well into the space between the flange **32** and the end **63** of the plate **28**. The spring **14** is attached to the inner surface **74** of the end **18** and is attached thereto by means of rivets **16**; however, it could be attached by any other suitable fastening means. The spring **14** is bent toward the brush **12** at **75** and the force on the coil **15** puts an inverse bend in the spring **14** as shown. As the commutator **10** rotates and wears away the lower end **23** of the brush **12**, the brush **12** will be urged downward by the force of the coil **15** on the top of the plate **28** and, at the same time, the upper end of the brush **12** will be urged toward the reaction surface **29**. The lower end of the brush **12** will be urged toward the reaction surface **29** by reason of the frictional force on the lower surface thereof by rotation of the commutator **10**. Therefore, the brush **12** will be bodily moved toward the reaction surface **29** and held in firm relation thereagainst. As the brush **12** wears away and shortens, the volute coil **15** will rewind and the frictional force of the portion thereof engaging the plate **28** will tend to cause the volute to climb toward the reaction surface **29**. This tendency will be opposed by the flange **32** which will hold it in the position shown throughout the life of the brush **12**, thereby causing the spring **14** to exert a resultant force on the outer end of the brush **12** which will do its part in holding the outer end in firm engagement with the reaction surface **29**.

In order to obtain the optimum pressure on the brush **12** toward the reaction surface **29**, a leaf spring **72** may be used. The use of such a spring is made possible by the positive stops provided which consist of the flange **32**. The leaf spring **72** is attached to the brush casing **11** by the rivets **16** or other suitable means and is disposed between the spring **14** and the casing **11**. The leaf spring **72** may be bent to pre-stress it to exert the optimum pressure on the brush **12** toward the reaction surface **29**.

In the embodiment of the invention shown in Fig. 3, a spring and brush assembly is shown in some respects similar to that shown in Fig. 1. The corresponding parts in Fig. 3 to the corresponding parts in Fig. 1 are sometimes numbered with the same number having one hundred added thereto to distinguish between the two embodiments. Fig. 3 shows a brush casing **111** supporting a brush **112**. The brush casing **111** has end **117** and a spring supporting reaction end **118** and sides **119**. Brush surface **124** engages the outer periphery of a commutator **110**. A constant pressure spring **114** having a volute end **115** is attached to the inner surface **144** of the end **118**. The surface **144** tapers outwardly and toward the brush **112**, thereby causing the spring **114** to incline toward the brush **112**. A keeper **150** is attached to the surface **144** between the spring **114** and the surface by means of rivet **116** and rivet **116** passes through both the keeper **150** and the spring **114**. The spring **114** could be attached to the surface **144** by other suitable means than the rivet **116**.

A slot **133** is formed in the outer end **126** of the brush **112** at the side thereof remote from reaction surface **129** and the side portion thereof is nested in the slot **133**. As wear reduces the length of the brush **112**, the volute **115** winds itself up and the edge **132**, as well as the inclined edge **130**, holds the volute **115** in positive relationship with the brush **112** and insures a resultant force applied by the spring **114** in a direction to force the brush **112** downward in opening **122** as well as toward the reaction surface **129** so that the resultant force applied to the brush **112** by means of the spring **114**, when combined with the frictional force of the rotating commutator **110** on the lower end of the brush **112**, holds the brush **112** firmly against the reaction surface **129**.

In the embodiment of the invention shown in Fig. 4, a brush casing **211** is disclosed having a reaction end **217**, spring end **218**, sides **219**, and a bottom **221**. The bottom **221** has an opening **222** therethrough. The commutator end **223** of brush **212** extends through the opening **222** and the commutator end surface **224** of the brush **212** engages the peripheral surface of the commutator **210**. The brush casing **211** has the sides **219** which connect the ends and bottom **221** together.

Upper surface **230** of the brush **212** has a plate **228** thereon which bends over at **227** into a relief therein whereby it is firmly fixed to the brush **212**. The opposite end of the plate **228** from the end **227** has a volute receiving saddle **1230**. A constant pressure spring **214** is attached at its lower end by means of rivet **216** or other suitable means to the inner face of spring support end **218** and is supported against the spacer **260** which is disposed between a keeper or backing member **250** and the lower end of the spring **214**. The spring **214** is bent at **245** toward the brush **212** whereby the spring **214**, when urged to the stressed position shown, exerts a force downward and toward reaction surface **229**.

The keeper **250** serves the dual purpose of forming a guard to prevent the spring **214** from coming out of place during disassembly and also forms a convenient means for holding the spring **214** in place while the rivet **216** is put into position.

It will be noted that as the brush **212** wears away and shortens, volute **215** will reroll but will be held in position nested in the saddle **1230** whereby a resultant force will be exerted on the brush **212** toward the commutator **210** and toward the reaction surface **229**. This resultant force, in combination with the frictional force between the commutator **210** and the surface **224**, will urge the brush **212** bodily toward the reaction surface **229**, thereby holding it in position.

