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D. E. HARVEY ET AL

3,513,343

BRUSH HOLDER ASSEMBLY

Filed March 11, 1968

2 Sheets-Sheet 1

FIG. 1

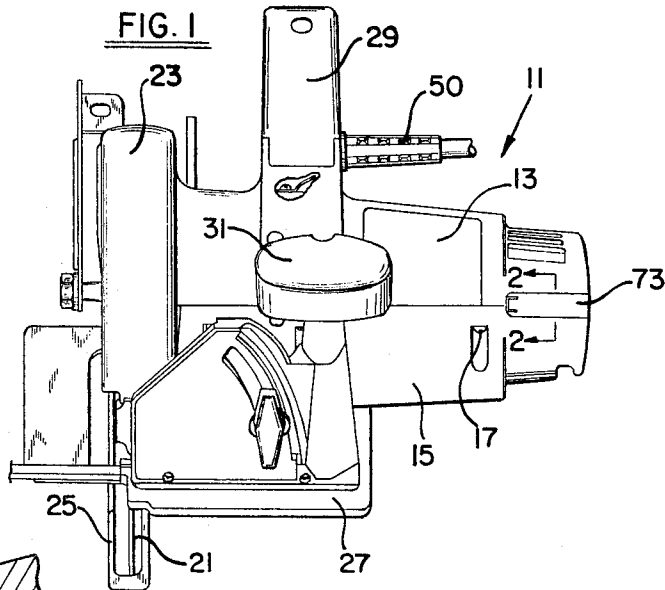


FIG. 2

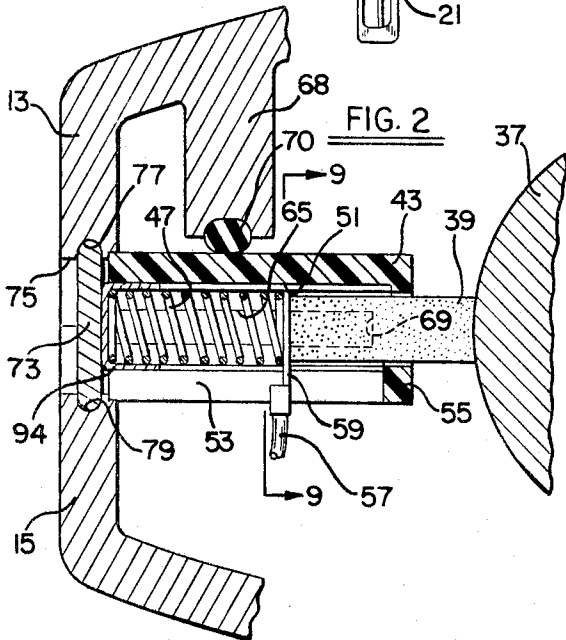


FIG. 4

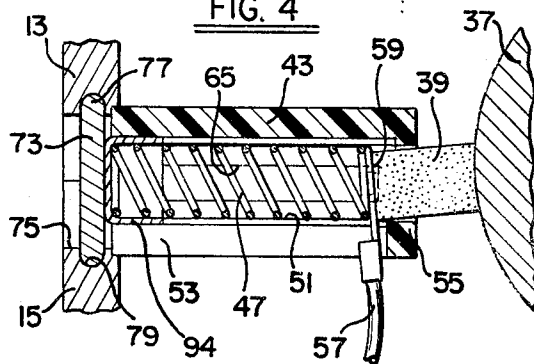


FIG. 3

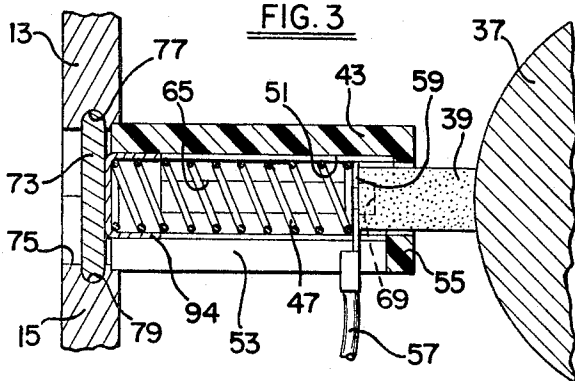
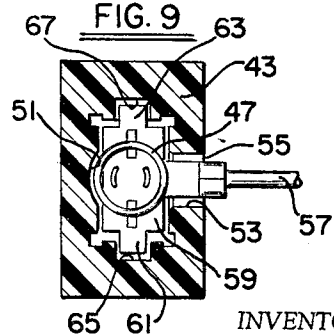


