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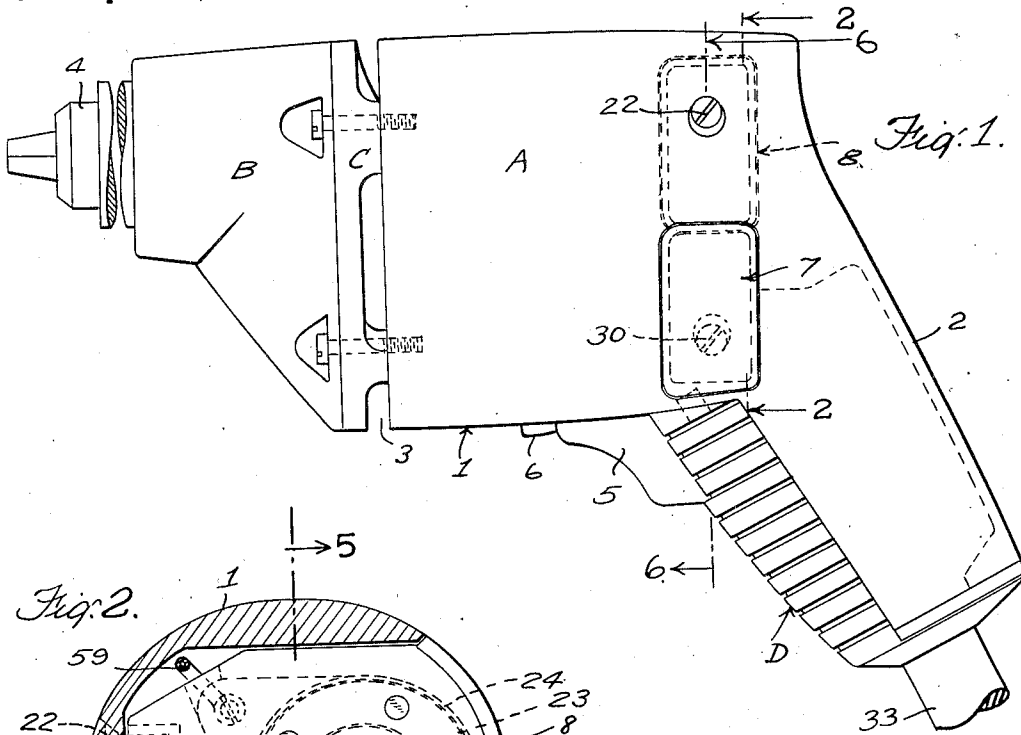
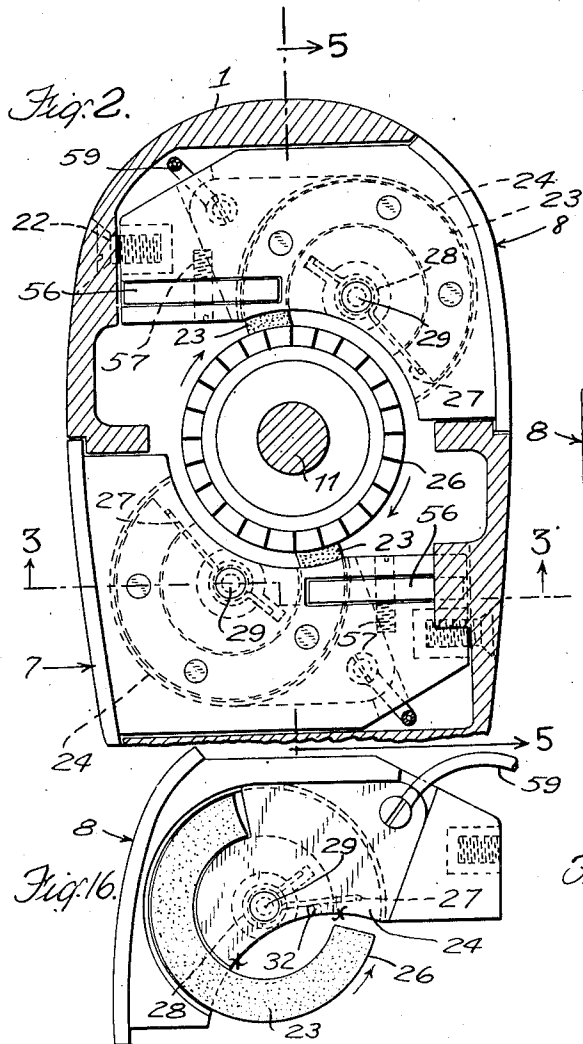
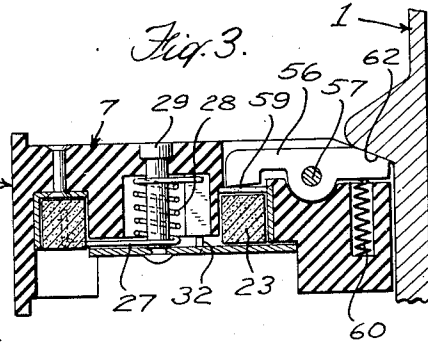
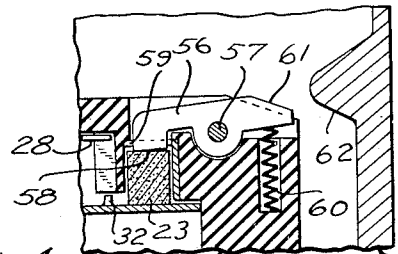
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BRUSH AND BRUSH HOLDER FOR ELECTRIC DRILLS