The embodiment of the invention shown in Fig. 5 discloses a brush casing **311** which has ends **317** and **318** connected by sides **319** and having a bottom portion **321**. The outer peripheral surface of commutator **310** is engaged by conforming surface **324** of lower end **323** of a brush **312**. The upper surface **330** of the brush **312** is inclined downwardly at an angle A. It has been discovered that the angle A must be between twenty-five degrees and forty-five degrees. If the angle is greater than forty-five degrees, the effective length of the brush is reduced since the beveled surface takes up an appreciable percentage of the length and thus shortens its life. If it is less than twenty-five degrees, the force toward the reaction surface will not be sufficient for desirable results and the volute will tend to slip on the upper end surface of the brush with the resulting undesirable effects.

The volute **315** of the spring **314** engages the surface and, due to the large angle of the surface **330**, the brush volute **315** will be restrained against its natural inclination to climb upward on the surface **330** as the brush **312** shortens due to wear and the volute **315**, therefore, rerolls.

The brush **312** is attached to the inner surface **344** of the end **318** by means of a rivet **316** or other suitable means which extends through the lower end **325** of the constant pressure spring **314** and through a keeper **350**. The spring **314** is bent at **345** toward the brush **312**. The keeper **350** protects the spring **314** against damage and also provides a means for preventing the brush **312** from jumping out of its casing **311** in case of shock due to explosion on shipboard and due to similar shocks.

During operation, the commutator **310** preferably rotates in the direction indicated and the frictional force on the surface **324**, when combined with the resultant force of the volute **315** toward the reaction surface **329**,

holds the brush 312 against the reaction surface 329 in positive relation thereto.

In the embodiment of the invention shown in Fig. 6, a brush 412 is supported in a brush holder 411 and rests against the reaction surface 429. The lower end of the brush holder 411 at 417 engages the surface 422 of the brush 412. The inner end surface 424 of the brush 412 engages the outer peripheral surface of commutator 410. A spring 414 is attached to the brush holder 411 at 475 and terminates at the upper end thereof in a tightly wound volute 415 which engages the upper tapered surface 463 of the brush 412 and engages the flange or pin 430 at 432. The flange or pin 430 could be molded into the brush 412 or tamped or pressed thereinto. The flange 430 restrains the brush 412 against movement over the end of the brush 412 toward the reaction surface 429 and, therefore, provides a positive stop.

An auxiliary spring 470 is fastened to the brush holder 411 at 474 and the upper end 472 engages the volute 415 at 471, exerting an additional force toward the flange 430 which adds to the force in that direction exerted by the volute 415 and urges the brush 412 toward the reaction surface 429. The tension on the spring 470 can be adjusted to obtain the optimum force toward the flange 430 and, because of the flange or pin 430, a positive stop is provided to prevent the volute 415 from climbing up the brush 412.

The foregoing specification sets forth the invention in a practical form but the structure shown is capable of modification within a range of equivalents without departing from the invention which is to be understood is broadly novel as is commensurate with the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A commutator brush holder comprising a brush casing, and an elongated spring, the commutator end of said spring being attached to said casing and the distal end of said spring terminating in a self-winding volute arranged to engage the upper end of a brush in said casing, said casing having an opening therethrough with a reaction surface on the inside edge thereof, one end of said brush being adapted to engage a commutator, the other end of said brush having a stop member affixed thereon to restrain said volute against movement toward said reaction surface, said spring being adapted to apply a force to said brush to urge said brush toward said reaction surface and toward said commutator adapted to be engaged by the commutator end of said brush.

2. The brush holder recited in claim 1 wherein said means to restrain movement of said volute comprises a flange attached to said brush inwardly from the edge adjacent said spring, said volute engaging said means including said flange.

3. The brush holder recited in claim 1 wherein said means to restrain movement of said volute comprises a plate attached to the end surface of said brush remote from said commutator end and extending outward therefrom, said end surface being inclined toward said spring, said plate extending outwardly beyond the edge of said brush adjacent said spring, and means on said plate to restrain said volute against movement over said plate toward said reaction surface.

4. The brush holder recited in claim 3 wherein said plate has a flange attached thereto intermediate the ends thereof, said volute of said spring being disposed against the overhanging ends of said plate and said flange.

5. In combination, a dynamo-electric machine having a commutator and a brush holder comprising a brush casing having a spring engaging end and a reaction surface portion, an opening through said casing, one inside edge of said opening comprising a reaction surface, means to attach said brush holder to a fixed member adjacent the commutator on said dynamo-electric machine, an elongated brush adapted to extend through said opening in said casing with one edge thereof lying along and in engagement with an inner surface of said reaction surface, the commutator end of said brush being disposed outside said casing and the end of said brush opposite said commutator end being inclined toward said commutator end and away from said inside surface, a plate attached to and lying along said end of said brush opposite said commutator end, said plate overhanging said brush remote from said reaction surface, the other end of said plate extending into a notch in said brush, and a flat elongated spring having one end coiled into a self-winding volute engaging said plate and a flange, the other end of said spring being attached to said brush holder, said spring being adapted to urge said brush into engagement with said reaction surface, said brush being displaced from the transverse center line of said commutator parallel thereto on the side thereof toward said reaction surface.

