Dec. 6, 1966 G. E. MAFFEY, JR 3,290,524

BRUSH HOLDER ASSEMBLY FOR INSULATED HOUSING

Filed March 25, 1964

2 Sheets-Sheet 1

FIG. 1

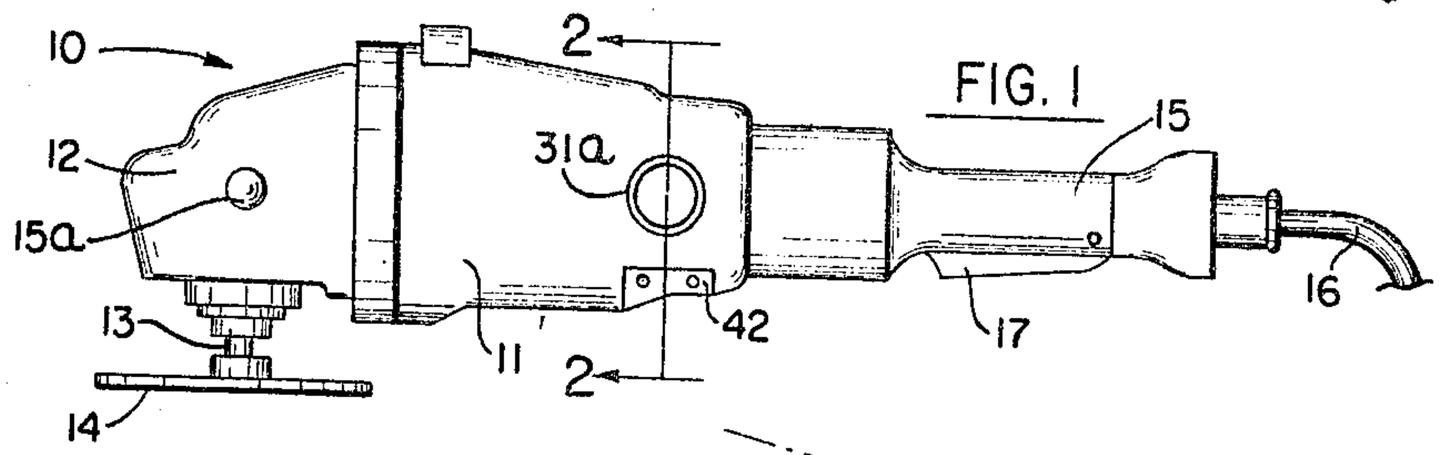


FIG. 4