FIG. 9



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FIG. 5

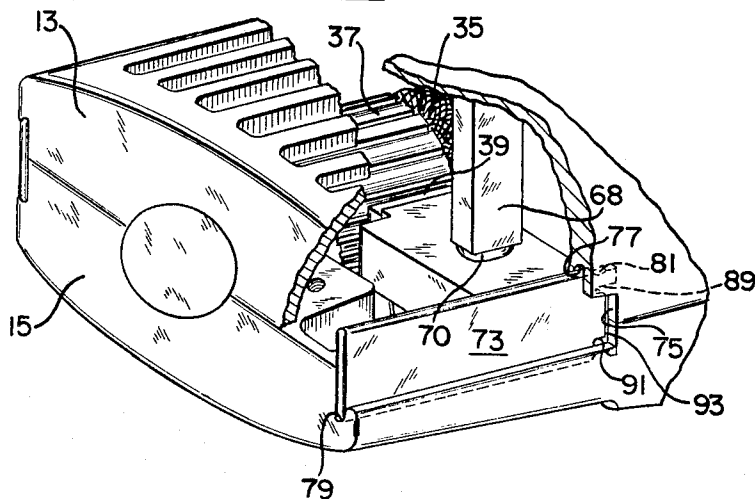


FIG. 6

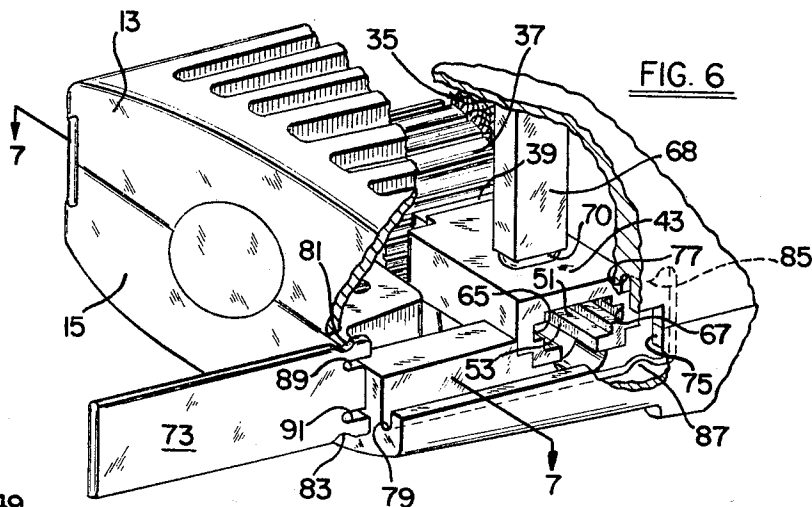


FIG. 7

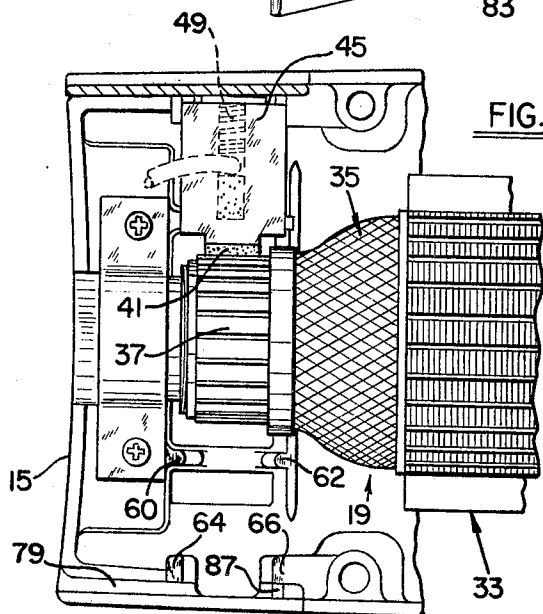
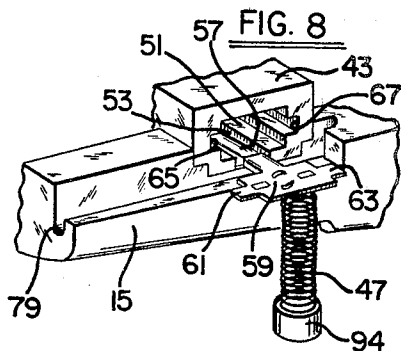