6. The combination recited in claim 5 wherein said casing has two sides and a bottom attached to said sides and end, said opening being formed in said bottom on the side thereof adjacent said reaction surface, said spring being attached to said brush holder at a point spaced from said brush.

7. A brush holder for a dynamo-electric machine having a commutator comprising a brush casing having a spring supporting end and a reaction surface end, a bottom on the commutator end of said brush holder, an opening in said bottom adjacent said reaction surface end, an elongated brush disposed in said opening and lying along said reaction surface, an elongated spring attached to said spring supporting end and extending therefrom, the distal end of said spring being in the form of a self-winding volute, and a notch formed in said brush in the upper portion thereof where the side remote from said reaction surface engages the end remote from said commutator end, said volute being disposed in said notch and adapted to urge said brush toward said reaction surface and toward said commutator.

8. The brush holder recited in claim 7 wherein said spring supporting end has a surface adjacent said brush inclined away from said commutator and toward said brush, said spring attached to said spring supporting surface having its attached end inclined upwardly and toward said brush.

9. The brush holder recited in claim 8 wherein an elongated handle is attached to said inclined spring supporting surface between said spring and terminating in a hook member overlying said volute.

10. In combination, a dynamo-electric machine having a commutator and a brush holder attached thereto comprising a brush casing having a spring supporting end and a reaction surface end, a bottom on the commutator end of said reaction surface end, an opening in said bottom, an elongated brush disposed in said opening and lying along said reaction surface, an elongated spring attached to said spring supporting end and extending therefrom, a distal end of said spring being in the form of a self-winding volute, a notch formed in said brush in the corner thereof where the side remote from said reaction surface engages the end remote from said commutator end, said volute being disposed in said notch and adapted to urge said brush toward said reaction surface and toward said commutator, said spring supporting end having a surface adjacent said brush inclined away from said commutator and toward said brush, said spring attached to said spring supporting surface having its attached end parallel to said inclined surface, and an elongated handle attached to said inclined surface between said spring and said surface, said handle extending along said spring and terminating in a hook member overlying said volute, said brush being displaced from the center line of said commutator in a direction toward said reaction surface.

11. A commutator brush holder comprising a brush casing, an elongated spring in said casing, the commuta-

tor end of said spring being attached to said casing and the distal end of said spring terminating in a self-winding volute, said casing having an opening therethrough with a reaction surface on the inside edge thereof, and a brush adapted to engage a commutator, the other end of said brush having means thereon to restrain said volute against movement toward said reaction surface, said means comprising a plate attached to the end of said brush remote from said commutator, said plate overhanging the edge of said brush adjacent said spring and said plate having a concave surface thereon, said volute of said spring engaging said concave surface whereby said spring urges said brush toward said commutator and toward said reaction surface.

12. The brush holder recited in claim 11 wherein said brush is offset from the center line of said commutator on the side thereof toward said reaction surface.

13. The brush holder recited in claim 12 wherein said spring is attached to said brush casing by means on the inside of one end surface of said casing, and a keeper extends co-extensive with said spring and upwardly therefrom and terminates in a curved portion overlying the volute of said spring disposed thereon with a spacer between said spring and said keeper.

14. In combination, a dynamo-electric machine having a commutator and a brush holder attached to said machine adjacent said commutator, said brush holder having a casing comprising an elongated spring, the commutator end of said spring being attached to said casing and the distal end of said spring terminating in a self-winding volute, said casing having an opening therethrough with a reaction surface on the inside edge thereof, and a brush adapted to engage a commutator, the other end of said brush having means thereon to restrain said volute against movement toward said reaction surface, said means comprising a plate attached to the end of said brush remote from said commutator and having a second plate attached to said first plate and extending generally perpendicular thereto, said first plate overhanging the edge of said brush adjacent said spring and having a concave surface thereon, said spring engaging said concave surface whereby said spring urges said brush toward said commutator and toward said reaction surface, said brush being offset from the center line of said commutator on the side thereof toward said reaction surface, and a keeper extending co-extensive with said spring and upwardly therefrom and terminating in a portion overlying the volute of said spring disposed thereon with a spacer between said spring and said keeper, said commutator adapted to rotate in a direction to urge said brush toward said reaction surface.

15. In combination, a dynamo-electric machine having a commutator, a brush holder attached to said machine adjacent said commutator, said brush holder having a casing and an elongated spring attached to said casing, the commutator end of said spring being attached to said casing and the distal end of said spring terminating in a self-winding volute, said casing having an opening therethrough with a reaction surface on the inside edge thereof, and a brush adapted to engage a commutator, the other end of said brush having means thereon to restrain said volute against movement toward said reaction surface, said means comprising a member embedded in the outer end of said brush intermediate thereof whereby said volute urges said brush toward said commutator and toward said reaction surface.

16. The combination recited in claim 15 wherein an auxiliary spring is attached to said brush casing and is generally coextensive with said elongated spring and urges the volute end of said elongated spring and said brush toward said reaction surface.

17. The combination recited in claim 15 wherein said member embedded in the outer end of said brush comprises a pin having one end embedded in said brush and the other end extending above the surface of said brush.

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