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DYNAMO-ELECTRIC MACHINE BRUSH HOLDER ASSEMBLY

Filed May 9, 1963

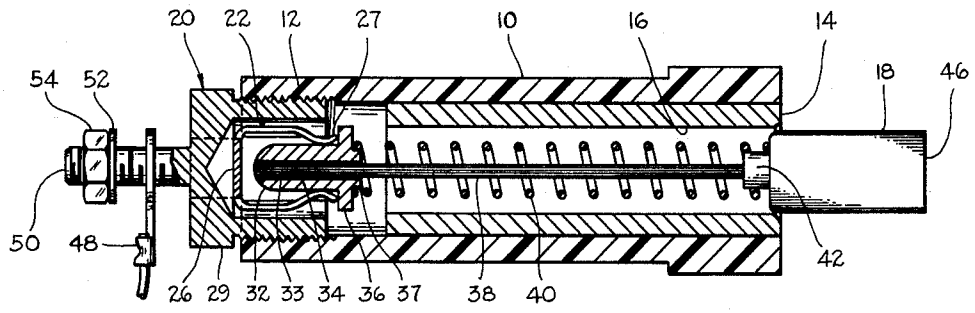


Fig. 1

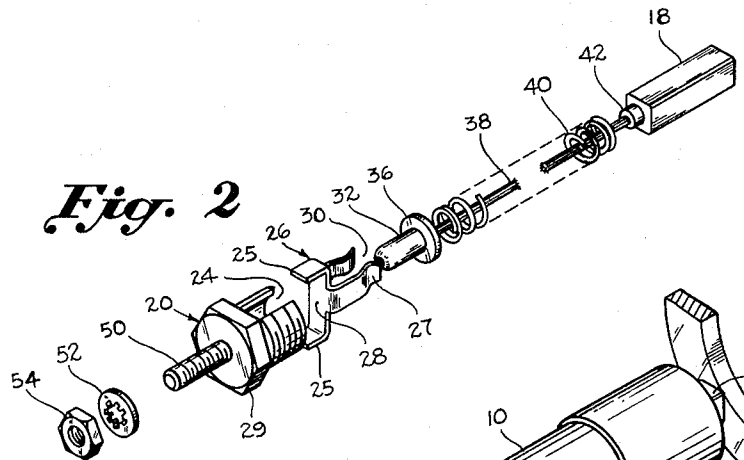


Fig. 2

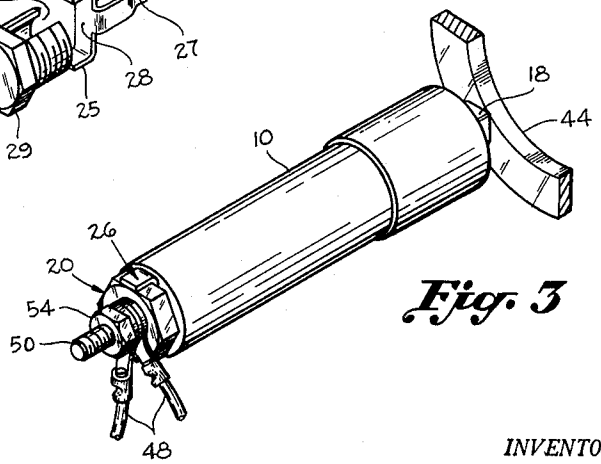


Fig. 3

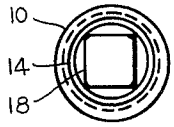


Fig. 4

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DYNAMO-ELECTRIC MACHINE BRUSH HOLDER ASSEMBLY

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This invention relates to brushes and brush holders of the type used extensively with electric motors.

The present invention was developed when it was found that during normal operating conditions, the life of the common type of brush was extremely short due to its design characteristics. As a result of tests using various types of brush holders, it was found that the electric current would follow the metallic brush guides to such an extent that arcing occurred on the sides of the brushes, causing a rapid deterioration of the brush sides. Eventually, this erosion or deterioration can become so extensive that the brush becomes cocked in its guide, resulting in poor contact and, eventually, general disintegration of the carbon brush. In addition, voltage loss during use was continuous due to the resistance between the brush and the metallic brush guide which led to the aforedescribed disintegration. As a consequence, extensive maintenance has been necessary to install new brushes. In continuous usage tests, it was found that the life expectancy of the brushes in the average type of brush holder was approximately 25 hours, a relative short period which causes frequent equipment failure and results in the frequent maintenance problems.