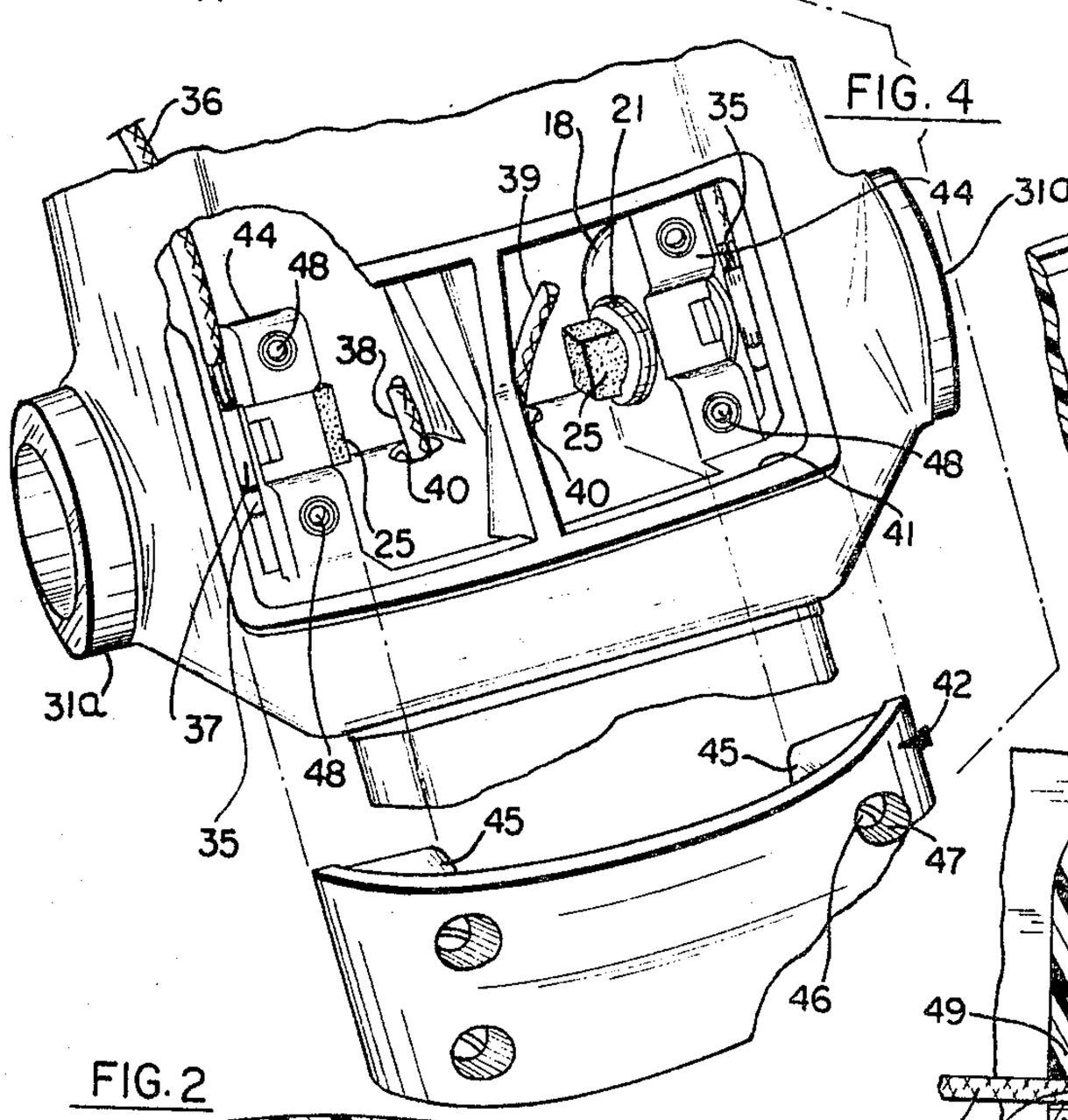


FIG. 4A

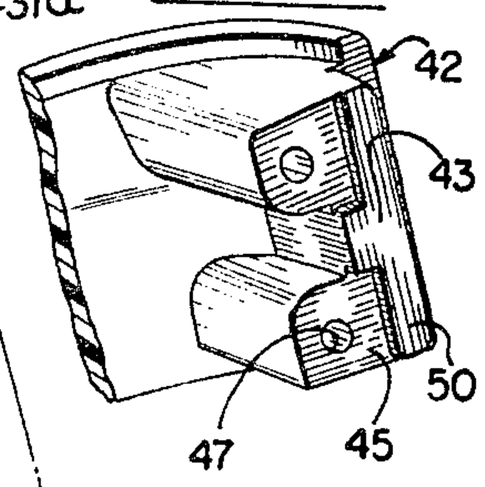


FIG. 3

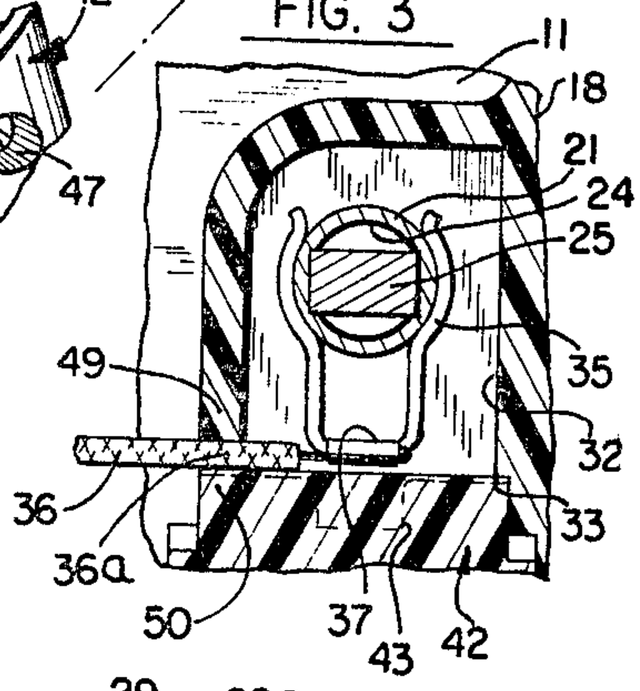
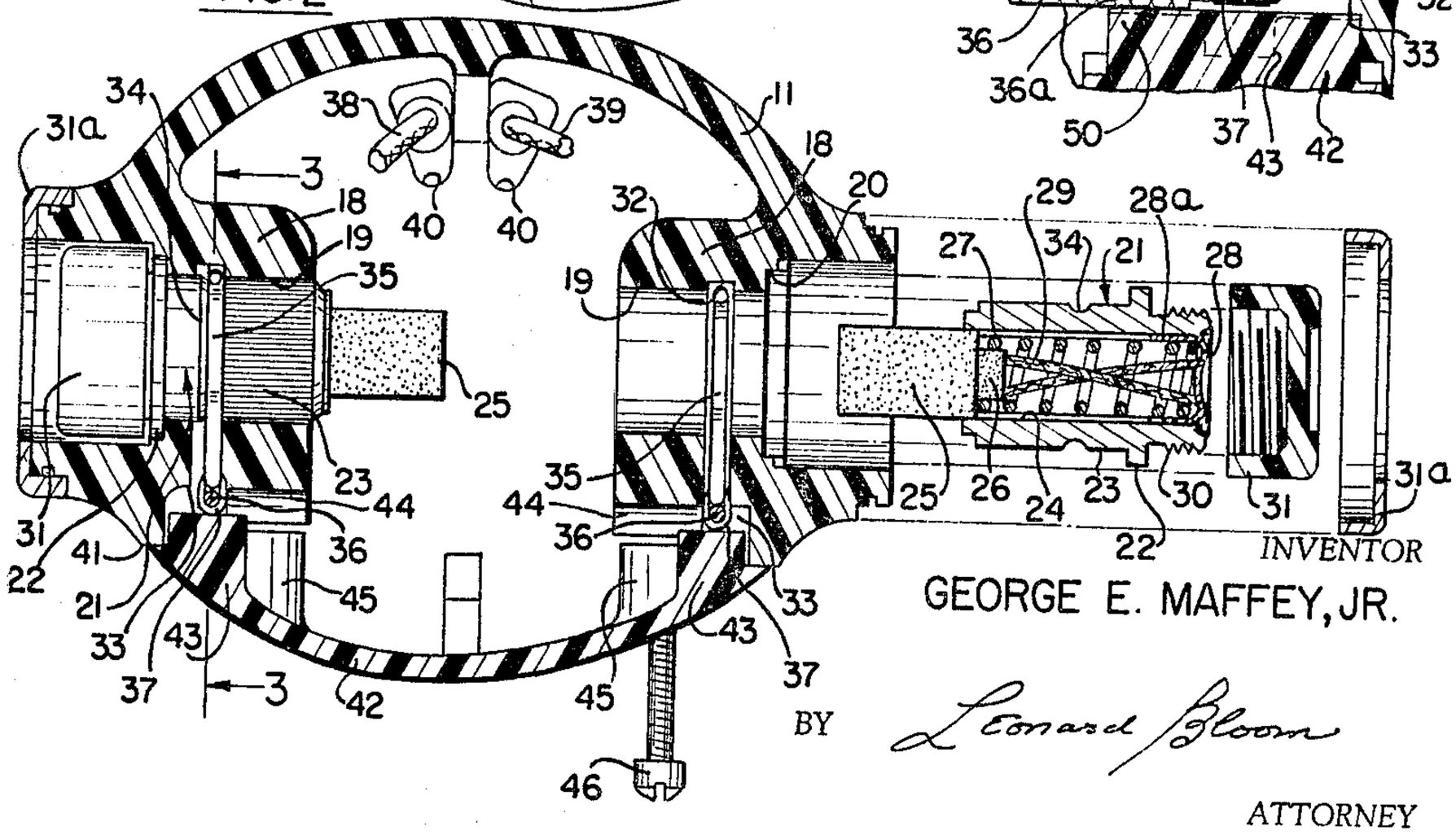


