April 4, 1967 B. SATKUNAS 3,312,845

BRUSH HOLDER

Filed Feb. 8, 1965

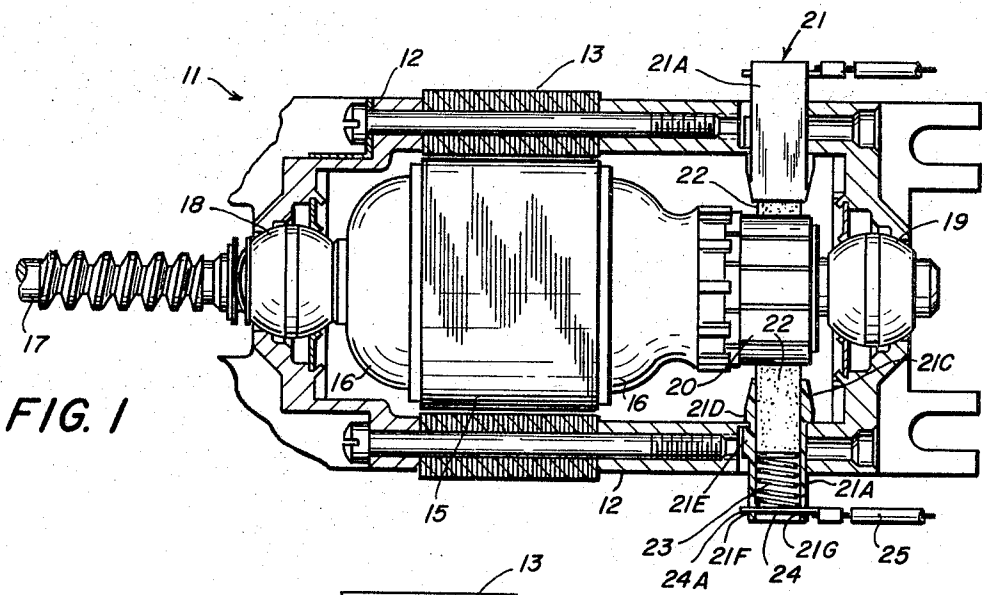


FIG. 1

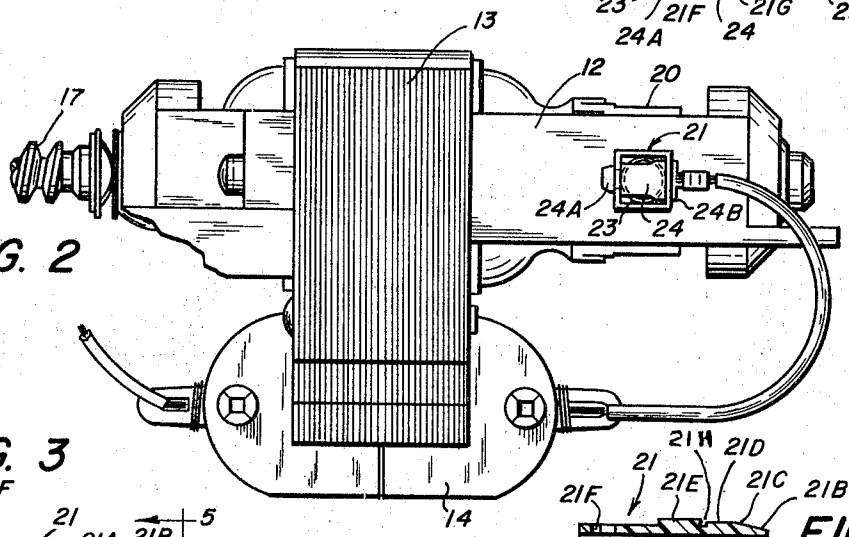
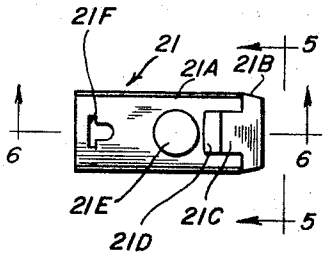


