Nov. 22, 1949 C. O. WEILBAECHER 2,488,788

BRUSH HOLDER PROVIDING RESILIENT APPLICATION OF THE BRUSH AGAINST THE BRUSH HOLDER WALL

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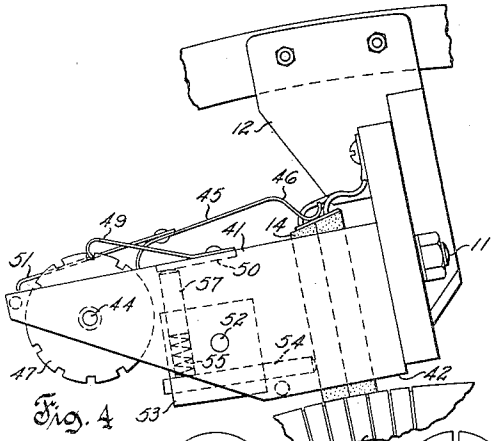

Fig. 4

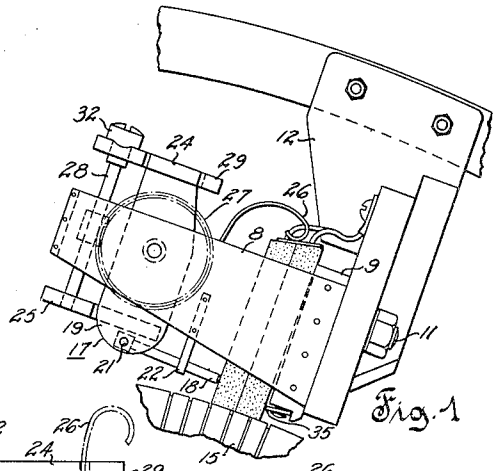

Fig. 1

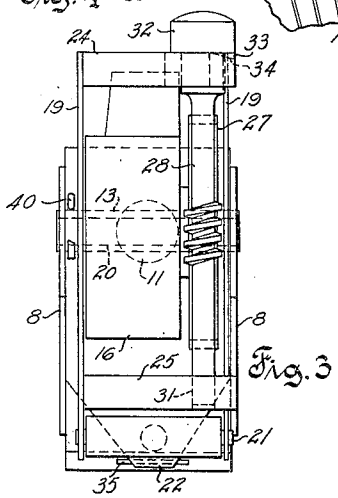

Fig. 3

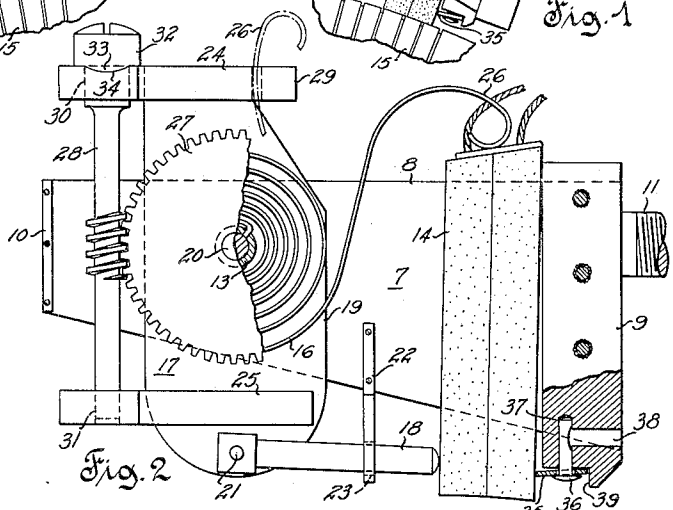

Fig. 2

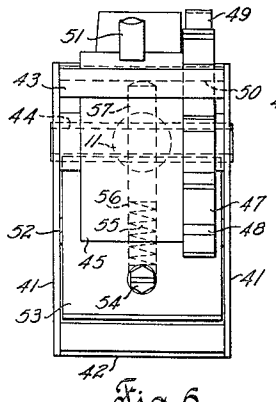

Fig. 6

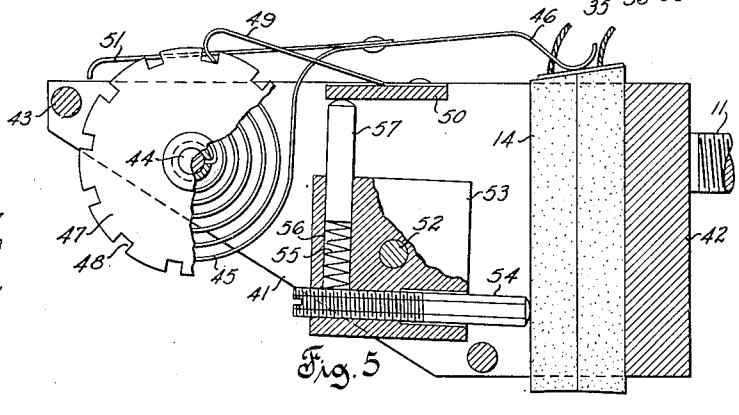

Fig. 5

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## BRUSH HOLDER PROVIDING RESILIENT APPLICATION OF THE BRUSH AGAINST THE BRUSH HOLDER WALL

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9 Claims. (Cl. 171—324)

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This invention relates to brush holders such as are used for applying brushes against commutators and slip rings of dynamo-electric machines.

An object of the invention is to provide an improved brush holder such that a given holder will accommodate a brush of any thickness within the usual range found in practice.

Another object of the invention is to provide an improved brush holder supporting a brush for trouble-free operation for either direction of rotation of the associated commutator.

Another object of the invention is to provide a brush holder permitting substantially friction-free movement of the brush as it follows an eccentric commutator.

Another object of the invention is to provide a brush holder which will eliminate vibration or chatter resulting from friction of the brush on the commutator.

Another object is to provide an improved brush holder in which a brush is readily inserted or removed.

Other objects and advantages will be apparent from a consideration of the following description taken in connection with the accompanying drawing, in which:

Fig. 1 is a view in side elevation of a brush holder constituting the preferred embodiment of the present invention;

Fig. 2 is an enlarged view in side elevation of the brush holder shown in Fig. 1 having a part thereof broken away and a side plate removed;

Fig. 3 is an end view of the brush holder shown in Fig. 2;

Fig. 4 is a view in side elevation of a modification of the brush holder shown in Fig. 1;

Fig. 5 is an enlarged view in side elevation of the brush holder shown in Fig. 4 having a part thereof broken away and a side plate removed; and

