Jan. 14, 1941. G. C. WILHIDE 2,228,801

ELECTRIC TOOL

Filed July 19, 1938 5 Sheets-Sheet 1

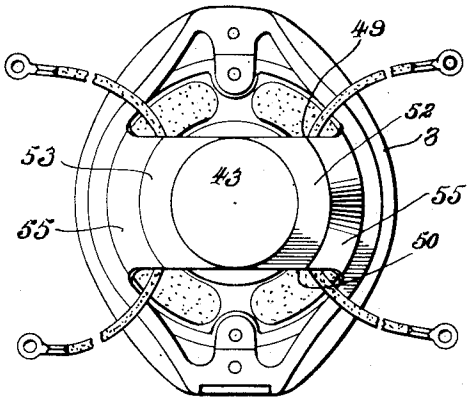


Fig. 3.

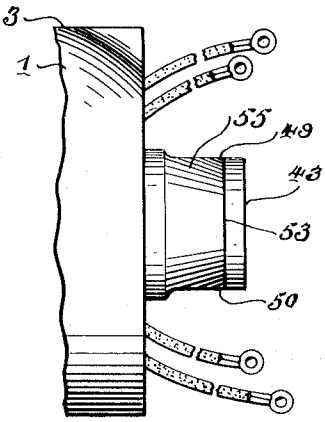


Fig. 4.

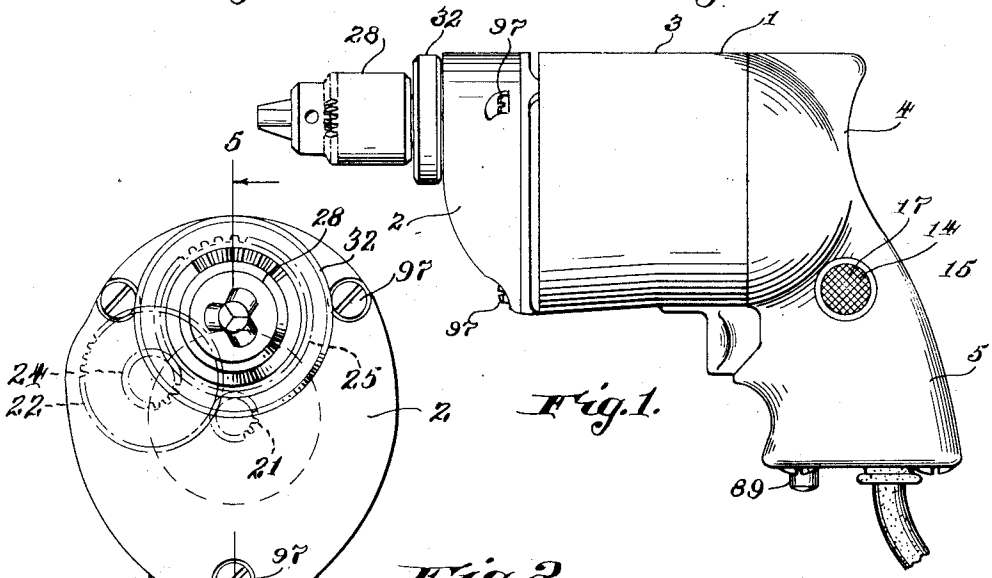


Fig. 1.

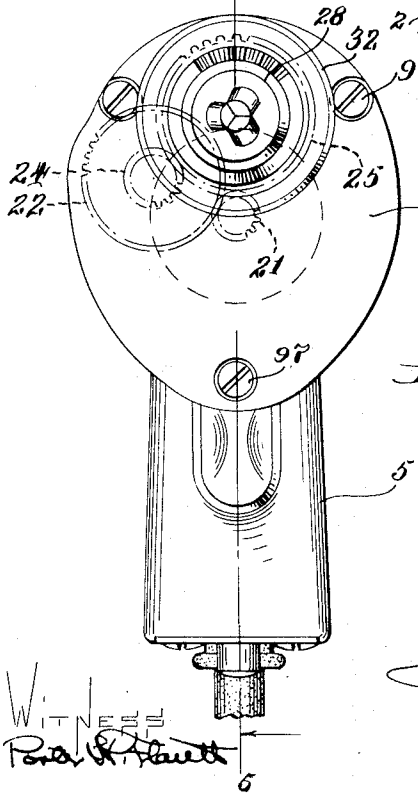


Fig. 2.