FIG. 2



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FIG. 5

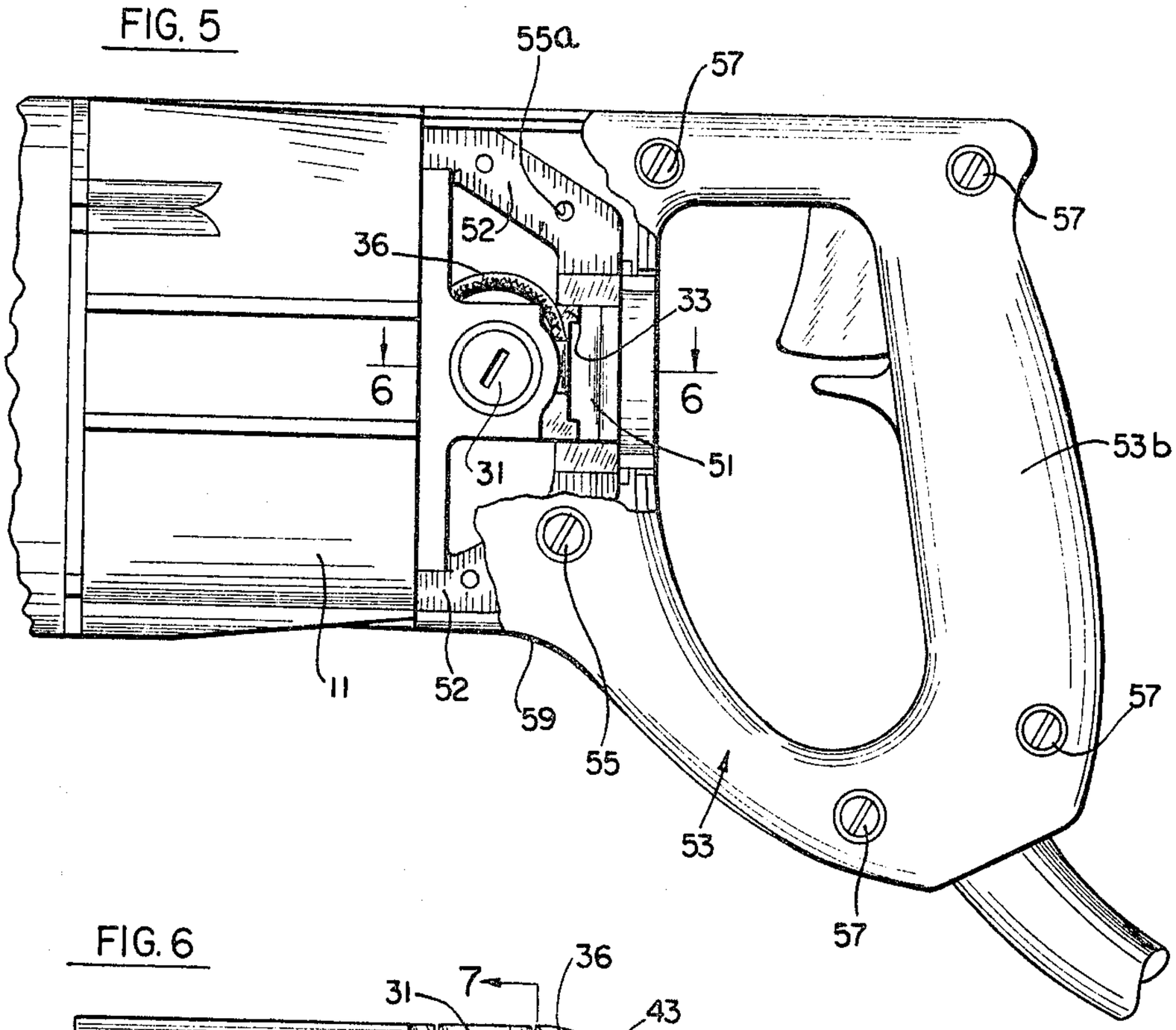