Fig. 6 is an end view of the brush holder shown in Fig. 5.

Referring more particularly to the drawing by characters of reference, numeral 7 generally designates the frame of the brush holder illustrated in Figs. 1, 2 and 3, which is made of any suitable material such as brass or steel.

The frame 7 comprises a plurality of walls 8, 9, 10. Wall 9 has a stud 11 extending therefrom for mounting the brush holder to a bracket 12 mounted on a dynamoelectric machine. The brush holder contains a carbon brush 14 extending radially with respect to the commutator 15 of the dynamoelectric machine as shown in Fig. 1. The brush 14 is shown as a split brush but a brush in one piece may be used.

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Resilient means are used for holding the brush 14 both against back wall 9 and against the commutator 15, i. e., both peripherally and radially with respect to the commutator. Such means may comprise a spiral spring 16 mounted in a substantially balanced cradle 17 and a thrust member 18 also mounted on the cradle.

The cradle 17 comprises a pair of side plates 19 forming supports mounted on a pivot 20. A pair of mass members 24, 25 are rigidly mounted on the pair of supports 19 at substantially equal and opposite radial distances from pivot 20. Pivot 20 extends through side walls 8 of frame 7 and through the pair of supports 19 of the cradle, mass members 24, 25 being remotely positioned from pivot 20 cause the cradle to have a relatively high moment of inertia. The cradle is substantially balanced in all positions by having the center of gravity thereof close to the pivot. A cotter pin 40 extending through pivot 20 between one of the cradle supports 19 and the adjoining frame side plate 8 prevents axial movement of pivot 20.

The thrust member 18 may consist of a round rod pivotally supported from the lower end of the cradle by a cross pin 21 extending between cradle supports 19. The extended portion of the thrust member 18 may be supported by any suitable guiding means such as a bracket 22 attached to the frame 7. Bracket 22 has an opening 23 of larger diameter than that of the extended portion of the thrust member to provide therein free play of the thrust member 18 in a radial direction. As shown, the thrust member 18 has a rounded end which contacts the end portion of the brush adjacent commutator 15 for holding the brush against wall 9 of its channel.