FIG. 8



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## BRUSH HOLDER ASSEMBLY

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15 Claims

## ABSTRACT OF THE DISCLOSURE

A brush holder assembly including an elongated body supported upon a motor housing and having a through passage. A brush in the passage is normally biased toward one end while the other end is covered by a member spaced from the body and supported upon the housing. The member is movable from outside the housing to uncover the passage and allow brush inspection.

The invention relates particularly to an improved, relatively inexpensive brush holder assembly and mounting therefor in an electric motor. The brush holder assembly includes a hollow body adapted to be fixed to the motor housing and having a carbon brush slidably disposed therein. Resilient means within the body and behind the brush biases the brush outwardly of one end of the body. The resilient means is backed by a member which is disjointed from the body, removably carried by the housing, accessible externally thereof and which, when removed from the housing, permits access to the brush.

Main objects of the present invention, therefore, are to provide an improved brush holder assembly and mounting therefor in an electric motor, which permits access to the brush for service and inspection thereof from externally of the motor, which employs a minimum of parts and which is easy to assemble and disassemble.

Further important objects of the present invention are to provide an improved brush holder assembly and mounting therefor of the above character which is relatively easy and inexpensive to manufacture, rugged in construction and safe and reliable in use.

Other objects and advantages of the present invention will become more apparent from a consideration of the detailed description to follow taken together with the drawings annexed hereto.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view illustrating a portable electric saw embodying the present invention;

FIG. 2 is an enlarged sectional view of FIG. 1 taken along the line 2—2 thereof and illustrating the brush holder construction of the present invention;

FIG. 3 is a view similar to FIG. 2 but showing the position of the parts after partial brush wear;

FIG. 4 is a view similar to FIGS. 2 and 3 and showing the position of the parts with maximum brush wear;

FIG. 5 is a perspective view illustrating the assembled brush holder construction in position in the motor housing and shown with parts broken away for clarity;

FIG. 6 is a view similar to FIG. 5 but showing certain parts in position for brush removal and other parts removed for clarity;

FIG. 7 is a sectional view of FIG. 6 taken along the line 7—7 thereof;

FIG. 8 is a fragmentary view, similar to FIG. 6, but showing the brush spring and terminal in position for brush removal; and

FIG. 9 is a sectional view of FIG. 2 taken along the line 9—9 thereof.

## BROAD STATEMENT OF THE INVENTION

Broadly described, the present invention relates to an electric motor of the type having a housing, a stationary field in said housing, a rotatable armature supported in said housing, said armature including a commutator, and a pair of brushes engageable with said commutator; and includes the improvement, in said motor, which comprises a pair of elongated bodies each having a passage there-through slidably receiving a respective one of said brushes, means securing each said body to said housing, resilient means in each said body normally biasing said brushes toward said commutator, said housing having a pair of openings therein aligned with respective ones of said passages, a pair of members carried by said housing spaced from said body and adapted to obstruct respective ones of said openings and prevent withdrawal of said resilient means, each said member being retained in place obstructing said opening by detent means and being movable from outside said housing to permit withdrawal of said resilient means and said brushes from each said body.