FIG. 6

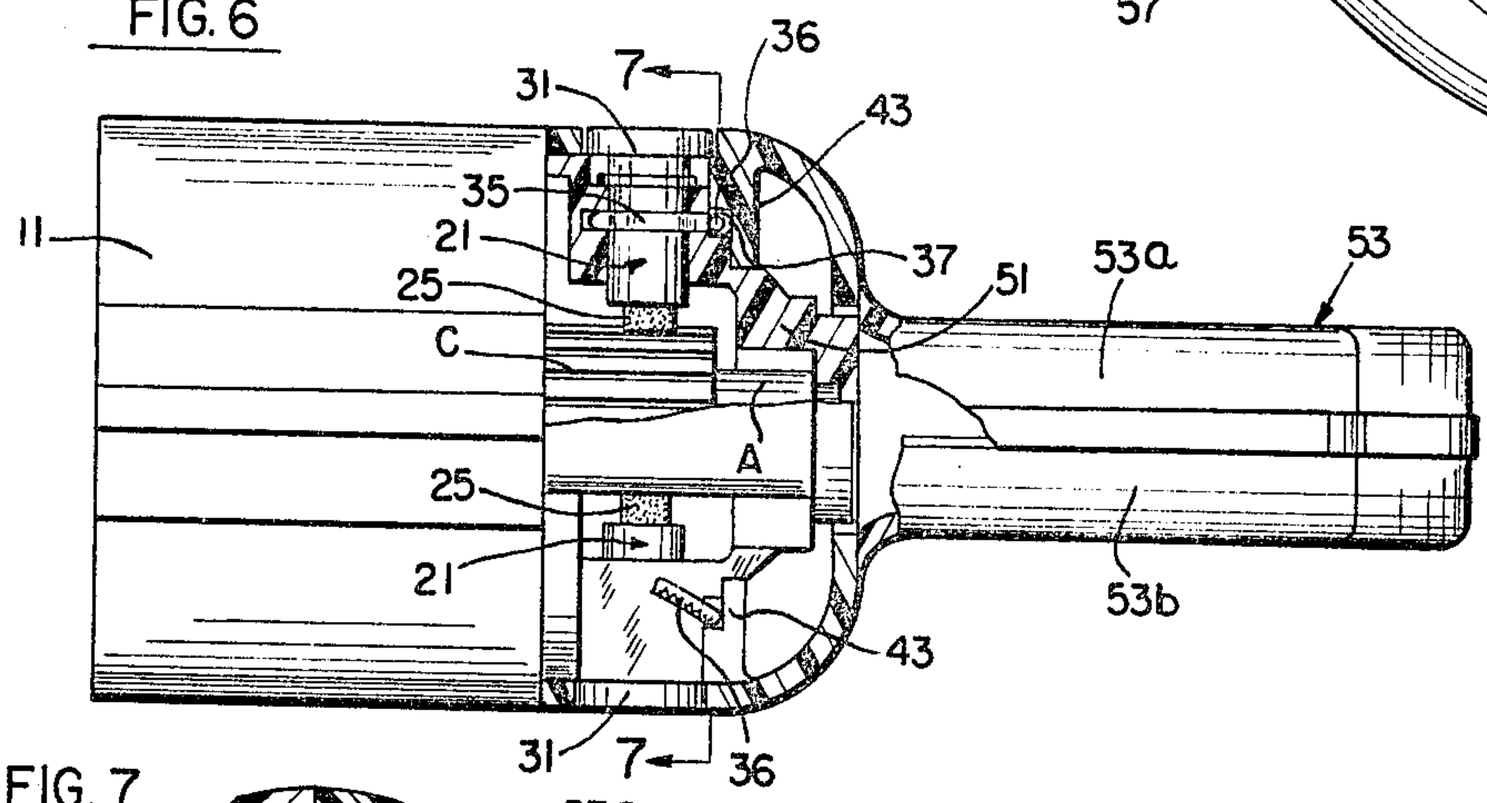
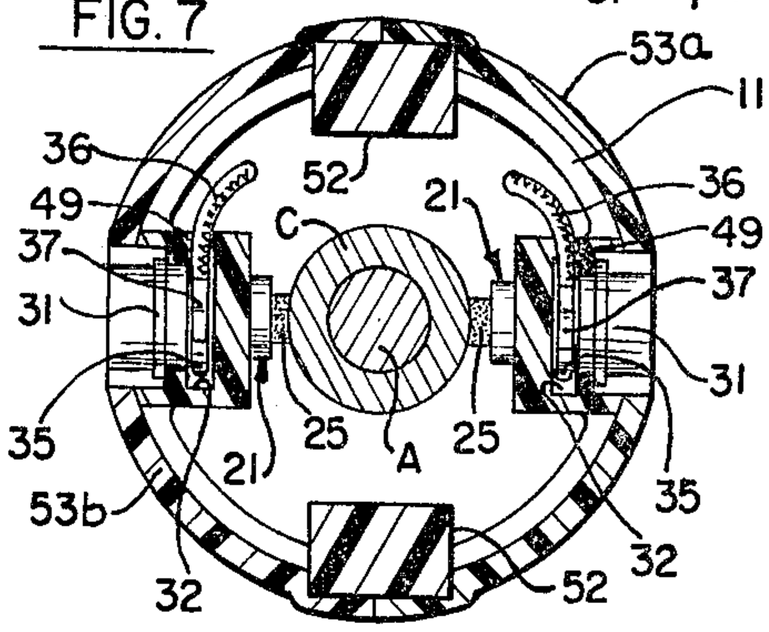