Filed April 24, 1945

3 Sheets-Sheet 1



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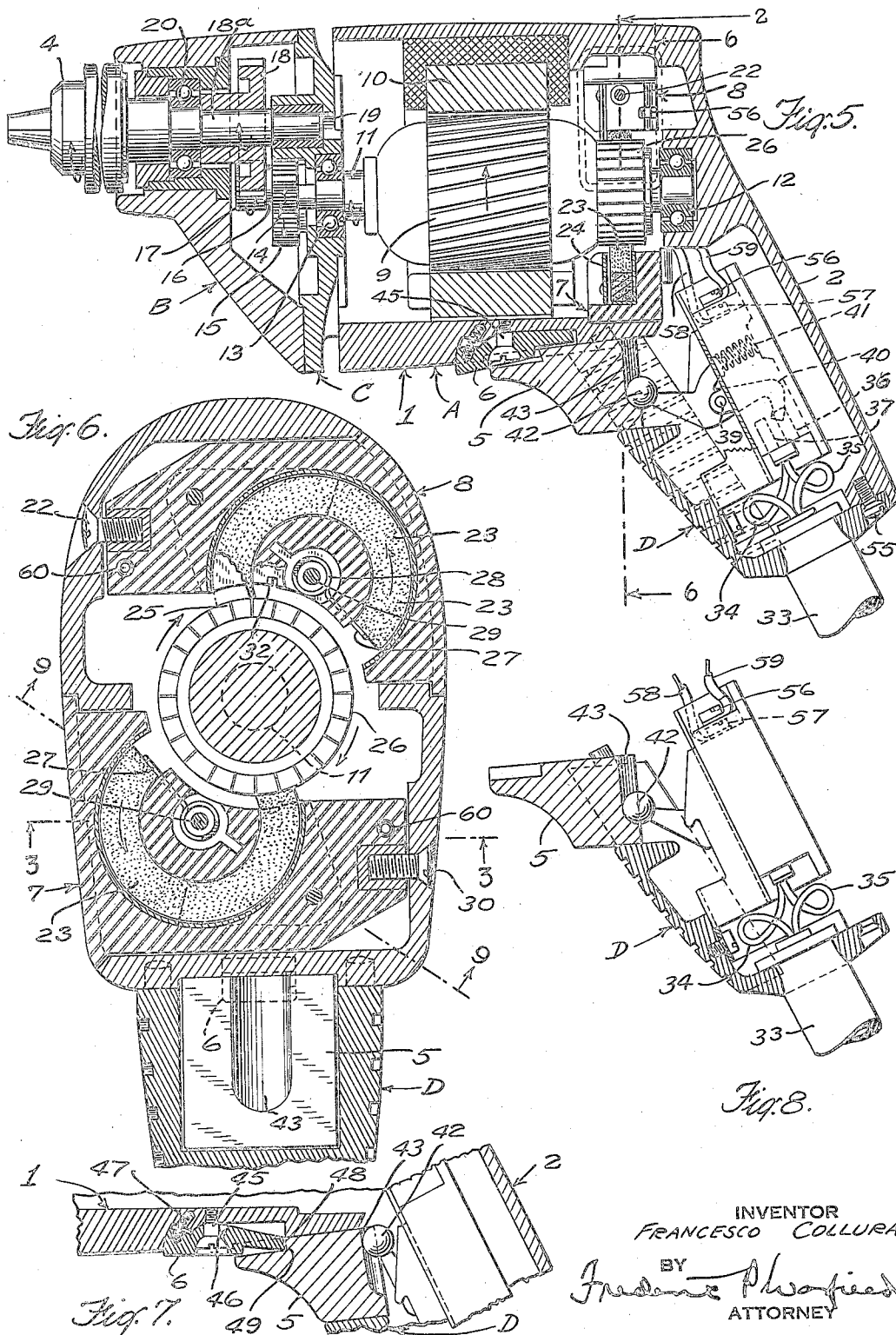
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BRUSH AND BRUSH HOLDER FOR ELECTRIC DRILLS