In another aspect, the present invention includes a brush holder assembly comprising a housing, a body having a passage therethrough and adapted to be fixedly supported in said housing, an opening in said housing aligned with said passage, a brush slidably disposed in said passage, resilient means within said passage and having one end operatively engaging said brush, a member movably carried by said housing within said opening and adapted to obstruct said housing opening and provide an abutment for the other end of said resilient means, said member being movable to uncover said housing opening and permit withdrawal of said resilient means and said brush therethrough without dismantling said housing and disturbing said body.

## DETAILED DESCRIPTION

Referring now more specifically to the drawings, FIG. 1 depicts a portable electric saw 11 which is a device typical of those in which the present invention finds use. However, it is to be understood that this is for purposes of illustration only and that the present invention finds use in the broader, more general class of electric motors or motor devices.

With this in mind, the saw 11 of FIG. 1 is seen to include a clam-shell type housing comprising upper and lower parts 13, 15 secured together by screws 17. A motor 19 (FIG. 7) is supported within the housing and is adapted, when energized, to rotate a saw blade 21 which is protected by an upper stationary guard 23 and a lower retractable guard 25. The saw 11 is adapted to be supported upon a work surface by means of a base plate assembly 27 which is fixed to the housing, and control and steadying handles 29, 31 fixed to or integral with the housing enable easy handling and manipulation of the saw 11.

The motor 19, as shown partially in FIG. 7, is of the universal type and includes a stationary field 33 fixedly secured within the housing and an armature 35 rotatably supported therein. The armature 35 includes a commutator 37 which is engaged by a pair of diametrically opposed, carbon brushes 39, 41, carried by brush holder bodies 43, 45, respectively, trapped between the housing parts 13, 15. The brushes 39, 41 are pressed against the commutator 37 by compression spring 47, 49, respectively. Electric current is supplied to the motor 19 from a power source through a line cord 50 (FIG. 1) and a suitable switch (not shown) controls the flow of current to the motor 19.

During operation of the motor 19, the brushes 39, 41 wear and eventually may need replacement. In general,

brush holder assemblies in electric motors and motor devices of this type fall into two categories, namely, those which are accessible externally of the motor housing and those which are not. Those which are accessible externally facilitate easy brush inspection and/or replacement but are relatively expensive because of the several parts required (e.g. screw caps, straps, etc.). On the other hand, those brush holder assemblies which are wholly within the housing require fewer separate parts and are less expensive to manufacture; however, to service the brushes generally requires that the motor housing be dismantled and this is time consuming, difficult and expensive. The present invention, in contrast, embodies the advantages of the easily serviceable, externally accessible brush holder assemblies, but costwise more closely approaches the internally accessible version. For purposes of simplicity, it will be understood that both brush holder assemblies employed here are substantially identical so that a description of one will suffice.

Thus, as seen in FIGS. 2-6, the brush holder body 43 is elongated, generally rectangular in configuration and has a plurality of notches (not shown) in one side thereof which receive projections 60, 62, 64, 66, respectively, forward on the housing part (FIG. 7). A post 68 on the housing part 13 carries a rubber plug 70 which bears against the other side of the brush holder body 43 to hold it in place on the projections 60, 62, 64, 66. A rectangular passage or opening 51 freely slidably receives the brush 39 which also preferably is rectangular in cross section. However, it is to be understood that other complementary passage, and brush configurations (polygonal, circular or otherwise) could be used.

The brush holder body 43 has an elongated slot 53 along one side thereof which extends from its rear or outer end. The slot 53 may extend the full length of the body 43 or it may terminate adjacent the forward or inner body end thereof providing a reinforcing strut 55 which rigidifies the body 43 and prevents collapse of the slot 53 during molding of the body 43. An electrical lead 57 has a terminal 59 connected thereto and which extends into the passage 51 through the slot 53. The terminal 59 engages the brush 39 and, under the force of the spring 47, moves through the passage 51 and slot 53 as the brush 39 wears. In addition, the terminal may have a pair of projecting ears 61, 63 adapted to ride in slots 65, 67 in the brush holder body 43. The slots 65, 67 terminate in shoulders 69, 71, which are spaced axially inwardly of the strut 55, so as to limit the extent of travel of the terminal 59 in the passage 51 and prevent withdrawal thereof through the inner end of the brush holder body 43 in a known manner.