In the present invention, life expectancy of the brush holder has been extended to an average of 2500 hours, a vast improvement over all of the common types of brush holders. This improvement has been accomplished by making a holder which has a metal brush guide that is absolutely free of any electrical connections thereby eliminating voltage loss due to resistance between the guide in the holder and the brush and completely eliminating arcing from the brush guide to the sides of the brush.

Accordingly, a primary object of this invention resides in the provision of a novel brush holder which completely eliminates arcing between the brush guide and the brush by utilizing an electrically isolated metallic brush guide.

A further object resides in the provision of a novel brush holder which virtually eliminates voltage loss due to the resistance between the brush guide and its associated interior components.

Another object of the present invention resides in the provisions of a novel brush and holder assembly which greatly increases the life expectancy of the brushes, permits ease of brush changes and eliminates costly shutdown time and maintenance problems.

FIGURE 1 is a cross section of a brush holder and brush assembly made in accord with the invention, showing all of the assembly components in their relative positions;

FIGURE 2 is an exploded perspective view of the brush assembly components which fit into the holder housing and guide sleeve;

FIGURE 3 is an assembled perspective view of the complete brush and holder illustrating the brush in contact with a slip ring; and

FIGURE 4 is an end view showing the square broached end of the brush guide as it would look after being assembled inserted into the main housing of the brush holder.

DESCRIPTION

The main holder housing or body **10** is an elongate sleeve made of a phenolic resinoid material or the equivalent and has an internal thread **12** at one end. A brass guide **14** is press fit into the unthreaded end of housing **10** and has a square broached or moulded hole **16** (FIGURE 4) within which the carbon brush **18** slides. A brass end cap **20** screws into the internal end threads **12** of body **10** and its threaded end portion **22** is drilled to a specific depth. A slot **24** is milled completely through the threaded portion of end cap **20** to enable retaining a copper spring clip **26** as will be described hereinafter.

The spring clip **26**, clearly shown in FIGURE 2, has bent lugs **25** forming a U shaped outer end **28** to fit into the end cap milled slot **24** and, if desired, bracket the exterior hexagon shoulders of the end cap. The opposite or inside end **30** of the spring clip **26** is also formed in a U shape, its two legs **27** being formed as resilient spring clip leaves to fit snugly around a brass contact button **32**. Brass button **32** is a round, bullet shaped member with a small hole **34** drilled completely through its center and has a radial flange **36** forming an axially directed piloting shoulder **37** on one end.

A braided copper wire flexible connector **38** with one of its ends moulded into the carbon brush **18** is threaded through a light compression coil spring **40**, inserted into the hole **34** of brass button **32** and soldered to the contact button as indicated at **33**. One end of spring **40** fits snugly over the cylindrical end pilot boss **42** of the carbon brush **18** while its opposite end fits over the axial pilot shoulder **37** of the brass button **32**, the two pilot bosses thus holding the spring **40** in a centered position away from engagement with guide **16**.

This assembly, the carbon brush **18**, the braided copper wire **38** and the brass button **32**, are slipped into the main holder body **10** with the carbon brush **18** sliding into the brush guide **14** with the brush lead contact button projecting from the threaded end **12**. The spring clip legs **27** are then clipped over the bullet end of the button **32** and the end cap **20** is positioned so the opposite U shaped end **28** of the spring clip **26** fits snugly into the milled slot **24**. End cap **20** is then screwed into the threaded end **12** of the main body **10** so it clamps the spring clip **26** tight between the hexagon portion **29** and the end shoulder of body **10**. The cap can be easily screwed into body **10** because the legs **27** of the spring clip **26**, also in firm contact over the button **32**, will rotate relative to the button **32** after one or more turns has tightened the braided lead **38**. Thus, as many turns as is necessary to tighten the end cap **20** can be made.

The brush holder assembly is then mounted into position in the motor casing or end bell in a conventional manner (not shown) and the brush **18** pushed back into the body **10**, compressing the spring **40** (see FIGURE 3). The spring **40**, must not have too many coils or it will buckle and bear against the guide **16**. As the brush **18** wears down from contact with the slip ring **44** (or commutator segments) the spring **40** will continually urge the brush **18** outward to maintain contact. Thus, a continuous, uniform pressure is exerted by the spring **40** on the carbon brush **18** so, the end contact brushing surface **46** of the brush **18** is in uniform positive contact with the slip ring **44** or commutator whichever the case may be.