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3 Sheets-Sheet 2



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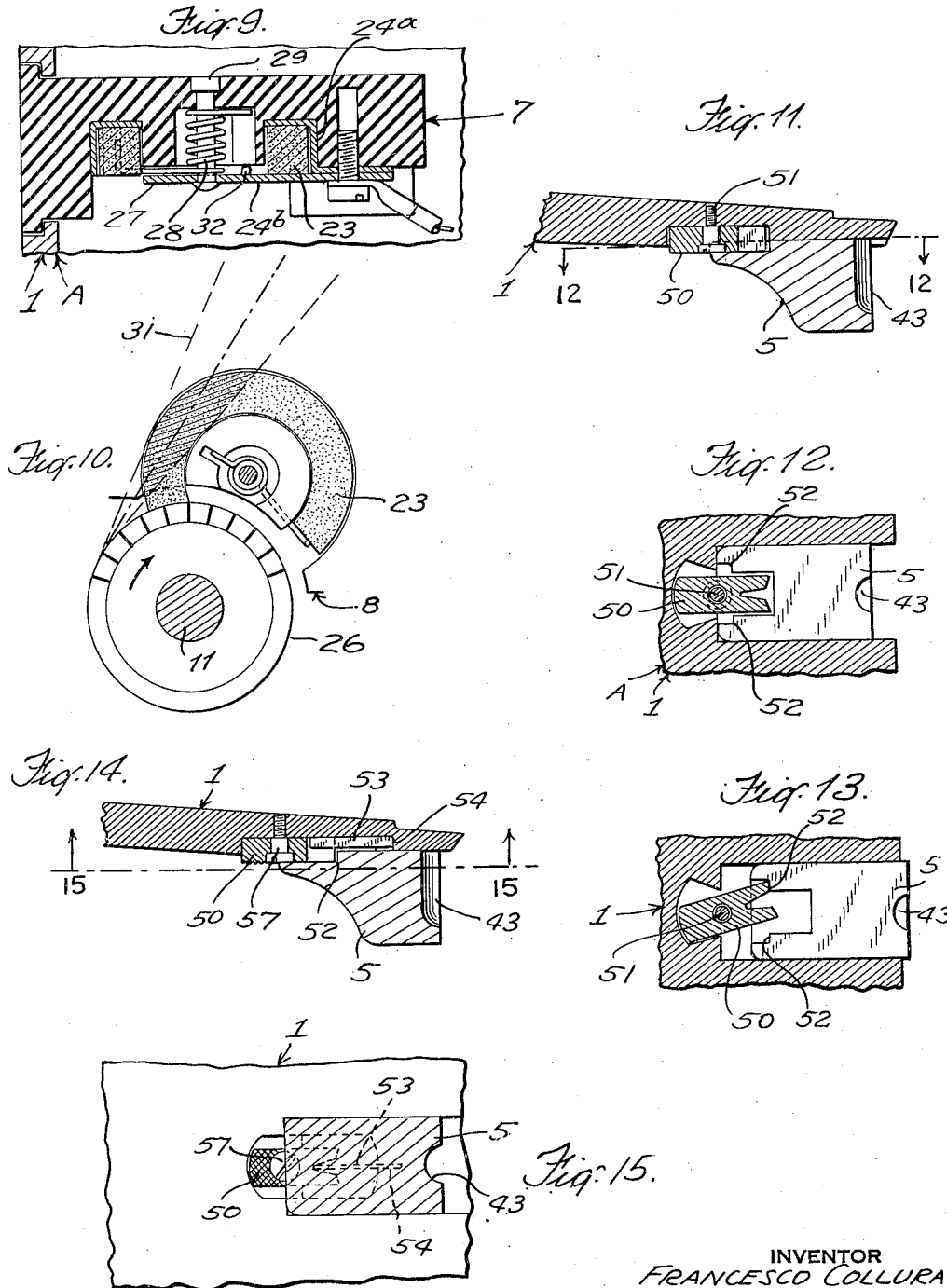
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BRUSH AND BRUSH HOLDER FOR ELECTRIC DRILLS