FIG. 2

FIG. 3



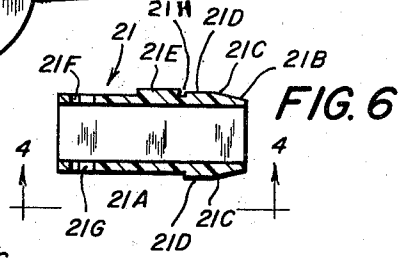


FIG. 6

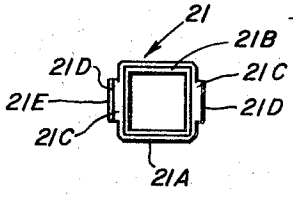


FIG. 5

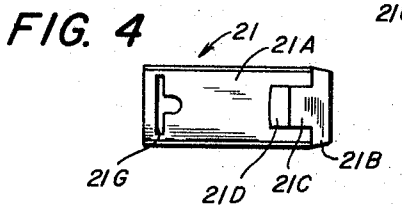


FIG. 4

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BRUSH HOLDER

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My invention relates to devices for holding the brushes of an electric motor in operating position.

An object of my invention is to provide an improved construction of a brush holder readily and easily mounted to the frame of the motor and which is readily connected to the terminals of electric conductors or wires.

Another object is the provision of an improved brush holder of insulating material having structural features which aid in the ready and rapid assembly of the brush holders with the motor and which securely hold the brush holder in position on the motor.

Another object is the provision for obtaining a good sliding fit between the brush and the holder thereof which permits easy movement of the brush axially of the holder with a minimum of friction.

Another object is the provision of a brush holder giving improved electrical insulating characteristics, reduced frictional characteristics for movement of the brush therein and also being particularly adapted for the ready assembly of the brush in the holder and the mounting of the holder to the frame.

Another object is the provision for an economical construction of brush holder and which also provides economies in the operation of assembling the brush holder with the motor frame.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawing, in which:

FIGURE 1 is a longitudinal sectional view through a typical electric motor to which my invention has been applied;

FIGURE 2 is a side view of the motor shown in FIGURE 1 and showing the brush holder on one side of the motor;

FIGURE 3 is an enlarged view of one side of the brush holder removed from the motor;

FIGURE 4 is an enlarged view of the opposite side of the brush holder removed from the motor; and is a view looking in the direction of the arrows 4—4 of FIGURE 6;

FIGURE 5 is an enlarged end view of the brush holder and looking in the direction of the arrows 5—5 of FIGURE 3; and

FIGURE 6 is a cross-sectional enlarged view of the brush holder removed from the motor and looking in the direction of the arrows 6—6 of FIGURE 3.

The typical electric motor to which my invention has been applied as shown in FIGURES 1 and 2 has been indicated generally by the reference character 11. It is to be understood that the invention is equally applicable to generators and dynamo-electric machines utilizing brushes making contact with the commutator, or other rotatable electric contact element. In this specification and claims, the invention will be referred to as related to a motor, as an electric motor is the most common and typical use for the invention. It is to be understood, however, that the word "motor" as used herein will include generators or dynamo-electric machines.

The motor 11 has a frame 12 having parallel frame members upon which is carried the stator 13 which in turn carries the usual stator winding 14. Carried by the frame 12 adjacent its opposite ends are the bearings 18 and 19 which rotatably carry the rotor 15 for the rotation of the rotor 15 relative to the stator. The usual rotor windings 16 are carried by the rotor 15. A driving shaft 17 extending through the rotor 15 and protruding from the motor frame 12 is rotated by the rotor upon electrical energization of the motor. Mounted on the motor shaft 17 so as to rotate therewith is the usual commutator or segmented collector 20. The commutator 20 has the usual function in such motors and the like.

Carried by the frame 12 and disposed radially outward of the commutator 20 are a pair of brush holders 21, the two brush holders 21 being on diametrically opposite sides of the commutator. One brush holder 21 is carried by one frame member of frame 12 and the other brush holder is carried by the opposite frame member of the frame 12. Each brush holder 21 is composed of a material of high electrical insulating characteristics, the provision of a good bearing surface for minimizing friction in the sliding of a brush axially therein, required resilient yieldability to provide the slight resilient yielding herein described for the holder 21, and which is relatively cheap and easily fabricated, such as by molding. Such materials having this combination of desirable characteristics are of the class including nylon and lexan. The preferred material that has been found suitable for the purposes of my brush holder is molded nylon.