Inventor

Glenn C. Wilhide

By Edwin T. Samuels

Attorney

Witness

Paul R. Hewett

Jan. 14, 1941. G. C. WILHIDE 2,228,801

ELECTRIC TOOL

Filed July 19, 1938 5 Sheets-Sheet 2

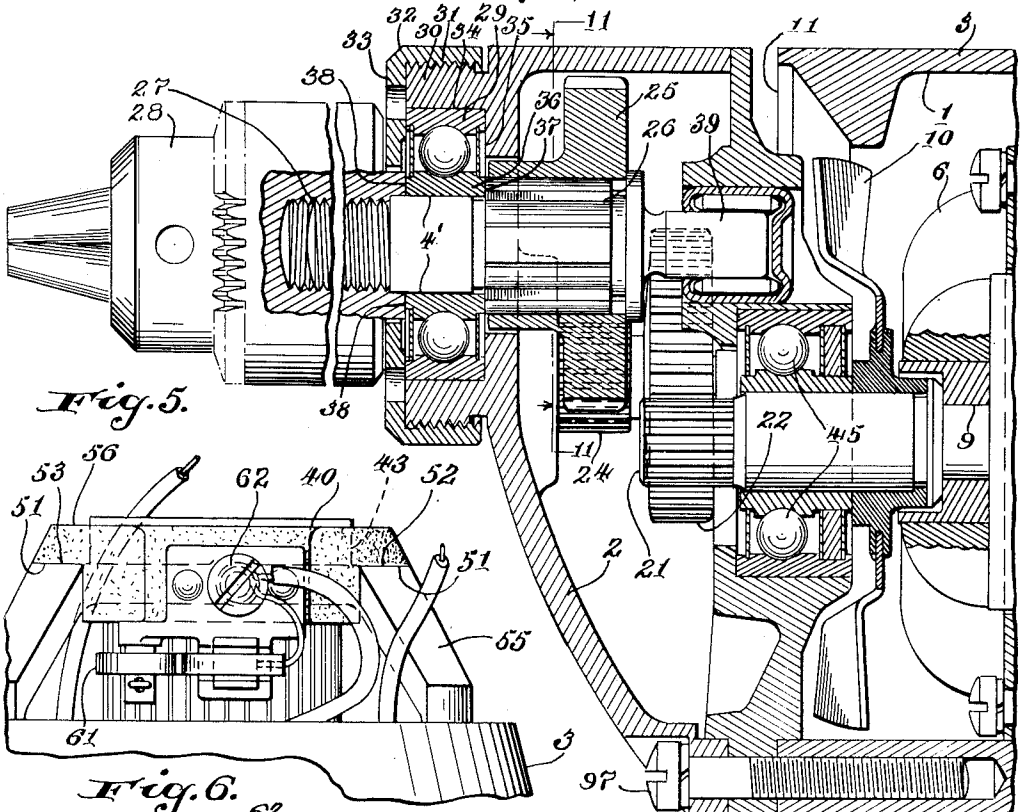


Fig. 5.

Fig. 6.

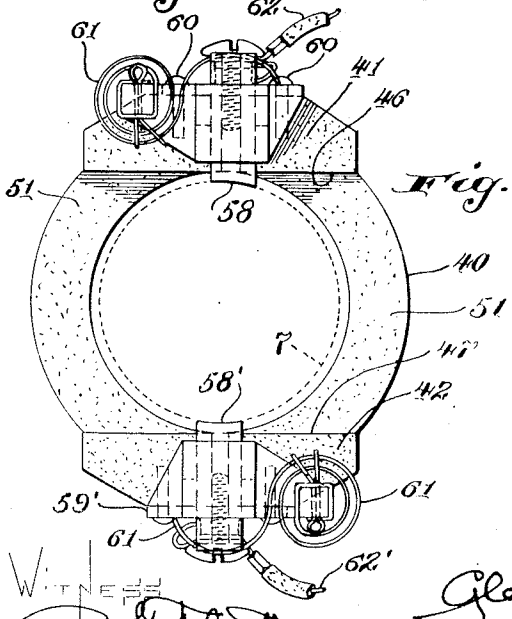


Fig. 8.