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3 Sheets-Sheet 3



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BRUSH AND BRUSH HOLDER FOR
ELECTRIC DRILLS

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9 Claims. (Cl. 171—323)

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This invention relates to electric drills, or other tools of a similar character, supplied with a hand grip section in the nature of a pistol grip, the operator's hand controlling the point of application of the drill and the amount of pressure thereon and also controlling the electric power switch so that the power may be conveniently thrown on and off.

An object is the provision of an electric hand tool having a minimum number of casing parts so that there are a minimum number of junction lines on the casing, which lines have the disadvantage of permitting entry of dust and other foreign matter, and also tend to limit the efficiency of the tool by causing discomfort or injury to the hand of the operator along the meeting lines of the casing, particularly at the hand grip section.

A further object is the provision of a commutator and brush assembly in an electric tool of this type which permits ready assembly, removal and replacement of brushes, provides a brush subject to a minimum of shearing, wearing and breaking strains, provides a brush having a commutator contact surface which functions with maximum efficiency and retains such maximum efficiency, and provides further a brush having an extended length so that replacement is necessary only at longer intervals, while at the same time the outside dimensions of the tool may be sharply limited and the tool rendered relatively light and compact.

A further object is the provision of a commutator brush of a special shape which permits maximum efficiency at the commutator contact area, maximum efficiency because of the length of the brush and the mass thereof available to take up frictional wear at contact, while at the same time space necessary for the application of such brush in its relation to a commutator is economized and the feed of such brush toward the contact area to take up the effects of contact wear may be readily and efficiently accomplished.

A further object is the provision in an electric tool of a device operating the on and off power switch, of a nature such that it may be readily operated by one hand of the operator so that the power may be readily thrown on by a finger of the operator's hand holding the tool at the hand grip, while at the same time the same finger, or a second finger of the operator's same hand, can throw into locking position a switch lock so that the power will remain on without the operator's pressure upon the switch. This switch lock may also be readily thrown, or released, to the un-

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locking position, permitting the switch to go to the power-off position so far as the lock is concerned.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts, which will be exemplified in the constructions hereinafter set forth, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a side elevation of an assembled electric drill embodying this invention;

Fig. 2 is a section on a somewhat enlarged scale on the lines 2—2 of Fig. 1 looking in the direction of the arrows;

Fig. 3 is a section on the lines 3—3 of Fig. 2 looking in the direction of the arrows, this view being on substantially the same scale as Fig. 1, and showing in detail the brush carrying unit as it is in position within the drill;

Fig. 4 is a detail showing the end of this brush carrying unit as it is being partly removed from the casing thereby permitting the operation of a brake which holds the brush in position within the brush carrying unit while it is being removed from the casing and thereafter;