The inner end of spring 16 is inserted in a slot of a bushing 13 fitted over pivot 20. The outer end of the spring is free and terminates in an inversely bent portion 26 forming a thrust member applied on brush 14 to force the brush radially against commutator 15.

A worm wheel 27 integral with bushing 13 is provided for winding spring 16. A shaft 28 is journaled in a drilled hole 30 in upper mass member 24 and a drilled hole 31 in the lower mass member 25. The shaft 28 is provided with a worm engaging the teeth of the worm wheel 27. Head 32 of shaft 28 is slotted and has a projection 33 on its underside. This projection seats in a corresponding indentation 34 in member 24 to prevent turning of the shaft 28 due to vibra-

tion and to require that the worm be lifted slightly to wind the spring 16.

Mass member 24 has an L-shaped projection 29 in which the free end of the spring may be inserted to free the brush when it is to be removed.

A brush guide 35 consisting of a thin metal plate is retained on the end of wall 9 adjacent commutator 15 by a rivet 36 extending through the guide into a drilled hole 37 of wall 9. Another drilled hole 38 transversely connects with the rivet hole 37. The stem of rivet 36 is flattened out where it crosses hole 38, so that the spread of the rivet locks it in place. A pin and set screw or other known suitable means could also be used for supporting guide 35. Guide 35 fits loosely on rivet 36 and extends from shoulder 39 of wall 9 into the channel containing the brush 14. Guide 35 causes the end portion of brush 14 adjacent the commutator to be held slightly away from wall 9, so that the brush 14 contacts the surface of wall 9 only near its other end. Guide 35 fitting loosely on rivet 36 and resting on shoulder 39 is caused to pivot about one of its edges and is tilted slightly upward or downward about that edge by radial movement of brush 14.

Shaft 28 is turned to wind spring 16 for adjusting the tension of the spring for obtaining desired contact pressure of brush 14 on commutator 15.

Bracket 22 and frame 7 define a channel for the insertion of brush 14 in the brush holder. The channel may receive a brush of any thickness not exceeding the distance between guide 35 and bracket 22. The minimum brush thickness is equal to the distance between guide 35 and thrust member 18 in the position reached thereby when mass member 25 is applied against bracket 22.

The thrust member 26 of spring 16 is applied against the end of brush 14 remote from the commutator to force the brush toward the commutator. The spring 16 reacting on brush 14 tends to rotate cradle 17 counterclockwise to urge thrust member 18 against brush 14 to hold it against guide 35.

When the commutator rotates in a direction from thrust member 18 to pivoted guide 35, or clockwise in Fig. 1, the friction of brush 14 on the commutator urges the commutator end of the brush against pivoted guide 35, and tends to pivot the brush about guide 35. The free end of spring 16 bent to form a thrust applying member acts against the inclined outer end of brush 14 to hold the outer end of the brush against wall 9 as well as to force the brush against the commutator. Thrust member 18 contacts the brush on the opposite side and just outside the line of contact of pivoted guide 35. In this manner, thrust members 18 and 26 exert on brush 14 a torque about pivoted guide 35 to prevent tipping of the brush due to the peripheral thrust exerted on the brush by rotating commutator 15.

When the commutator rotates in a reverse direction, counterclockwise in Fig. 1, the force of friction urges the commutator end of the brush peripherally against thrust member 18, tending to move the brush away from pivoted guide 35. The tension in spring 16 is adjusted so that the cradle will hold the brush firmly against wall 9 and pivoted guide 35 against the force of friction acting on the brush.

In either direction of rotation the frictional forces tend to set up brush chatter, which chatter is prevented by the damping effect of cradle 17 due to its relatively high moment of inertia.



The free end of spring 16 forces the brush in its channel radially against the commutator. Due to eccentricity and other irregularities in the commutator, the brush 14 moves radially back and forth in its channel as it follows the commutator. The brush is permitted a limited amount of radial movement without sliding on thrust member 18 or pivoted guide 35. Thrust member 18 and pivoted guide 35 move radially with the brush to the extent of their free play. Brush 14 is therefore provided with substantially friction-free movement of limited stroke to closely follow its associated commutator.