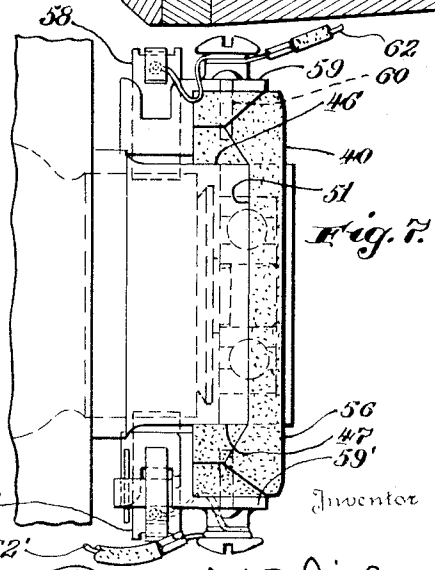


Fig. 7.

Witness

Inventor

Glenn C. Wilhide

By Edwin T. Samuels

Attorney

Jan. 14, 1941. G. C. WILHIDE 2,228,801

ELECTRIC TOOL

Filed July 19, 1938 5 Sheets-Sheet 3

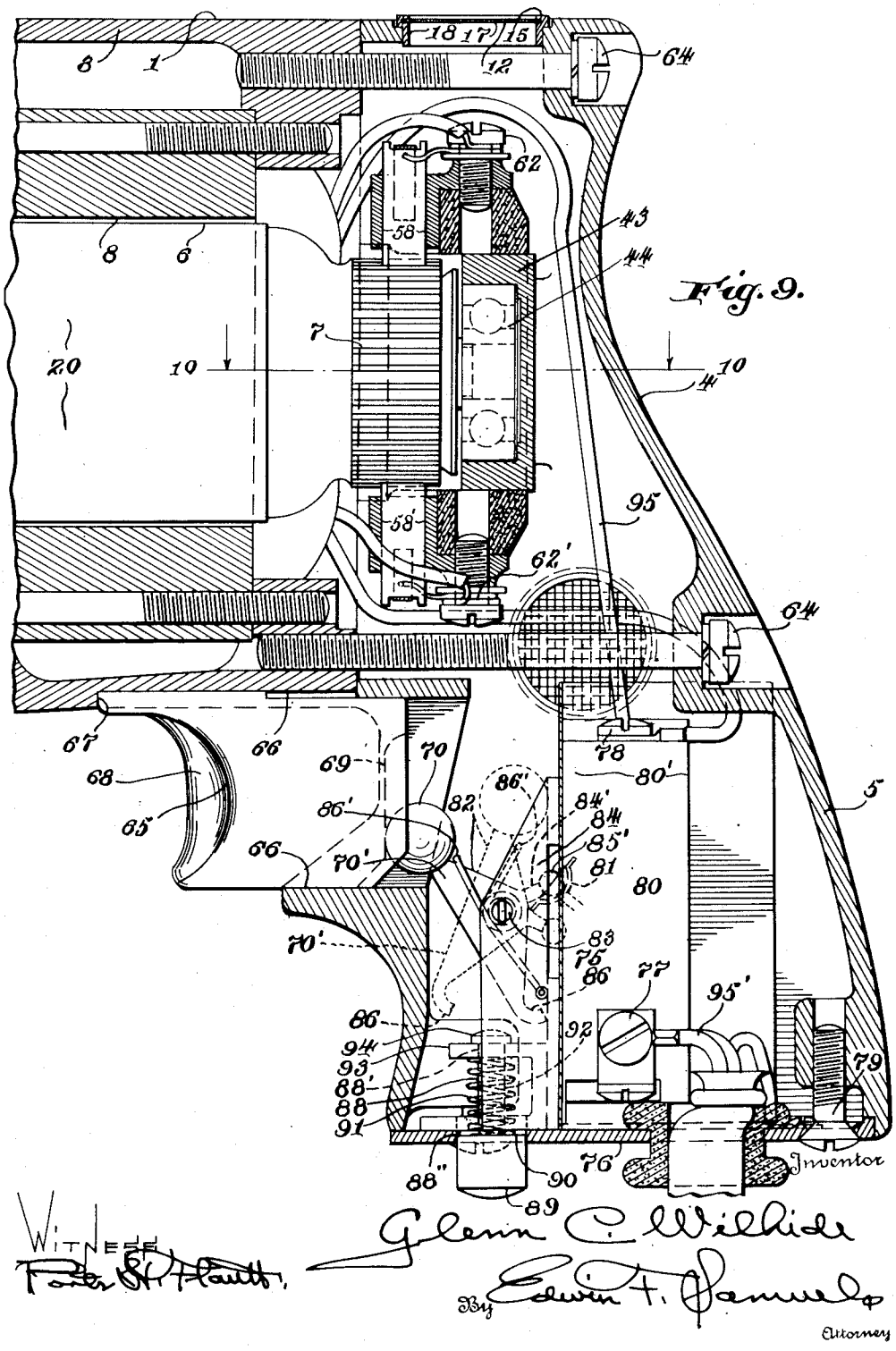


Fig. 9.

Witness

Inventor