FIG. 7



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BRUSH HOLDER ASSEMBLY FOR INSULATED HOUSING

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5 Claims. (Cl. 310—71)

The present invention relates to a brush holder assembly for a motor housing made from an insulating material, and more particularly, to a brush holder assembly which is compatible with the design and manufacture of an insulated electric tool.

It is an object of the present invention to provide a brush holder assembly which will fully comply with the various rigid safety requirements, such as the Continental Electrical Code, which governs the importation and usage of electric tools in Europe.

It is another object of the present invention to provide a brush holder assembly having a terminal received within a blind slotted recess or pocket formed within the insulated housing, the terminal being electrically connected to the brush, in combination with an insulated member secured to the housing and having an internal land portion which substantially covers the opening in the recess so as to trap the terminal within the recess.

It is yet another object of the present invention to provide an insulated member which serves a dual entrapment function: one, it traps the terminal within the recess and prevents the terminal or any portion thereof from coming out of the recess, should terminal breakage occur; and two, it traps the adjacent portion of the conductor against the insulated housing and prevents the conductor from becoming loose and exposed, should a breakage occur between the conductor and its terminal.

It is a still further object of the present invention to provide a conductor having a resilient horse-shoe type of clip-on terminal which is trapped within an internal recess or pocket formed within the insulated housing; the clip-on terminal is seated within an external annular groove formed on a conductive brush holder insert that is in turn secured within a boss formed integrally within the insulated housing, the insert having a brush slidably guided therein and electrically connected thereto, and the clip-on terminal serving the auxiliary function of helping to retain the insert within the housing in the event that the brush holder insert becomes loose.

It is a still further object of the present invention to provide a brush holder assembly which may be fabricated and assembled into an insulated portable electric tool with ease and convenience, one which is economical to produce, yet rugged and reliable for periods of extended usage.

In accordance with the broad teachings of the present invention, there is herein illustrated and described, an electrical brush means for a housing made from an insulating material, the means comprising a brush which is slidably guided within the insulated housing and a recess or pocket formed in the housing transversely of the brush. The recess is substantially closed, but has an opening through which it is accessible; and a conductor has a terminal means which is received through the opening in the recess and is electrically connected to the brush. A member, formed from an insulating material, is secured to the housing; and the member has an internal portion which substantially fits over the opening in the recess to trap the terminal therein. Additionally, and in a preferred embodiment, the insulating member pinches the portion of the conductor (which is adjacent to the terminal) against the insulated housing, thereby preventing an exposure of the conductor.

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In accordance with the further teachings of the present invention, there is herein illustrated and described, a brush holder assembly for a housing made from an insulating material; the assembly comprises a conductive brush holder insert secured within the housing, and a brush slidably guided within the insert and electrically connected thereto. A blind slotted recess is formed in the housing, transverse to and communicating with the external surface of the insert. This recess, which is in the nature of a pocket, is substantially closed on three sides, but has an opening through which it is accessible. An external groove is formed on the conductive brush holder insert to communicate with the recess. A conductor has a resilient substantially U-shaped clip-on terminal secured on its end; and the terminal is received through the opening of the recess and is seated within the groove on the brush holder insert to make an electrical connection with the insert, and through the insert, with the brush. An insulated means is then provided to trap the terminal in the recess, thereby preventing the terminal or any portion thereof from coming out of the recess and being exposed, should a terminal breakage occur.