Fig. 5 is a section taken on the line 5—5 of Fig. 2 but drawn to the scale of Fig. 1;

Fig. 6 is a section on the lines 6—6 of Fig. 5 looking in the direction of the arrows, this view being again on a slightly enlarged scale to compare with the scale of Fig. 2;

Fig. 7 is a sectional detail showing the trigger which controls the power switch in locked power supplying position;

Fig. 8 is a further detail partly in section showing the trigger and some of its related parts in the off or no-power position;

Fig. 9 is a sectional detail of one of the brush carrying units;

Fig. 10 is a detail showing the relation between brush and commutator with an indication of the passage of tangential lines of force, caused by the contact between the rotating commutator and the brush, through the mass of the brush;

Fig. 11 is a detail section showing a modified form of trigger lock;

Fig. 12 is a detail showing the parts of Fig. 11

in section and in the unlocked position, on the lines 12—12 of Fig. 11;

Fig. 13 is a section looking in the direction of the arrows showing this form of trigger lock in locking position;

Fig. 14 is a sectional detail showing a trigger lock such as that shown in Fig. 11 but with a spring tending to hold this lock in non-locking position;

Fig. 15 is a section on the lines 15—15 of Fig. 14 looking in the direction of the arrows; and

Fig. 16 is a side elevation of one of the brush carrying units showing the brush as it is inserted in the holder ready to be moved in the holder to its operative position.

In the drawings, Fig. 1 shows a drill assembled in accordance with my invention which comprises a main body section A having a central casing member 1 and a pistol grip member 2 integrally connected therewith and forming part of a single casting which may be readily constructed of metal or aluminum. An end section B of the casing is connected to the section A by the interposition of section C, provided with ventilating passages 3 leading to the interior of the tool. A drill chuck 4, broken away in its length for convenience of illustration, projects from the end of the casing section B.

A further casing section D is shown below the hand grip section 1 of the main casing and fitted thereto to complete the outside form of the tool. A switch trigger 5 and a projecting part of a lock therefor at 6 are shown. At 7 is shown the outer surface of a brush carrying unit fitted to an opening in the casing. A similar brush carrying unit 8 is indicated by dotted lines as provided on the opposite face of the tool casing.

Referring now to Fig. 5 there is shown an electric motor having a conventional armature 9, field magnet 10 and windings therefor. This armature carries a central operating shaft 11 journaled at 12 in casing A and 13 in casing C, and carrying at its outer end a pinion 14 which operates pinion 15 on a stud shaft 16 carrying at its end a pinion 17 meshing with the pinion 18 on the chuck shaft 18a, journaled at 19 and 20, which drives the chuck 4 and drill or other tool when the chuck is supplied with such tool.

We turn now to the assembly units carrying the brushes which constitute an important feature of this invention. Referring first to Fig. 6, an upper brush assembly unit is indicated at 8, removably held in position in the upper part of the tool casing by a screw 22 and carrying arc shaped brush 23, indicated as of usual carbon material, held within metallic holder 24 and having a contact area at 25 bearing upon the commutator bars 26 and fed forward as it is worn away at the contact area by spring pressure of the arm 27 bearing against the end of the brush, this arm being the extended end of a coil spiral spring 28 suitably mounted upon stud 29 carried by the body of the unit 8.

The brush holder 24 has two parts, in addition to its main frame work, a back plate 24a, shown most clearly on Figs. 3, 9 and 16, and a front plate 24b which is cut away in part as shown on Fig. 16 to provide an open faced slot within which one end of the arc shaped brush may be inserted from the side when the drill is in process of assembly or when it is necessary to install a fresh brush. This makes it possible to use a comparatively long arc shaped brush, providing a greater mass of material which will accordingly have a longer life and require less frequent re-