When the direction of rotation of the machine is reversed, brush 14 remains in exactly the same position because of the absence of lost motion in its engagement with thrust member 18 and guide 35. So-called double seating of the brush is thus prevented, and the position of the magnetic axis of the armature remains undisturbed.

Another embodiment of this invention is illustrated in Figs. 4, 5 and 6 showing a brush holder having independent means for holding the brush in position in its channel and of forcing it radially against a commutator. The brush holder frame comprises a pair of side walls 41 and a back wall 42 defining a channel in which the brush 14 is inserted. Walls 41 are joined at one end by wall 42 and at the other end by a rod 43.

The plates forming side walls 41 of the brush holder frame support a pivot 44 extending therebetween. A spring 45 has one end anchored in a bushing fitted on pivot 44. The other end 46 of the spring is free and terminates in a bent position forming a thrust member applied on the top of brush 14 to force the brush against commutator 15 of a dynamoelectric machine.

An index wheel 47 having uniformly spaced notches 48 about the periphery thereof and integral with the bushing is provided for adjusting the tension of spring 45. A resilient latch member 49 has one end mounted on a plate 50 extending across the side walls 41 of the frame. The other end of the latch member 49 is bent back to fit in a notch 48 of wheel 47. The latch member is biased to bear against wheel 48 so that it locks the wheel to prevent unwinding of spring 45.

Another latch member 51 has one end attached to the free end 46 of spring 45 and the other end free and bent to form a hook. Latch member 51 may be used to hold the free end 46 of spring 45 in a fixed elevated position by placing the hook end of the latch member over rod 43. This is used when replacing a brush in the brush holder.

Another pivot 52 extends through side plates 41 and pivotally supports a balanced cradle 53 mounted thereon. The cradle is made of a solid block of metal so that it will have a relatively high moment of inertia. A thrust member 54 is screwed through the cradle and adjustably extends to the channel of the brush holder so that it contacts the end portion of brush 14 within the channel of the brush holder adjacent the commutator.

A drilled hole 56 in cradle 53 contains a spring 55 for outwardly forcing a pin 57 inserted in drilled hole 56 over spring 55. The end of pin 57 is rounded and contacts a flat surface of cross plate 50. Spring 55 forces pin 57 against cross plate 50 of the frame, causing cradle 53 to pivot to urge thrust member 54 laterally against brush 14 to hold it against wall 42 of the channel. Thrust member 54 may be made from hexagonal

bar stock and threaded lightly so as to leave flat surfaces on the top portions of the threads. Spring **55**, being applied on one of such flat surfaces, prevents rotation of member **54** as a result of vibration thereof.

The brush holder may be used for either direction of rotation of the commutator. The resilient means comprising spring **45** reacts between the frame of the holder and the end of brush **14** to force the brush radially in its channel against the commutator. Spring **45** also holds the end of brush **14** remote from the commutator against wall **42** of the brush channel.

The cradle **53** reacts between the frame and the side of the brush adjacent the commutator to hold the brush against wall **42**. The relatively high moment of inertia of the cradle dampens any vibration tending to rise in brush **14** due to the friction of the brush on the rotating commutator.

Although but two embodiments are illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. A brush holder for applying a brush in contact with a commutator, said brush holder comprising a frame including a plurality of walls defining a channel for said brush, a substantially balanced cradle pivotally supported in said frame, resilient means mounted in said cradle for forcing said brush toward said commutator and for holding said brush against one of the walls of said channel, and adjustable tensioning means acting between said resilient means and said cradle for adjusting the tension of said resilient means, whereby said cradle is left free to pivot in said frame to act on said brush through said resilient means.

2. A brush holder for applying a brush in contact with a commutator, said brush holder comprising a frame including a plurality of walls defining a channel for said brush, a cradle comprising a pair of supports mounted on a pivot in said frame at approximately the center of gravity of said cradle, adjustable resilient means mounted in said cradle for forcing said brush toward said commutator and for holding said cradle against said brush to apply said brush against one of the walls of said channel, and a pair of mass members mounted between said supports remote from said pivot on opposite sides thereof, whereby said cradle has a high moment of inertia for damping any vibration tending to be set up in said brush.