In accordance with a first embodiment of the present invention, this last-named insulated means to trap the terminal in the recess comprises a window formed in the housing, the window facing the opening in the recess within which the terminal is received, and an insulated cover plate seated in the window and secured to the housing; the cover plate has an internal land portion which substantially fits over the opening in the recess so as to trap the terminal therein.

While it is old in the art to removably secure a brush cover plate to a motor housing, nevertheless, the present invention transcends this prior art, not only in function, but also in structure. The purpose of the brush cover plate of the prior art is merely to facilitate an inspection of the brushes and the commutator. On the other hand, the present invention provides a cover member which is molded from an insulating material and has an internal land portion which substantially encloses a blind slotted recess or pocket molded integrally within the housing, the latter also being made of insulating material; and the insulated cover member thus serves the function of trapping a "live" terminal within the recess, and preferably, of simultaneously trapping or pinching the adjacent portion of the "live" conductor against the insulated housing, thereby preventing exposure of the terminal, any portion of the terminal, or the conductor itself.

In accordance with another embodiment of the present invention, the insulated means to trap the terminal in the recess comprises a transverse rear bridge, which is formed integrally with the insulated housing, and a longitudinally-split rear handle, which is also formed of insulating material, and is secured to the bridge. The handle has a pair of complementary mating halves, each of which is provided with an integrally-formed internal land that encloses the opening in a respective recess so as to trap the terminal therein.

In accordance with a further concept of the present invention, the insulated entrapment member is provided with a second internal portion, formed adjacent to its internal land portion, which pinches the terminal's "live" conductor against a complementary ledge formed in the insulated housing, thereby preventing an exposure of the conductor should a failure occur between the conductor and its terminal.

These and other objects of the present invention will become apparent from a reading of the following specification, taken in conjunction with the enclosed drawings, in which:

FIGURE 1 is a side elevation of a typical insulated portable electric tool with which the teachings of the present invention may find particular utility;

FIGURE 2 is a transverse section, taken along the lines 2—2 of FIGURE 1, enlarged over the scale of FIGURE 1, showing the manner in which a pair of internal lands on an insulated cover plate trap a pair of respective terminals within their respective recesses in the insulated housing, and further showing the components of one brush holder assembly in exploded relationship;

FIGURE 3 is a detail section, taken along the lines 3—3 of FIGURE 2, showing the manner in which each terminal is trapped within its respective recess, and also showing the manner in which the adjacent portion of the conductor is pinched or trapped between the insulated mating portions of the housing;

FIGURE 4 is an exploded fragmentary perspective of the insulated cover plate and of the lower portion of the insulated housing, the latter having a window formed therein to receive the insulated cover plate;

FIGURE 4*a* is a partial perspective of the insulated cover plate, looking into the interior of the plate, showing the internal land which fits over the opening in the recess to trap the terminal therein, and further showing the mounting bosses to secure the cover plate to the housing;

FIGURE 5 is another embodiment in which a longitudinally-split rear handle is secured to a transverse bridge formed integrally with the insulated motor housing, each handle half having an internal land which traps a respective terminal within its recess;

FIGURE 6 is a transverse section, taken along the lines 6—6 of FIGURE 5, and showing the manner in which the entrapment occurs; and

FIGURE 7 is a section taken along the lines 7—7 of FIGURE 6.

With reference to FIGURE 1, there is illustrated a portable electric sander **10** with which the teachings of the present invention may find particular utility. The sander **10** may be constructed as a fully-insulated or "all insulated" electric tool; however, it will be appreciated by those skilled in the art that the teachings of the present invention are not necessarily confined to the particular tool shown, but rather are equally applicable to other tools, and indeed, to other types of electrical apparatus. With this in mind, and for orientation purposes, the overall sander **10** comprises a motor housing **11**; a gear case **12** secured forwardly of the motor housing; a main drive spindle **13**; a rotating pad **14** driven by the spindle; the pad serving as the support for an abrasive wheel, not shown, or for a buffing device or other tool; an end handle **15** secured rearwardly of the motor housing; an auxiliary side handle **15***a* (shown in end elevation) to assist in guiding and controlling the tool; an electric line cord **16** received by the end handle; and a trigger switch **17** by means of which the sander is energized.

With reference to FIGURE 2, it will be appreciated that the motor housing, and indeed the other housing components of the sander **10**, are suitably molded from an insulating material, such as a polyester resin having glass fibers embedded therein for structural purposes. The motor housing **11** has a pair of integrally-molded bosses **18** which project radially inwardly of the housing, and each of the bosses **18** has a bore **19** and a counterbore **20** formed therein to communicate with the external surface of the housing. A substantially-cylindrical conductive brush holder insert **21** is secured within the bore **19** and has an annular shoulder **22** seated within the counterbore **20**. The conductive insert **21** has a series of longitudinal knurls **23**, see FIGURE 2, formed on its outer cylindrical surface by means of which the insert **21** is press-fitted within the bore **19**, and preferably, a suitable cement is also used to retain the insert. The insert **21** has a longitudinally-formed through opening **24**, which is preferably rectangular in cross-section; and a carbon brush **25** is slidably guided within the through opening **24** formed in the insert. The carbon brushes **25** engage a conventional drum-type commutator formed on a rotating armature (not shown for ease of illustration) and each brush **25** is provided with a necked-down rear portion **26**, see FIGURE 2, which seats one end of a coil spring **27**. The opposite end of the spring **27** is seated against a conductive cap **28**, and the cap **28** has a pair of ears **28***a* which are slidably guided within the opening **24** in the conductive insert **21**. A pair of flexible shunt wires **29**, or other suitable means, are provided between the cap **28** and the brush **25** so as to electrically connect the conductive insert with the brush. The insert **21** has an externally-threaded rear cylindrical portion **30** which receives an insulated cap **31**, and a protective metal ring **31***a* is cemented or otherwise secured to the housing to alleviate wear or accommodate scraping of the housing in the vicinity of the bosses.