Glenn C. Wilhide

By Edwin T. Samuels

Attorney

Jan. 14, 1941. G. C. WILHIDE 2,228,801

ELECTRIC TOOL

Filed July 19, 1938 5 Sheets-Sheet 4

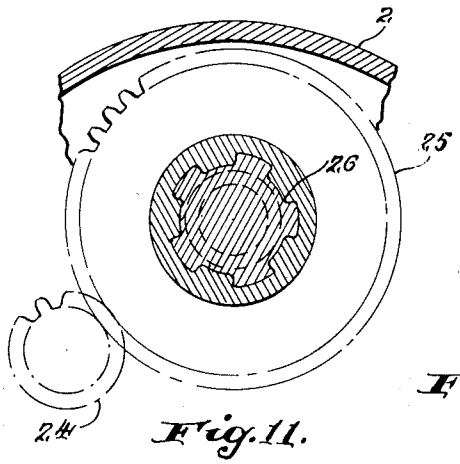


Fig. 11.

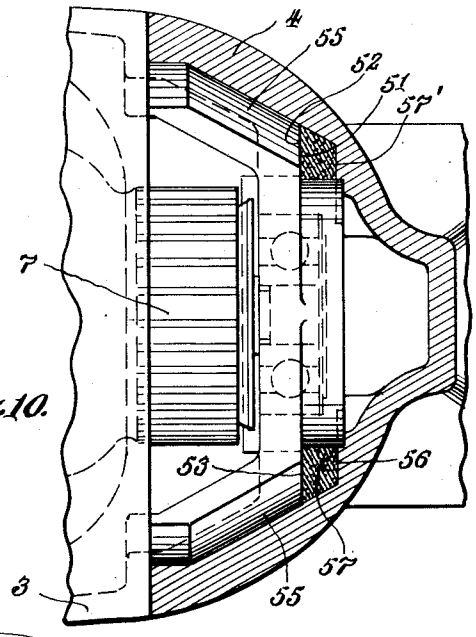


Fig. 10.

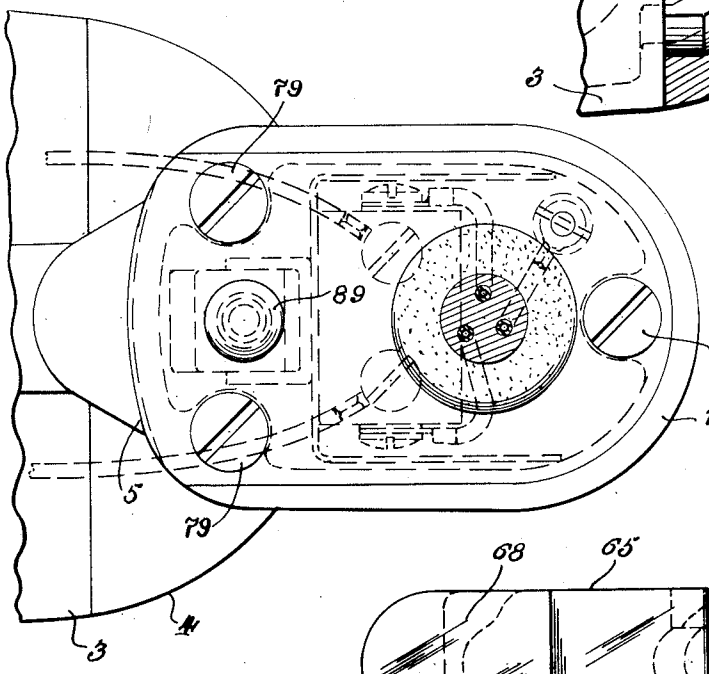


Fig. 12.