Thus, as the brush 39 wears, the spring 47 maintains good contact between the brush 39 and commutator 37, and between the terminal 59 and the brush 39 and provides good commutation and therefore prevents premature brush wear (by erosion) and damage to the motor parts. When the brush has worn to a point where the terminal ears 61, 63 seat against the shoulders 69, 71, the brush 39 may cock or cant slightly, as shown in FIG. 4 under the rotating force of the commutator 37 and because of clearance between the brush 39 and the passage 51. The terminal 59 and spring 47, however, are securely held in place within the brush holder passage 51 by means of the cooperative engagement between the terminal ears 61, 63 and shoulders 69, 71, respectively. This is so even if the brush 39 were to come completely out of the passage 51. The maximum advance of the terminal 59 and lead 57 toward the commutator is substantially as shown in FIG. 4.

As described, the compression spring 47 is positioned behind the terminal 59 within the passage 51 and serves to bias the brush 39 into engagement with the commutator 37. The spring 47, in turn, is trapped in place within the passage 51 by a slide plate 73 which is disjoined or detached from the brush holder body 43 and

is carried by the housing parts 13, 15. As shown in FIGS. 2-6, the housing parts 13, 15 are cut away forming an opening 75 which aligns with the passage 51 in the brush holder body 43. The slide plate 73 is adapted to fit in and obstruct this opening 75, being slidably received in elongated grooves 77, 79 in the housing parts 13, 15, respectively. The slide plate 73 has at least one and preferably a pair of notches 81, 83 at opposite sides thereof which are adapted to receive projections 85, 87 within the grooves 77, 79, respectively. A pair of slots 89, 91 are formed in the slide plate 73 so that the portions thereof forwardly of the notches 81, 83 can flex inwardly during movement past the projections 85, 87 so that the slide plate 73 snaps into and out of position in the opening 75.

In addition, the slide plate 73 is cut back between the slots 89, 91 so that when the slide plate 73 is in position fully within the opening 75 with the projections 85, 87 in the grooves 77, 79, (FIG. 5) a slit 93 is formed between the inner end of the plate 73 and the end of the opening 75. Thus, a tool such as a screwdriver may be inserted into the slit 93 to pry the slide plate in a direction to free the recesses 81, 83 from the projections 85, 87 and uncover the opening 75. Of course, the slide plate 73 is inserted into place in the opening 75 simply by manually moving it through the grooves 77, 79 and snapping the notches 81, 83 into place over the projections 85, 87. The slide plate 73 is spaced from the outer end of the brush holder body 43 to facilitate easy insertion and removal of the slide plate 73. The spring 47 has a cap 94 fitted over the outer coils thereof to prevent the slide plate 73 from catching the outermost coil of the spring 47 and deforming it laterally as the plate 73 is pushed into place along the grooves 77, 79.

It will be appreciated that when the slide plate 73 is withdrawn wholly from the opening 75 or at least to the point where enough of the opening 75 is uncovered to fully expose the passage 51, the brush spring 47, the terminal 59 and the brush 39 may be removed from the passage 51, inspected and/or replaced, if necessary. To this end, the terminal 59 may be fixed to the spring 47 so that the spring 47 can serve as a handle for removing the terminal 59 from the passage. This construction and the position of the spring 47 and terminal 59 when removed from the passage 51 is illustrated in FIG. 8; however, for a detailed explanation thereof, reference may be made to the copending application of David E. Harvey et al., Ser. No. 725,654, now Pat. No. 3,476,965, filed May 1, 1968 and owned by the assignee of the present application. It will be understood that the lead 57 is sufficiently flexible to allow full withdrawal of the terminal 59 from the passage 51, as shown in FIG. 8, so that the brush 39 may be removed if necessary. After inspection and/or service, the parts are repositioned in the body 43 and the slide plate 73 repositioned in the opening 75.