placement. As shown in Fig. 16, the brush is dropped into the open faced slot and then moved in an anti-clockwise direction, carrying the spring arm 27 with it and winding up the coil spring, until it reaches the position shown at Fig. 2 when it is ready for use. If it were not for the provision of this holder thus formed with one section cut away so as to permit placing of the brush in the position shown in Fig. 16, it would be possible to use only a comparatively short arc brush to the extent of the distance between the points marked x and x on Fig. 16. It is found that with the construction as shown a brush may be used well over the 180° arc in length and up to a point of 270° and beyond in length. The 270° length of the arc is found quite serviceable and useful. As shown on Figs. 2 and 6 the long arc shaped brush there illustrated is of a length such that while one end bears at its contact area upon the commutator the other end approaches, as shown, the commutator at a point along the circumference, and a relatively long brush is thereby provided limited only by the practical length of a brush having one end at the contact area bearing upon the commutator and the other end sufficiently spaced from the commutator so that the spring arm 27 may be interposed as shown in Figs. 2 and 6. It will thus be seen that the arc shaped brush is struck upon a circle, the center of which, when the brush is installed, is outside the peripheral circumference of the commutator. The brush thus has a contact area at one end extending radially across it while the mass of the brush extends away from said contact area along an arc shaped line which may be extended so far as desired up the point where further extension would bring its farther end, and the feed spring bearing against it, too close to the commutator. It will accordingly be seen that, while in some other relations the arc shaped brush such as is shown would have a useful function, independently of the construction of its holder, in the present relation, as shown, the shape of the brush is of special importance and the shape of the holder providing the cut away portion for assembly of the brush is also of special utility.

A similar brush unit 7 is shown in Fig. 6 below the commutator removably held in place by screw 30 and carrying a brush, brush holder, and controlling spring therefor in all respects the same as that already described for the upper brush.

This brush makes possible the use of a relatively large mass of brush material, rendering replacements much less frequent, while at the same time relatively small space is occupied by the brush and a smaller, more compact tool is secured. In addition, the major tangential lines of force caused by the friction between the brush and the oncoming rotary armature will as is indicated in Fig. 10 at 31, pass through the body of the brush in the line of its path of movement rather than across such line of movement as in brushes now in common use. This tends to lessen the uneven wearing away of the brush at the line of contact with the commutator and thereby to a marked extent increases the efficiency of the brush and lengthens its useful life. At the same time the wearing and shearing action between the brush and its holder are reduced to a minimum and particularly there is no excessive shearing action between the brush and the holder at the end of the holder where the brush is forced against this end in a construction

now widely used in the art. With this type of brush also all of these conditions remain substantially constant throughout the life of the brush as it is fed forward and until it is quite used up.

Since with this construction of brush and the following spring arm 27, when the brush is used down to the end, the spring would, if not prevented, come in contact with the armature and damage would be caused thereby, I provide a stop in the nature of a lug 32; struck up from the inner side of the brush holder 24 in a position such that the spring arm will, at the appropriate time toward the end of its travel be caught by this lug and be held as against further advances.

A form of electric tool in general use embodies a straight brush with a spiral spring bearing against the end of such brush and feeding it forward to contact with the commutator. This involves a shearing, breaking and crumbling effect upon the lower end of the brush as already described but it also involves an irregular erosion of the brush at the contact area caused by the fact that the feeding forward of the spring is necessarily uneven and the pressure of the brush on the commutator at the contact area accordingly uneven. With the present construction, however, the spring pressure of the arm 27 upon the end of the arc shaped brush is an even pressure exerted evenly through the mass of the brush and as a result the erosive action at the contact area is substantially even and the brush wears away evenly and with maximum efficiency.

With the brush assembly unit described, having a spring pressure behind the brush tending to force it out of its container, the brush would be forced out by spring action as the brush assembly unit is being removed from the casing and contact of brush and commutator broken. To prevent this there is provided as shown in Figs. 2, 3 and 4 a brake, inactive when the brush assembly unit is in position within the casing, and brought into action as the brush assembly unit is removed from the casing.