In operative assembly wires **48** (external power source) are attached to a stud **50**, which conveniently is made as an integral part of the end cap **20**, and a washer **52** and nut **54** are mounted on stud **50** and turned down tight, holding the wires **48** tightly against the end cap **20**. Thus, the electrical path is through the wires **48**, end cap **20**, spring clip **26**, brass button **32**, braided wire **38** and the carbon brush **18** to the slip ring **44**, and there is no path for parallel current flow between the brush and the metal guide sleeve **14**.

Thus a metallic but non-conducting brush guide means is provided in a simple brush and brush holder assembly

to assure minimum wear of the brush guide surfaces, substantially complete elimination of voltage losses between brush and guide and complete elimination of guiding surface deterioration between brush and guide. At the same time a very simple expedient to enable quick and easy brush removable, substitution and reassembly is provided.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by Letters Patent is:

1. A brush and holder assembly for dynamo-electric machines comprising: a brush; a metal tube within which said brush is longitudinally movable and guided; a dielectric sleeve, one end of which surrounds and mounts said metal tube, and the other end of which projects beyond the metal tube; an electrically conductive terminal means fixed to said other end of said sleeve and spaced away from said metal tube; a flexible connection between said brush and said terminal means; a coil compression spring surrounding said flexible connection, one end of said spring engaging said brush and one other end of said spring engaging said terminal means; said spring being disposed and maintained in spaced relationship away from contact with said metal sleeve.

2. A brush and holder assembly for dynamo-electric machines comprising: a brush of square cross section with a pliot boss on an end; a short metal guide tube with square internal cross section within which said brush is longitudinally movable and guided; an elongated dielectric tube one end portion of which surrounds and rigidly mounts said metal guide tube, and the other end of which projects beyond said metal guide tube; an electrically conductive terminal means including a quick release fastener means fixed to said other end of said dielectric tube and spaced away from said metal guide tube; a flexible connection between said brush and said quick release fastener means; said quick release fastener means having a pilot boss projecting toward said metal tube; a coil compression spring surrounding said flexible connection, one end of said spring engaging said brush pilot boss and the other end of said spring engaging the pilot boss on said fastener means; said spring being maintained in spaced relationship within but away from contact with said metal sleeve by alignment between said pilot bosses.

3. An electrical brush and holder assembly comprising: a tubular insulating holder means; a brush movable longitudinally within said tubular means; electrical connecting means at one end of said tubular means; flexible electrical conducting means connecting said brush to said electrical connecting means; said electrical connecting means comprising a male contact terminal member, a spring clip member frictionally engaged by spring clip action on said male member, a compression coil spring between said brush and said male member and surrounding said flexible conducting means, and an electrically conductive end cap releasably secured to said one end of said tubular means and cooperating with said spring clip member to retain it on said one end of said tubular means.

4. A brush and holder assembly, adapted to be fixed in a dynamo-electric machine comprising: a brush; a tubular body means having a through bore, a guide portion of which is non-circular in cross-sectional shape for guiding and supporting said brush in contact with a current collector of the machine; a spring means biasing said brush out of said body means; releasable metal clip means, electrically connected to said brush, having radially extending lugs and including a seat abutment for said spring means; a cap member releasably secured in one end of said tubular body, said cap member having means directly and releasably embracing said radially extending lugs and clamping them against the end of said tubular body while said cap member is secured to said body.

5. A brush and holder assembly as defined in claim 4, wherein said cap member is made of electrically conductive material and an integral terminal connection is provided on said cap member.

6. A brush and holder assembly as defined in claim 4, wherein said clip means includes: a spring clip device having at least two spring leaf clips and said lugs integrally thereon, and a separable projection contact member frictionally embraced by said spring leaf clips; and a flexible electric lead is connected to said projection contact member, passes through said spring means and is secured to said brush, said projetcion contact member being urged into said frictional engagement in said clip device by the biasing force of said spring means.

7. A brush and holder assembly comprising: an insulated elongate body means having a longitudinal bore for receiving and slidably guiding a brush therein; a removable electrically conductive end cap on said insulating body having a portion adapted to protrude into said longitudinal bore, said portion having a transverse slot therein; a metal clip device having radially extending lugs thereon disposed within the slot of said end cap, said lugs being clamped by said end cap against the end of said dielectric body to thereby secure said clip device; a projection contact device frictionally secured within said end clip; a light coil compression spring disposed within said bore and abutting said contact device; a brush member disposed within said bore and abutting the other end of said spring; and a flexible electrical conductor interconnecting said contact device and said brush.