The brush holder 21 has four rectangular sides 21A which provide a tubular structure of rectangular cross-section, in this instance, square cross-section. At the inner end of the holder 21, that is, the end to be directed toward the commutator, the walls are chamfered to provide the chamfered end 21B. The portion of the holder on the inner side of the frame members is referred to as the first or inner end portion and the portion of the holder extending outwardly of the frame in a direction away from the commutator is referred to as the second or outer end portion. On the first or inner end portion of the brush holder, there is a raised detent portion 21D. In the embodiment illustrated, there is a detent portion 21D on the opposite outer wall of the holder 21. The detent portion 21D has a flat surface parallel to the axis of the holder 21 and an inclined camming surface 21C extending from adjacent the inner end of the holder to the flat surface of the detent portion. The inclined camming surface 21C is on the same incline as the outer surface of the chamfered end whereby the inclined camming surface 21C is in effect a continuation of the inclined surface provided by the chamfered end 21B.

It is to be noted that the detent portion 21D on diametrically opposite sides of the holder 21 have widths that are substantially less than the width of the respective wall 21A of the holder. By having the detent portion 21D spaced from the opposite parallel walls joining the walls carrying the detent portion 21D, the respective walls 21A from which the detent portions 21D extend may more readily resiliently yield or "collapse" upon lateral pressure on the detent portions 21D toward the axis of the holder 21.

Spaced in an axial direction from the detent portions 21D and extending laterally outward from one of the walls 21A is a boss or raised projection 21E. In the embodiment illustrated, the boss 21E is on the same wall 21A from which extends one of the detent portions 21D. The lateral extension of the boss 21E from the wall 21A is substantially greater than that of the detent portion 21D as seen in FIGURES 5 and 6. It is to be noted that there is a space in an axial direction between a common plane through the detent portions 21D closest to the boss 21E and the boss 21E. This niche or space 21H between the boss 21E and a detent portion 21D is at a location on the holder having substantially the same cross-sectional dimension as the main portion of holder 21.

Adjacent the outer end of the second or outer portion of holder **21**, there are two aligned slits or openings **21F** in one wall **21A** and **21G** in an opposite wall **21A**. These slits **21F** and **21G** accommodate the spade terminal **24** connected to a conductor or wire **25**. As seen in the drawing, the spade terminal **24** has a relatively small forward end **24A** and a relatively wide rearward end **24B**. The slit **21F** is relatively short so as to accommodate the small end **24A** of the spade terminal and has a width as well as length causing the edges of the holder around the slit **21F** to snugly and frictionally engage or interlock with the small end portion **24A** of spade terminal **24**. As better seen in FIGURE 3, the slit **21F** is enlarged at a location intermediate its ends so as to better permit the edge portions of slit **21F** to resiliently flex upon forcing of the small end **24A** into the slit **21F**.

The slit **21G** in the opposite wall of the holder has a length to accommodate the wide portion **24B** of the spade terminal. Its length and width are such as to snugly embrace and frictionally engage the portion **24B** when inserted therein. The slit **21G** also has an enlarged portion intermediate its ends as seen in FIGURE 4 to facilitate resilient flexing of the edge portions of the slit **21G**.

To mount the holder **21** in the frame **12**, a holder without brush or other parts therein is pressed through the holder-accommodating opening in a frame member from the outside of the frame in a direction toward the commutator **20**. The chamfered end **21B** first enters this opening and helps in leading or introducing the holder into the opening. The opening has an internal cross-section closely complementing the outside dimension of the holder **21** at the location of its rectangular shape. Upon forcibly pressing the holder **21** through the opening toward the commutator, the inclined camming surfaces **21C** engage opposite edge portions of the opening and resiliently yield and partially but slightly collapse the holder so as to enable the detent portions **21D** to pass through the opening to the position illustrated in FIGURES 1 and 2. When in this position, the holder, being resiliently yieldable, again causes the detent portions **21D** to move out to their normal position shown in FIGURES 1 and 2. The detent portions **21D** thus provides shoulders which abut the inner side of the respective frame member and prevent withdrawal of the holder from the frame. In the same movement, the boss **21E** has moved so as to abut the outer side of the frame at the opening and thus stops or prevents further or continued movement of the holder toward the commutator. The holder is thus firmly locked to the frame member in the position illustrated in FIGURES 1 and 2. The operation, of course, is the same for the holders **21** of the opposite sides of the frame.