As shown, this brake is in the form of a lever 56 pivoted on stud 57 carried by the brush assembly unit and formed at one end at 58 to pass down through opening 59 in the container frame so that it may bear upon the side of the brush 23. Spring 60 bearing upon the other end of this brake lever tends normally to force it to braking position. This brake lever is provided at its other end at 61 with an inclined surface bearing upon the inclined projection 62 on the inner face of the casing section. It will thus be seen that when the brush assembly unit is in position within the casing the brake lever will be held to the inactive position against the force of spring 60 as shown in Fig. 3, and that the brush may be freely fed forward in use. As however the brush assembly unit is being removed from the casing the end of the brake lever passes away from the projection 62 and as shown in Fig. 4 spring 60 forces up the one end of the brake lever and the other braking end is then brought into action against the brush to hold it in position within the container and prevent its being forced out by the action of the spring arm 27.

We come now to the switch for turning on and off the power in the use of the tool. The under side of the hand grip section of the tool is closed by casing section D, shown as ribbed to

limit slipping of the hand. This section of the casing carries a tube 33 through which passes the electric lead wires 34 and 35 with contact posts 36 and 37. In Fig. 5 switch lever 38 pivoted at 39 and carrying an extended contact arm 40 is shown as only in contact with the post 36 and power supply to the tool is accordingly broken. This condition is normally maintained by action of the spring 41 acting against the pivoted lever 38 to hold the parts in the position shown in Fig. 5. When this lever 38 is turned on its pivot in a clockwise direction its arm 40 will bridge the two contacts and power will be supplied to the tool. Leads of the circuit through the motor and back are all such as conventionally used in the art and are not shown in detail. Posts 56 and 57 as shown in Fig. 5, and at the upper end of Fig. 8, supply connections for the ends of lead wires 58 and 59 connected in conventional manner for driving the chuck rotating motor. So far as this invention is concerned, it is only necessary that there be means for switching on and off the power under the control of a spring-pressed switch to be operated by the trigger and trigger lock mechanism now to be described.

As shown in Figs. 5 and 8, the end of the switch lever 38 is in the shape of a ball as at 42 which travels in a groove 43 on the inner end of trigger 5, sliding in ways within the upper member of the casing section D and just below the lower face of the main frame section I.

In the position shown in Figs. 5 and 8 the spring 41 is carrying the switch lever 38 and the trigger 5 forward or to the left. When it is desired to use the tool, the operator with his hand on the hand grip section by the use of, for example, his second finger, presses in the trigger 5 against the force of the spring. This completes the circuit and the tool is rotated through the connection described.

If it is desired to maintain the tool in operation without the necessity of continued finger pressure upon the trigger member 5, the operator, as by the use of the first finger of his hand, or by the slight upward movement of the same finger which is pressing upon trigger member 5, can press up the pivoted detent lever 6 shown in Figs. 5 and 7. This lever is carried by the screw 45, tapped into the under face of the frame section I, and rocks up and down upon the spherical inner face 46 of the screw head as shown. Spring 47 tends to throw this detent into the inactive position shown in Fig. 5. When the trigger is held back by the finger of the operator into the power supply position as shown in Fig. 7 and the detent is pushed up against the action of the spring 47 by the same or another finger of the same hand of the operator, the inner end of the detent slightly inclined as at 48 is brought to position against the edge 49 of the cut out in the trigger 5 also slightly inclined and the parts will be held in that position until the operator releases the lock by again pressing in slightly on the trigger so that the trigger lock may automatically resume the position shown in Fig. 5.

It will thus be seen that there is provided an off and on switch which may be readily operated by the finger of one hand and at the same time be locked in position so long as desired by the slight movement of the same or another finger of the same hand of the operator and this lock again released when desired.

In Figs. 11 to 15 is shown another form of locking lever for the switch trigger. In this case the

locking lever 50 is shown mounted for simple horizontal pivoting movement about the screw 51 tapped into the frame. This lever when in its intermediate position as shown in Fig. 12 has no effect upon the switch trigger. When, however, the switch trigger is retracted to the position shown in Fig. 13 the operator by turning, with his finger, the locking lever 50 in either direction may lock it against either one of the faces 52 of the end cut out on the top of the switch trigger.

Figs. 14 and 15 show a detent lock same as that shown in Figs. 11, 12 and 13 but there is also provided a leaf spring 53 seated at one end in the frame at 54 normally tending to hold the locking lever in its central non-active position. In this case the lever is thrown to the locking position by the finger of the operator against the force of this spring, which will without action of the operator return the lock to negative position when the switch trigger is retracted.