The construction of the present invention permits external access to the brushes from outside of the motor housing and does not require that the latter be dismantled, or disturbed at all. In addition, this "external access" is provided for by means of a construction which is quite simple and inexpensive, particularly when compared with some prior art, externally accessible brush holder assemblies such as those which employ, for example, more expensive, threaded caps.

By the foregoing, there has been disclosed an improved brush holder assembly calculated to fulfill the inventive objects hereinabove set forth, and while a preferred embodiment of the present invention has been illustrated and described in detail, various additions, substitutions, modifications and omissions may be made thereto without departing from the spirit of the invention as encompassed by the appended claims.

We claim:

1. In an electric motor of the type having a housing, a stationary field in said housing, a rotatable armature

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supported in said housing, said armature including a commutator, and a pair of brushes engageable with said commutator; the improvement, in said motor, which comprises a pair of elongated bodies each having a passage therethrough slidably receiving a respective one of said brushes, means securing each said body to said housing, resilient means in each said body normally biasing said brushes toward said commutator, said housing having a pair of openings therein aligned with respective ones of said passages, a pair of members carried by said housing spaced from each said body and adapted to obstruct respective ones of said openings and prevent withdrawal of said resilient means, each said member being retained in place obstructing said opening by detent means and being movable from outside said housing to permit withdrawal of said resilient means and said brushes from each said body.

2. A brush holder assembly comprising a housing, a body having a passage therethrough and adapted to be fixedly supported in said housing, an opening in said housing aligned with said passage, a brush slidably disposed in said passage, resilient means within said passage and having one end operatively engaging said brush, a member movably carried by said housing within said opening spaced from said body and adapted to obstruct said housing opening and provide an abutment for the other end of said resilient means, said member being movable to uncover said housing opening and permit withdrawal of said resilient means and said brush therethrough without dismantling said housing and disturbing said body.

3. The improvement of claim 1 wherein each said resilient means is a compression spring operatively caged between its respective brush and member.

4. The improvement of claim 1 wherein each said member is a plate slidably disposed in grooves in said housing along opposite sides of said opening for movement generally transversely of the passage of its respective body.

5. The improvement of claim 4 wherein each said resilient means is a compression spring operatively caged between its respective brush and plate, and includes a cap disposed over at least the outermost coils of said spring adjacent said plate, whereby to prevent lateral displacement of the outermost coil during movement of said plate.

6. The improvement of claim 4 wherein said detent means is formed on said housing and plate for releasably retaining said plate in position closing said opening.

7. The improvement of claim 6 wherein said detent means includes at least one projection in one of said grooves adapted to be received in a notch in said plate.

8. The improvement of claim 6 which includes slit means formed between said plate and said housing when

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said plate is in position closing said opening, said slit means being adapted to receive tool means, whereby to facilitate release of said detent means and movement of said member for withdrawal of said resilient means and said brushes from each said body.

9. The improvement of claim 3 which includes electrical conductor means interposed between each said spring and its respective brush, and means within each said passage for limiting movement of said conductor means toward said commutator.

10. A construction as defined in claim 2 wherein said resilient means includes a compression spring.

11. A construction as defined in claim 2 wherein said member comprises a plate slidably carried by said housing for movement in a direction generally transverse to said passage.

12. A construction as defined in claim 11 wherein said resilient means is a compression spring caged between said brush and plate, and a cap disposed over at least the outermost coils of said spring adjacent said plate, whereby to prevent lateral displacement of the outermost coil of said spring during plate movement.

13. A construction as defined in claim 11 which includes cooperable means in said housing and said plate for releasably securing said plate in a position closing said opening.

14. A construction as defined in claim 13 wherein said cooperable means includes at least one projection on said housing and a generally complementary notch in said plate, said plate having a portion adjacent said notch adapted to deflect during engagement with said projection, as said plate moves into place closing said opening, whereby said plate notch snaps in place over said projection.

15. A construction as defined in claim 14 wherein said plate and housing define a slit therebetween when said plate is in position closing said opening, said slit adapted to receive a tool therein for prying and moving said member in a direction releasing said at least one notch from said projection.

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310—242