After the holder is so mounted to the frame, a brush **22** usually made of carbon, or sometimes of copper or other alloy of electrical conducting characteristics, is moved axially into the holder **21** from the outer end thereof. The cross-sectional dimension of the brush **22** is such that it slidably interfits with the inner wall of the holder **21**. The nature of the nylon or equivalent material is such as to provide a good bearing engagement for the brush **22** and this facilities its ready sliding movement toward and away from the commutator **20**.

After the brush is inserted, such as to its position shown in FIGURE 1, then a metal coil spring **23** is placed within the holder from the outer end thereof. The spring **23** is compressed by a suitable tool and while so compressed, the spade terminal **24** is mounted transversely in the holder by forcibly thrusting it through the aligned slits **21F** and **21G**, the direction of movement being from the larger slit **21G** toward the smaller slit **21F**. After the spade terminal is in the position shown in FIGURES 1 and 2, the tool compressing the spring **23** is withdrawn and the spring **23** then abuts against the spade terminal **24**. The bias of the spring **23** is such as to resiliently urge the brush **22** toward the commutator **20**. The metal

spring **23** also provides electrical connection between the spade terminal **24** and the brush **22**.

It has been found that the invention above described improves the efficiency of brush movement and facilitates the ready assembly of the brush and brush holder with the motor.

The present disclosure includes that contained in the appended claims, as well as that of the foregoing description.

Although this invention has been described in its preferred form with a certain degree of particularly, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. In an electric motor having a frame, said frame having brush-accommodating openings of rectangular cross-section extending therethrough, a commutator rotatably carried by the frame and positioned inwardly from said brush-accommodating openings, electrical conductors having spade-type terminals of a shape having a forward end of smaller width than the rearward end, the terminals being adapted to be electrically interconnected with said commutator, and brushes adapted to engage and electrically connect with said commutator, the improvement of brush holders for carrying the respective brushes in engagement with said commutator, each said holder comprising an open-ended tubular structure of rectangular cross-section complementarily interfitting in a said brush-accommodating opening and having a first portion extending from an inner side of the frame toward the commutator and having a second portion extending from an outer side of the frame away from the commutator, said holder on opposite sides of said first portion thereof having projections extending outwardly from the planes of said opposite sides a greater distance than the corresponding sides of said opening to engage on said inner side of the frame and prevent withdrawal of the holder outwardly from the frame away from the said commutator, said projections each having an inclined camming surface extending from the plane of the respective side of the structure adjacent the inner end of said first portion to the maximum extent of said each projection to cammingly lead the said projection into a said opening upon pressing the said first portion of structure into the opening toward said commutator, said structure being composed of a resiliently yieldable material of the order of nylon and lexan to permit the structure to resiliently yield in pressing the said first portion carrying said projection into said opening, said material being of high electrical insulating property to insulate the brush from the frame, said structure having a boss extending from a side thereof, the boss having a shoulder spaced from said inner side of the frame and abutting said frame on the outer side thereof to prevent further movement of said structure through the opening toward the commutator, said structure having extending through opposite sides thereof adjacent the outer end of said second portion aligned open spaces for receiving a said spade terminal extending through the open spaces transversely of the structure, one of said open spaces being shorter than the other and snugly engaging the smaller forward end of the spade terminal and the other of said open spaces snugly engaging the larger rearward end of the spade terminal, the material of the structure resiliently yielding to permit insertion of the spade terminal into said aligned open spaces and to restrain the spade terminal against withdrawal from the aligned open spaces, said holder having a bore for accommodating an axially aligned electric brush therein in sliding engagement with the inner walls of the holder and for permitting the brush to extend axially of the holder from the holder toward and against the commutator, said bore also ac-

commodating a metal coil spring therein between, and in engagement with, said brush and said spade terminal in said aligned open spaces, the coil spring resiliently biasing the brush toward the armature and providing electrical connection between the brush and spade terminal.

2. The structure as claimed in claim 1 and in which the inner end of the first portion of said structure is chamfered to cammingly lead the said first portion into the respective opening toward said commutator.

3. The structure as claimed in claim 2 and in which said aligned open spaces in the second portion of the structure are extended longitudinally of the structure at a location intermediate the ends of the respective open spaces to aid resilient flexing of the sides of the open spaces upon insertion of the spade terminal into the aligned open spaces.