3. A brush holder for applying a brush in contact with a commutator, said brush holder comprising a frame including a plurality of walls defining a channel for said brush, a cradle comprising a pair of supports mounted on a pivot in said frame at approximately the center of gravity of said cradle and a pair of mass members mounted between said supports remote from said pivot on opposite radii thereof for imparting to said cradle a relatively high moment of inertia, a thrust member mounted on said cradle, resilient means reacting between said frame and said cradle for causing said pivoted cradle to urge said thrust member against said brush for holding said brush against one of the walls of said channel and for damping vibrations tending to arise in such brush.



4. A brush holder for applying a brush in contact with a commutator, said brush holder comprising a frame including a plurality of walls defining a channel for said brush, a cradle pivotally supported in said frame, a thrust member mounted on said cradle for contacting said brush, a spring having one end mounted in said cradle and the other end free, said free end being applied against the end of said brush for forcing said brush toward said commutator and for causing said pivoted cradle to urge said thrust member against said brush for holding said brush against one of the walls of said channel.

5. A brush holder for applying a brush in contact with a commutator, said brush holder comprising a frame including a plurality of walls defining a channel for said brush, a cradle supported on a pivot in said frame at approximately the center of gravity of said cradle, said cradle comprising a pair of supports mounted on said pivot and a pair of mass members mounted between said supports remote from said pivot on opposite sides thereof, a thrust member mounted on said cradle for contacting the end portion of said brush adjacent said commutator, and a spring having one end mounted in said cradle and the other end free, said free end being applied to the end of said brush for forcing said brush toward said commutator and for causing said pivoted cradle to urge said thrust member against said brush for holding said brush against one of the walls of said channel.

6. A brush holder for applying a brush in contact with a commutator, said brush holder comprising a frame including a plurality of walls defining a channel for said brush, a cradle pivotally supported in said frame, a plurality of thrust applying members, resilient means mounted in said cradle urging one of said thrust members against the end of said brush for forcing said brush toward said commutator and for causing said pivoted cradle to urge another said thrust member against said brush for holding said brush against one of the walls of said channel.

7. A brush holder for applying a brush in contact with a commutator, said brush holder comprising a frame including a plurality of walls defining a channel for said brush, a pivoted guide supported on said frame for limited movement radially of said commutator, said pivoted guide extending into said channel and contacting said brush adjacent said commutator, a balanced cradle supported on a pivot in said frame, said cradle having a thrust member pivotally supported thereon, said frame providing means supporting said thrust member for contacting the end of said brush adjacent said commutator, said supporting means providing for limited radial movement of said thrust member with said brush, and means comprising a spring acting between said cradle and the end of said brush remote from said commutator for forcing said brush toward said commutator and reacting to cause said pivoted cradle to urge said thrust member against said brush for holding said brush against said pivoted guide and one of the walls of said channel; whereby, said thrust member and said pivoted guide provide for a substantially friction-free movement of limited radial stroke of said brush.

8. A brush holder for applying a brush in contact with a commutator, said brush holder comprising a frame including a plurality of walls defining a channel for said brush, a pivoted guide

supported on said frame for limited movement radially of said brush, said pivoted guide extending into said channel and contacting one side of said brush at a point adjacent said commutator on a circle of predetermined radius concentric with said commutator, a balanced cradle supported on a pivot in said frame, said cradle having a thrust member pivotally supported thereon, said frame providing means supporting said thrust member for contacting the other side of said brush at a point outside said circle, and means comprising a spring acting between said cradle and the end of said brush remote from said commutator for forcing said brush toward said commutator and reacting to cause said pivoted cradle to urge said thrust member against said brush for holding said brush against said pivoted guide and one of the walls of said channel.

9. A brush holder for applying a brush in contact with a commutator, said brush holder comprising a frame including a plurality of walls defining a channel for said brush, a pivoted guide supported on said frame for limited movement radially of said commutator, said pivoted guide extending into said channel and contacting one side of said brush at a point adjacent said commutator on a circle of predetermined radius concentric with said commutator, a pivoted thrust member, means supporting said thrust member for contacting the other side of said brush at a point outside said circle, and resilient means for forcing said brush toward said commutator and for urging said thrust member against said brush for holding said brush against said pivoted guide and one of the walls of said channel.



CHESTER O. WEILBAECHER.


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