8. A brush and holder assembly as defined in claim 7, wherein said elongate body means includes an elongate dielectric sleeve and a short metal guide tube press fit into one end of said sleeve; said end cap and said clip device ar spaced apart from said metal sleeve and means on said brush and said contact device cooperate with ends of said spring and maintain said spring in approximate coaxial alignment with said metal guide tube spaced radially inwardly away from contact within said metal tube.

9. A brush and holder assembly for dynamo-electric machines comprising in combination: an elongate peripheral insulating bushing; a sleeve-like metallic brush guide, shorter than said bushing and fixed in one end of said bushing; a brush disposed for longitudinal guided reciprocation in said brush guide; a flexible conducting lead having one end thereof integral with said brush; a spring contained within said brush holder spaced from contact with said guide, abutting and adapted to bias said brush into conductive engagement with a rotating current transferring device on the machine; said flexible lead passing through said spring; a terminal contact integral with the other end of said lead having a base portion engaged by the other end of said spring; a clip device having radially disposed lugs extending beyond the inner diameter and adjacent the other end of said bushing and frictionally engaging said contact device; a terminal cap having a portion adapted to be releasably connected to said other end of said bushing and extending thereinto; the cap portion extending into said bushing having a transverse slot embracing said clip device lugs and permitting the ends of said lugs to extend through the side openings of said slots; said end cap, upon connection to said bushing, clamping said lugs against the end of said bushing and retaining said clip device securely in position in said one end of said bushing.

10. A brush and holder assembly for use with dynamo-electric structure comprising: a tubular body made of non-conductive material; a tubular, wear resistant, electrically conductive brush guide secured in one end of said

body having means for slidably guiding, along its longitudinal axis, a brush member; an end means for said body, made of electrically conductive material, including means for rigidly releasably fastening to the opposite end of said body in spaced apart relationship to said brush guide; a conductive spring clip means disposed into said opposite body end and being releasably clamped to said opposite body end by clamping cooperation between said end cap and said body; an elongate brush member slidably reciprocable within said guide and having flexible conductive means integral therewith and extending from its inner end; a male projection connection fixed to the extended end of said flexible conductive means and frictionally clamped in said spring clip means; a light compression coil spring surrounding said flexible conducting means and having one end abutting said brush and the other end abutting said male projection connection; and means including portions of said spring clip and said male projection connection for positioning and maintaining said spring in spaced relationship away from contact with said guide.

11. A brush holder for dynamo-electric machines comprising: a metal tube within which a brush is adapted to be longitudinally movable and guided; a dielectric sleeve, one end of which surrounds and fixedly mounts said metal tube, the other end of which projects beyond said metal tube; an electrically conductive terminal means on the other end of said sleeve including a receptacle contact clip means disposed into the other end of said sleeve, said entire terminal means being spaced and maintained out of direct contact with said metal tube.

12. A brush holder for use with dynamo-electric structure comprising: a tubular body made of non-conductive material; a tubular wear resistant, electrically conductive brush guide secured in one end of said body having means for slidably guiding, along its longitudinal axis, a brush member; an end means for said body, made of electrically

conductive material, including means for rigidly releasably fastening to the opposite end of said body, in spaced apart relationship to said brush guide; and a conductive spring clip means, adapted to receive a terminal connection from a lead on a brush, disposed into said opposite body end and being rigidly fastened to said opposite body end by clamping cooperating between said end cap and said body.

13. A brush holder as defined in claim **12**, wherein said clip means has radially disposed lugs extending beyond the inner diameter and adjacent the other end of said sleeve; and said end means has a portion adapted to be releasably connected to said other end of said sleeve and extending thereinto; the portion extending into said sleeve having a transverse slot embracing said lugs with the ends of said lugs extending through the side openings of said slots; said end means clamping said lugs against the end of said sleeve and retaining said clip means securely in position in said one end of said sleeve.

14. A brush assembly for dynamo-electric machines comprising an elongate brush with a pilot boss on one end adapted to be disposed for longitudinal guided reciprocation in a brush guide; a flexible conducting lead having one end thereof integral with said pilot boss end of said brush; a coil compression spring surrounding said lead and abutting and seated on said pilot boss; and a male terminal contact integral with the other end of said lead having a shoulder portion engaged by the other end of said spring.

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MILTON O. HIRSHFIELD, *Examiner.*