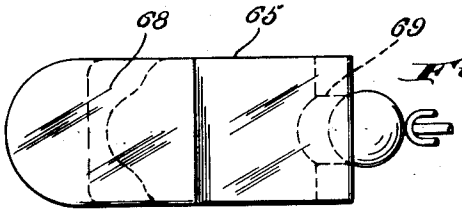


Fig. 13.

Inventor

Glenn C. Wilhide

By Edwin T. Samuels

Attorney

Witness

Jan. 14, 1941. G. C. WILHIDE 2,228,801

ELECTRIC TOOL

Filed July 19, 1938 5 Sheets-Sheet 5

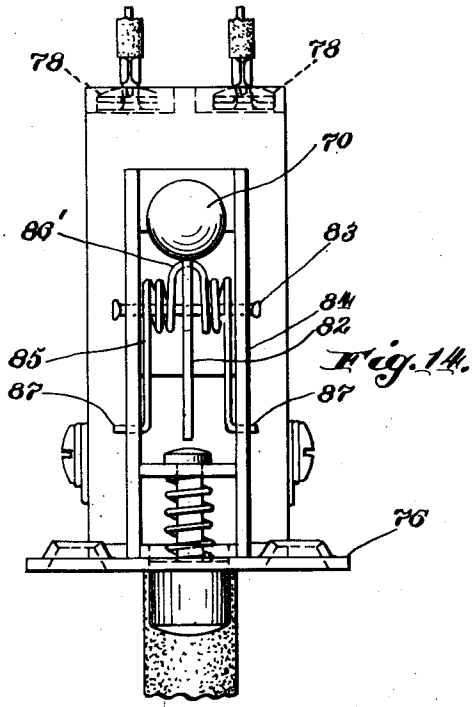


Fig. 14.

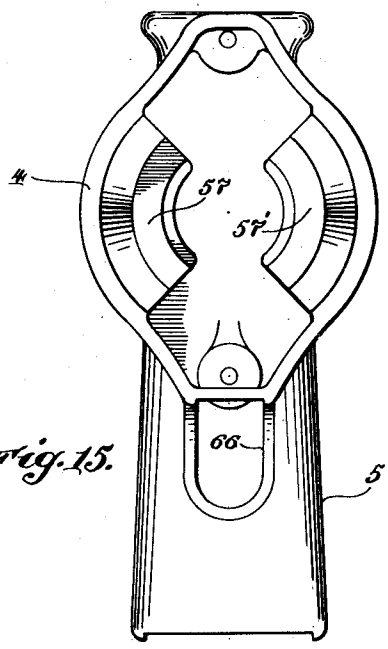


Fig. 15.

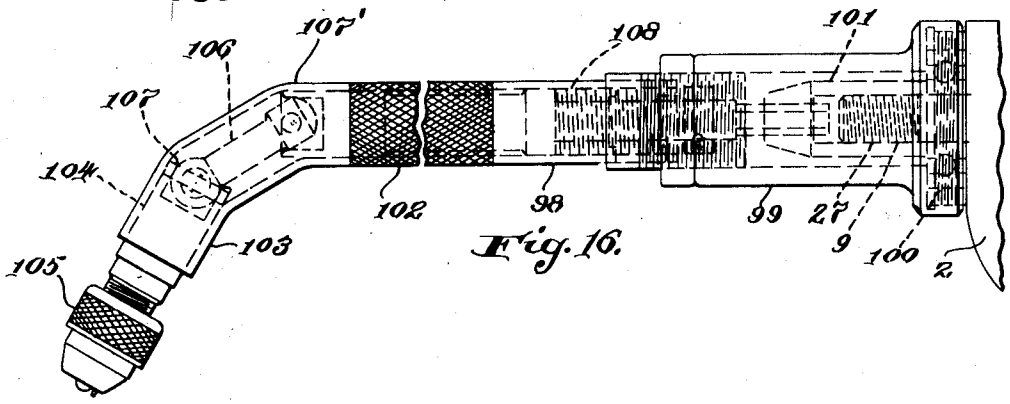


Fig. 16.