The efficiency of the outside assembly form of the casing construction as shown in Figs. 1 and 5 has been sufficiently referred to.

This construction, however, has a further advantage in the form and arrangement of casing sections in that it permits a ready insertion of interior working units followed by completion of casing assembly and an equally ready removal of the parts for repair, replacement or any other purpose. Referring on this point to Fig. 5, it will be seen that the interior motor assembly in the main section of the casing can be inserted as a unit, thereafter the two brush units put in place, the connecting section C of the frame added, and the casing section B and the chuck drive parts carried thereby added as a unit. Thereupon, the assembly is completed by positioning the lower hand grip section D shown in Fig. 8 in position such that the leads 58 and 59 can be readily connected to their screw contact posts and thereupon this section carried up to the position shown in Fig. 5 and held there by screw 55.

The entire tool may be thus assembled or disassembled with a minimum of effort and when assembled it shows marked efficiency in operation and limited likelihood of breakdown in use.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which as a matter of language might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In an electric tool a brush adapted to bear at its end upon a commutator and extended from said bearing contact along a circular arc and at its farther end approaching the commutator at a point along the circumference thereof from said bearing contact area, and a coil spring having an arm extended therefrom bearing against the farther end of the brush to impose a spring pressure upon the arc shaped brush to feed it to the armature contact area as it is worn.

2. In an electric tool a brush adapted to bear at its end upon a commutator and extended from said bearing contact along a circular arc and at its

farther end approaching the commutator at a point along the circumference thereof from said bearing contact area, and a coil spring having an arm extended therefrom bearing against the farther end of the brush to impose a continuous and even spring pressure upon the arc shaped brush to feed it to the armature contact area as it is worn, a stop for said spring, in position, at the end of its feeding stroke, to prevent contact thereof with the commutator.

3. In an electric drill, a brush assembly unit comprising an arc shaped holder, an arc shaped brush carried thereby, spring means acting to feed said brush from said holder and a spring-pressed brake operating through an opening in said brush holder upon the brush to retain it within the holder.

4. In an electric tool a brush assembly unit, comprising an arc shaped holder, an arc shaped brush carried thereby, a spring tending to feed said brush through the said holder, a spring-pressed brake operating through an opening in said brush holder upon the brush at a point adjacent its contact area end, and means for holding said brake out of action when the brush assembly unit is in operative position within the tool.

5. In a brush assembly unit, a holder, arc shaped for the reception of an arc shaped brush, a portion of said holder being cut away to permit the insertion of one end of the arc shaped brush within such cut away portion.

6. In a brush assembly unit, an arc shaped brush holder, an arc shaped brush, the material of said holder being cut away at one side to provide an opening such that the end of the brush may be inserted in said opening from the side.

7. In a brush assembly unit, an arc shaped brush, an arc shaped brush holder, said brush having a contact area at one end therefor, a spring bearing upon the other end of said brush to feed it to the commutator, a section of the holder being cut away so that the brush can be inserted from the side and the brush then moved, carrying the spring with it and putting tension upon the spring until the brush is in position for use.

8. In a brush assembly unit, an arc shaped brush, an arc shaped brush holder, said brush having a contact area at one end therefor, a spring bearing upon the other end of said brush to feed it to the commutator, a section of the holder being cut away so that the brush can be inserted from the side and the brush then moved, carrying the spring with it and putting tension upon the spring until the brush is in position for use, and a brake adapted to bear against said brush to hold it in position within the commutator as against the pressure of said spring.

9. In a brush assembly unit, an arc shaped brush, an arc shaped brush holder, said brush having a contact area at one end therefor, a spring bearing upon the other end of said brush to feed it to the commutator, a section of the holder being cut away so that the brush can be inserted from the side and the brush then moved, carrying the spring with it and putting tension upon the spring until the brush is in position for use, and a spring-pressed brake adapted to bear against said brush to hold it in position within the commutator as against the pressure of said spring.

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