With reference again to FIGURE 2, and with further reference to FIGURES 3, 4, and 4*a*, a blind slotted recess **32** is formed in the boss **18**, transversely of the bore **19** and intersecting the bore; and as shown more clearly in FIGURE 3, this recess **32** is in the nature of an internal pocket which is substantially closed on three sides, but has an opening **33** by means of which it is accessible. An external annular groove **34** is formed on the knurled cylindrical portion **23** of the insert **21**, and the groove **34**, see FIGURE 2, is alined with the recess **32** when the conductive insert **21** is secured within the boss **18**. A resilient substantially U-shaped clip-on terminal **35** is received through the opening **33** of the blind slotted recess **32** and is seated within the external annular groove **34** formed on the conductive brush holder insert **21**, thereby making electrical contact with the insert **21** (and through the insert **21**, cap **28**, and shunt **29**) to the brush **25**. Additionally, the terminal **35**, in combination with the groove **34**, serves the auxiliary function of preventing axial movement of the brush holder insert **21** out of the boss **28** in the housing. Each terminal **35** is secured to a "live" conductor or lead **36** by means of a conventional crimp-on connector **37**, and the conductors **36** come from the motor field coils (not shown) in a manner familiar to those skilled in the art. The electric line cord **16**, moreover, has a pair of wires **38** and **39**, see FIGURES 2 and 4, which enter the motor housing through openings **40** and are interconnected with the switch **17** and go to the motor field coils in a conventional manner.

Means are provided for trapping the terminals **35** within their respective recesses **32**, and also, for pinching the adjacent portion of the respective conductors **36** against the insulated motor housing **11**. In one embodiment, the entrapment means, see FIGURES 2 and 4, includes a window **41** formed integrally with the molded insulated housing **11** and facing the openings **33** in the respective recesses **32**. An insulated cover plate **42** is seated in the window **41** and is secured to the housing; and the cover plate **42** has a pair of internal land portions **43**, see FIGURES 3 and 4*a*, which fit over the respective openings **33**, substantially enclosing the recesses **32**, and trapping the respective terminals **35** therein. A first pair of spaced-apart raised bosses **44**, see FIGURE 4, are formed on each boss **18** adjacent to one side of the opening **33** for the blind slotted recess **32**, and a complementary second pair of spaced-apart raised bosses **45**, see FIGURE 4*a*, are formed in the insulated cover plate **42** adjacent to each land portion **43**. When the cover plate **42** is seated in its window **41**, the complementary bosses **44** and **45** match with one another, see FIGURE 2, and the plate **42** is secured to the housing **11** by means of screws **46** which pass through bores **47** in the second bosses **45** and are received in internally-threaded sleeves **48** anchored within the first bosses **44**.

With reference again to FIGURE 3, a ledge **49** is formed in the insulated housing **11** adjacent to each opening **33** in the respective recesses **32**, and the insulated cover plate **42** has a complementary portion **50** formed adjacent to its

internal land 43. As shown in the drawings, this portion 50 is preferably formed as an extension of the land 43. When the insulated cover plate 42 is secured to the insulated motor housing 11, the portion 36*a* of the "live" conductor 36 (adjacent to its terminal 35 and crimp-on connector 37) is trapped, that is, pinched slightly between the ledge 49 in the housing and the complementary portion 50 in the cover plate 42; and thus the insulated cover plate 42 serves a dual entrapment function: one, it traps the terminal 35 within the closed recess 32 and prevents the terminal 35 (or any portion thereof) from coming out of the recess 32, should terminal breakage occur; and two, it traps the adjacent portion 36*a* of the "live" conductor 36 and prevents the conductor 36 from becoming loose and exposed in the event that a breakage occurs between the conductor 36 and its terminal 35.

Another embodiment of the invention is illustrated in FIGURES 5, 6, and 7; here, the invention is applied to an "end handle" fully-insulated portable electric tool, such as a drill or screwdriver. The motor housing, still designated by the numeral 11, is made of a suitable insulating material and has an integrally-formed transverse rear bridge portion 51 which is supported by integrally-formed struts 52. Mutually-alined conductive brush holder inserts 21 with brushes 25 are secured within the bridge 51; The brushes 25 engage the commutator C on armature shaft A. The brush holder inserts and related components are substantially identical to that which was described previously for the sander 10, and hence a further description has been omitted. The end or rear handle 53 is formed from a suitable insulating material and is split longitudinally into a pair of complementary mating portions or halves 53*a* and 53*b*. Each handle half is secured to the motor housing 11 by means of screws 55 which pass through holes 55*a* in struts 52. Also, the handle halves 53*a* and 53*b* are secured to each other by screws 57.