Glenn C. Wilhide Inventor

By Edwin T. Samuels

Attorney

Patented Jan. 14, 1941

2,228,801

UNITED STATES PATENT OFFICE

2,228,801

ELECTRIC TOOL

Glenn C. Wilhide, Towson, Md., assignor to The Black & Decker Manufacturing Company, a corporation of Maryland

Application July 19, 1938, Serial No. 219,976

8 Claims. (Cl. 172—36)

The invention relates to a power driven rotary hand tool which is shown in the form of a drill, and is known to the trade as a portable electric tool being manually supported and directed.

The invention provides such a tool of improved construction and arrangement and one which is more compact, and more convenient in form and therefore easier to handle, and operate than the prior art tools. It is also more conveniently adapted for the use of attachment for various purposes and therefore of general utility, and it has the advantage that important groups of mechanism are assembled in the form of integral units adapted for insertion and removal as assembled, and therefore adapted to quick, cheap, and convenient adjustment, repair, and replacement. The object of the invention is to provide a drill which is improved in these and other features.

Among the improvements of the invention is a brush mounting or support which carries the complete brush mechanism. This brush support and brush mechanism being assembled as a unit is easily installed and removed for cleaning, adjustment, or repair, and replacement, and reinstalled in the tool without difficulty, and without the necessity of removing and replacing any screws, bolts, and the like. When installed, the brush assembly, particularly the support, is automatically positioned and clamped or held in position by the automatic cooperation of the frame or casing sections.

The invention has as a further object, the provision of means for quick and convenient installation in driving relation with the power source of this tool, of attachments for various operations. These attachments are suitably connected to and supported on the tool casing. They include angle drilling attachments, flexible shaft attachments, for drilling and the like, and the construction is also suited to attachments for various other purposes in which the rotary motion of the spindle can be utilized.

It is also of interest that the tool may be symetrically arranged as to the plane of the motor and spindle axes, it being of distinct advantage that the grip, and particularly the trigger which operates the switch are symetrical in respect to this plane so that the trigger can be conveniently pulled by the index finger of either hand in which the tool is held.

It is also of interest that the entire switch and switch operating mechanism except the trigger which is separately mounted, may be assembled on a single plate or support, the switch being preferably enclosed within a casing, and that after the electrical connections are made the entire assembly may be instantaneously inserted, or installed in its place in the grip or handle in operative relation to the trigger, the assembly or unit being likewise removable for repair, and adjustment, and likewise capable of instantaneous replacement or reinstallation.

This assembly also includes a locking mechanism for locking the switch in the on position which lock in the form shown is released by a slight further pull on the trigger. The locking mechanism is preferably mounted on the plate with the switch and switch actuating mechanism.

The circuit shown is arranged in accordance with the three wire system, both energizing connections being made and broken at the switch simultaneously.

In the accompanying drawings I have illustrated a tool embodying the features of my invention in the preferred form.

In the drawings:

Figure 1 is a side elevation of the tool on a reduced scale.

Figure 2 is a front elevation of the tool, i. e. taken from the left in Figure 1, and on a slightly larger scale.

Figure 3 is a rear elevation of the field case with the field and rotor therein, the brush housing and handle being removed.

Figure 4 is a framentary side elevation of the construction shown in Figure 3.

Figure 5 is a fragmentary vertical central section on an enlarged scale of the front end of the field and gear casings, and the parts therein, the same being taken on the line 5—5 in Figure 2, and certain of the parts being in elevation.

Figure 6 is a fragmentary top plan on same scale of the rear end of the field casing, the commutator and brush assembly being shown, the forward portion of the field being broken away, and the brush housing being removed.

Figure 7 is a side elevation of the subject matter, Figure 6, looking from the right in Figure 6.