4. A brush holder for an electric motor having a frame, a commutator rotatably carried by the frame, the frame having an opening therethrough directed radially of the armature for accommodating the brush holder, said brush holder comprising a tubular structure adapted to hold a brush axially movable relative thereto and protruding axially therefrom toward and in electrical engagement with said commutator, said tubular structure being of electrical insulating material and resiliently yieldable to provide slight yieldable flexing under restraint and assuming its normal shape, said structure being partially insertable through said opening in the frame to extend a first end portion thereof from an inner side of the frame toward the commutator and an opposite end portion thereof from the outer side of the frame away from the commutator, said structure having a projection extending from a side thereof to engage the inner side of the frame for preventing withdrawal of the structure from the opening away from the commutator, said projection having a slanted camming surface for leading the projection into the opening upon pressing the structure into the opening toward the commutator, said projection having a width less than the width of said side from which the projection extends to facilitate the resilient yielding of the said side of the structure inwardly of the structure upon pressing of the projection with said first portion of the structure into said opening, said structure having a boss extending outwardly of a side thereof and spaced axially of the structure from a transverse plane through said projection to engage the outer side of the frame and prevent movement of said second portion of the structure through the opening toward the commutator, whereby the frame may be locked intermediate the said transverse plane through the projection and a transverse plane through the boss, said structure having transversely disposed aligned holes through the second portion thereof for accommodating a spade terminal of an electrical conductor, the structure being adapted to accommodate a metal coil spring therein between a brush therein and said spade terminal for biasing the brush toward the commutator and providing electrical connection between the spade terminal and brush.

5. A holder as claimed in claim 4 and in which said structure is composed of nylon.

6. A holder as claimed in claim 4 and in which said structure is composed of lexan.

7. An improved brush holder for an electric motor having a frame and a commutator rotatably carried by the frame, the frame having a frame member spaced from said commutator and parallel to the axis thereof, said frame member having an opening extending therethrough from a first side toward the commutator to a second side away from the commutator for accommodating the brush holder in juxtaposition to the commutator, said holder comprising an elongated structure having a bore extending therethrough and an outer wall generally complementing the inner wall of said opening, said structure being composed of a material having the electrical-

insulating, resilient yieldability, bearing characteristics and strength of nylon, the structure being insertable through said opening in the frame from said second side of the frame toward said commutator to provide a first portion extending from said first side toward the commutator and a second portion extending from said second side away from the commutator, said first portion having a detent portion extending laterally outward from said outer wall of the structure to engage said first side of the frame and prevent withdrawal of the structure from the opening in a direction away from the commutator, said detent portion having an inclined camming surface extending on its end toward the commutator to aid the detent portion enter said opening upon the insertion of the structure into the opening from said second side of the frame, said second portion having a stop portion extending laterally outward from the outer wall of the structure to engage said second side of the frame and prevent further movement of the structure through said opening toward the commutator, said second portion having slits extending through opposite walls thereof for receiving a spade terminal inserted therethrough transversely of the structure, the edges of said slits being formed to resiliently yield upon insertion of the spade terminal therethrough and to bind upon the spade terminal therein, said bore in the structure being adapted to accommodate an electric brush slidable axially thereof and protruding from said first portion thereof into engagement with the commutator and a metal coil spring interposed between the brush and spade terminal disposed through said slits, said spring biasing the brush toward the commutator and providing electrical connection between the brush and spade terminal.

8. A holder as claimed in claim 7 and in which the walls of the structure at the end directed toward said commutator are chamfered to aid in leading said end into the opening upon the insertion of the structure therethrough from said second side, the chamfered wall continuing on the incline of said inclined camming surface of the detent portion to provide a substantially uninterrupted inclined surface, and in which said detent portion has a width substantially less than the width of said outer wall of the structure from which it extends to facilitate the resilient yielding of said wall inwardly of the structure upon the structure and detent portion passing through said opening.

9. A holder as claimed in claim 8 and in which said slits have enlarged portions intermediate their respective ends to aid in the resilient flexing of the edges of the slits upon insertion of the spade terminal therethrough.

10. A holder as claimed in claim 8 and in which said structure includes two detent portions extending in opposite directions laterally of the said outer walls, respectively, and in which said stop portion extends substantially a greater distance from a said outer wall than said detent portions.

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