As with the insulated cover plate 42 of the first embodiment, each handle portion has an internal land 43 which substantially fits over the opening 33 in each recess 32 to trap the terminal 35 therein, and also, an adjacent portion (not shown) which traps or pinches the conductor 36 against the ledge 49 (see FIG. 7) formed in the insulated housing 11. The operation of this embodiment of the invention is thus identical to the first embodiment, and it will be appreciated that the bridge 51 and split handle 53 serve the same entrapment function as the window 41 and cover plate 42.

Because of the resilient nature of the terminals 35 and the manner in which they are snapped in place, they remain in contact with the conductive insert 21 even after the cover plate 42 (or either handle half 53*a* or 53*b* in the other embodiment) is removed from the insulated housing 11; however, the terminals 35 may be easily snapped off of the insert 21 by merely inserting a flat blade, such as a screwdriver, and lifting up on the connector 37.

Obviously, many modifications may be made without departing from the basic spirit of the present invention; and accordingly, within the scope of the appended claims, the invention may be practiced other than has been specifically described.

I claim:

1. A brush holder assembly for a housing made from an insulating material, comprising, in combination:
- (a) a conductive brush holder insert secured within the housing;
- (b) a brush slidably guided within said insert and electrically connected thereto;
- (c) a blind slotted recess formed in the housing transverse to, and communicating with, the external surface of said insert;
- (d) said recess being substantially closed and having an opening through which said recess is accessible;

- (e) an external groove formed on said insert and communicating with said recess;
- (f) a conductor having a resilient substantially U-shaped clip-on terminal secured on its end, said terminal being received through said opening of said recess and being seated within said groove on said insert; and
- (g) insulated means to trap said terminal in said recess.

2. A brush holder assembly for a housing made from an insulating material, comprising, in combination:
- (a) a conductive brush holder insert secured within the housing;
- (b) a brush slidably guided within said insert and electrically connected thereto;
- (c) a recess formed in the housing and communicating with said insert;
- (d) said recess being substantially closed and having an opening through which said recess is accessible;
- (e) a conductor having a terminal secured thereto, said terminal being received through said opening in said recess and engaging said insert;
- (f) a window formed in the housing facing said recess; and
- (g) a cover plate made from an insulating material, seated in said window, and secured to the housing;
- (h) said plate having a portion substantially fitting over said opening in said recess to trap said terminal therein.

3. A brush holder assembly for a housing made from an insulating material, comprising, in combination:
- (a) a transverse rear bridge formed integrally with the housing;
- (b) a pair of mutually-alined conductive brush holder inserts secured within said bridge;
- (c) a brush slidably guided within each of said inserts and electrically connected thereto;
- (d) a pair of recesses formed in said bridge, one each communicating with a respective one of said inserts;
- (e) said recesses being substantially closed and each having an opening through which said respective recess is accessible;
- (f) a pair of conductors, each having a terminal secured on its end, said terminals being received in said respective recesses and engaging said respective inserts; and
- (g) a longitudinally-split rear handle formed of insulating material and comprising a pair of mating halves secured to said transverse rear bridge;
- (h) each of said mating halves having an internal portion substantially fitting over said opening in said recess to trap said terminal therein.

4. A brush holder assembly for a housing made from an insulating material, wherein the housing is provided with an integrally-formed inwardly-directed boss which is closed on all sides, the improvement comprising, in combination:
- (a) a brush and means to slidably guide said brush within the boss formed in the housing;
- (b) a slotted transverse recess formed in the boss, intermediate the ends of the boss;
- (c) said recess being substantially closed on three sides and having an opening through which said recess is accessible;
- (d) a conductor having a terminal secured on its end, said terminal being received through said opening of said recess;
- (e) means to electrically connect said terminal with said brush; and
- (f) a member formed from an insulating material and secured within a window in the housing;
- (g) said member having a portion thereof substantially fitting over said opening in said recess to trap said terminal therein.

5. A brush holder assembly for a housing made from an insulating material, comprising, in combination:

(a) a conductive brush holder insert secured within the housing;

(b) a brush slidably guided within the insert and electrically connected thereto;

(c) a blind slotted recess formed in the housing transverse to, and communicating with, said insert;

(d) said recess being substantially closed and having an opening through which said recess is accessible;

(e) a ledge formed in the housing adjacent said opening in said recess;

(f) a conductor having a terminal secured on its end, said terminal being received in said recess and engaging said insert; and

(g) a housing member made of an insulating material secured to the housing;

(h) said member having a first portion substantially fitting over said opening of said recess to trap said terminal therein; and

(i) said member further having a second portion, complementary with said ledge in the housing, to pinch therebetween the portion of said conductor adjacent said terminal.

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