Figure 8 is a front elevation of the brush ring or support, and brushes thereon comprising the brush assembly removed from the casing.

Figure 9 is fragmentary section on the plane of Figure 5 showing the rear end of the field casing, the field and rotor, and extending through the brush housing and switch handle, or pistol grip, and showing the brush assembly and switch.

Figure 10 is a horizontal section through the brush housing taken on line 10—10, Figure 9

and showing the rear end of the field casing including the motor shaft bearing housing, and its supports.

Figure 11 is a transverse vertical section on the line 11 in Figure 5.

Figure 12 is a fragmentary bottom plan view of the switch handle or pistol grip showing the switch assembly base plate, or the butt plate from below, and the adjacent portion of the casing, the latter being broken away.

Figure 13 is a plan of the trigger removed.

Figure 14 is a front elevation of the switch actuating mechanism and switch casing base removed.

Figure 15 is a front elevation of the brush housing looking rearwardly at the inside of same, and showing the handle or grip.

Figure 16 is an elevation of an angle drilling attachment, operated by the tool shown.

Referring to the drawings by numerals, the machine parts are enclosed within a casing 1. This casing is in three separate sections, comprising a gear casing 2, a field casing, or housing, 3, and a brush housing or casing 4. This latter is integral with the handle 5, which also serves as a switch housing.

The tool includes the usual rotor 6 with its commutator 7, and field 8, all of which are enclosed within the field casing 3. Toward the front of the tool the rotor shaft carries a fan 10, for ventilating the motor by way of the ventilating openings, 11 at the front where the air is discharged. The intake passages for the air shown at the rear and indicated by reference character 12, 14—14, are preferably circular, and are protected by screen buttons or plugs 15 which consist each of a screen 17 and a frame 18 which is adapted to be driven or wedged into the opening 19 of each passage 12, 14—14. These screen plugs are conveniently removed, and the screen being on the outside is easily cleaned without removal to prevent plugging. The removal provides for easy replacement, the screens being made cheaply in large quantities. They afford most satisfactory protection for the bearings, brushes, etc. from the accumulation of grit and dirt, and consequent wear and short circuiting.

The gear casing 2 which is forward of the field casing or housing 3 contains the gearing by which the spindle 4' is driven by the motor 20, and particularly from the rotor shaft 9.

In the form shown, the shaft 9 carries a toothed pinion 21 which meshes with a gear 22 which carries on its shaft a pinion 24 which meshes with the spindle gear 25 whereby the latter is driven at reduced speed by motor 20. Gear 25 is mounted on the splined portion 26 of the spindle 4', the forward end of which is threaded 27 to receive the chuck 28 which is secured thereto by means of the thread 27.

The spindle is mounted at the front end in the radial ball bearing 29 which is adapted to receive and take up end thrust as well as any radial tendency of the shaft. The outer race 34 of this ball bearing is seated in a nose 30 formed on the front end of the gear casing 2, and this nose is threaded externally at 31 to receive a cap 32 which has a front flange 33 which takes over the ball bearing at the forward axial end of the same forming a forward abutment for the outer race 34 which bears at its rear axial end against a flat surface 35 formed on the gear casing 2. The inner race 36 bears at its rear end against the shoulder 37 at the forward end of the splined portion 26 of the spindle or spindle shaft 4', and at its front axial end it is adapted to bear against the corresponding surface 38 of the chuck 28 which extends inside of the cap 32.

This arrangement provides for the removal of the cap, likewise the chuck 28 for the connection as hereinafter described, of a suitable attachment to the tool in driving relation thereto, the attachment being supported on the thread 31 of the neck 30 and the operating shaft of the attachment being connected to the threaded end 27 of the spindle. These attachments perform various rotary tool operations.

The rear end of the spindle is supported in a roller bearing indicated by reference character 39.

An important feature of the invention resides in the brush support, and in the manner of positioning and clamping the same in the casing in cooperative relation with the field casing and the brush housing or casing, the field, and the commutator. The brush support is indicater by reference character 40, see particularly Figure 8. The brush support 40 is shown in the form of a ring which is preferably circular and of non-conducting composition. This ring is adapted to fit about, and to tightly enclose the rear bearing housing 43 which carries and encloses the rear ball bearing 44 of the rotor shaft 9, the front bearing which is of the ball race type being shown at 45 in Figure 5. This ring 40, as shown, is provided at its upper and lower extremities, i. e. adjacent its north and south poles with forwardly projecting portions or members 41 and 42. These portions 41 and 42 have positioning surfaces 46 and 47 which are preferably flat as shown and inwardly disposed to bear on corresponding surfaces provided for this purpose on integral portions or extensions of the field casing indicated at 49 and 50 in Figure 3. These latter surfaces are preferably flat, or may otherwise conform to the surfaces 46 and 47, and they cooperate with surfaces 46 and 47 to position the supporting ring 40 in its exact angular relation to the rotor. The said surfaces in the form of the invention shown are parallel and horizontal in the upright position of the tool as shown in Figures 5 and 9. The ring 40 also has forward surfaces 51, Figure 8 between the surfaces 46 and 47 which surfaces 51 are shown as of arcuate form, and of radial contour as to the axis of the rotor and they bear against corresponding surfaces 52 and 53 which are of similar angle and contour and are formed on projecting portions 55 of the field casing. In this connection, it will be noticed that the bearing housing 43 is supported on the field casing 3 proper, by means of said braces or struts 55 which extend rearwardly from the field casing proper 3, and are inclined inwardly to said housing 3 as best shown in Figures 6 and 10, being in the preferred form shown integral at their forward ends with the casing 3, and at their rear ends with the bearing housing 43. It is also to be noted, see Figure 10, that the rear surface 56 of the brush support 40 is engaged in the assembled position of the parts by a corresponding and cooperating surface 57, provided for this purpose on the brush housing 4 and accurately machined to the proper plane to clamp and position the brush carrier or support 40, and hold it clamped in the correct relation to the commutator 7, and field 8. By reference to Figure 7, it will be noticed that the brushes 58 and 58' are supported and guided in brush carriers, seated on and suitably attached by

means of screws or rivets 60 to, the upper and lower surfaces respectively of the projecting portions 41 and 42 at the top and the bottom of the brush support 40.

The brushes are pressed against the commutator, by springs 61 substantially in accordance with the usual practice and the electrical connections to the brushes at 62 and 62' are likewise in accordance with the usual practice or substantially so.

In assembling the tool, or in installing the brush assembly after it has been removed for any purpose, the connections 62 and 62' are first made in the usual manner, after which the brush supporting ring 40 is forced over the bearing housing 43, the positioning surfaces 46 and 47 on the brush supporting ring 40 engaging the upper and lower positioning surfaces 49 and 50 carried by the field casing, or more particularly, the projection therefrom, as best shown in Figure 3. The contact of these positioning surfaces serves to locate the brush support 40, and the brushes in the exact desired angular relation with the commutator 7 and field 8. In the final position of the assembled parts, surfaces 51 on the brush support engage the surfaces 52 on the field casing, and the rear surface 56 on the brush support, when the brush housing is assembled and attached to the field casing is engaged by the surface 57 in the brush housing, Figures 10 and 15. Thus the support and brushes are definitely, and automatically located in assembling the tool without necessity for attention, or possibility of error on the part of the workman. The brush support being thus angularly positioned by contact of surfaces 46 and 47 on the support 40 with the surfaces 49 and 50 on the field casing and positioned and clamped in the direction of the axis by close contact of surfaces 51 on the support and 52 and 53 on the field casing, and by engagement of surfaces 56 on the support 40 with and by surface 57 in the brush housing and grip 4 and 5 is automatically located and clamped in the casing, as the latter is assembled and fastened. The brush parts and support are assembled as a unit and connected before installing, and are installed as a unit, and freely and instantaneously removed as a unit for testing adjustment, and replacement, and tests and adjustments are much more easily made on this account.

The brush housing, or casing and the grip or switch handle 5, which is integral therewith, are attached to the end of the field casing 3 by means of screws, 64, in such a way that it can be easily separated by removing these screws. Due to the special type of brush mounting, it is possible to have ready access to the brush and commutator for inspection, cleaning and brush replacement, and, it is also possible, when desired, to inspect the brushes while the motor is running by merely opening the casing.

The arrangement, location, and means for actuating, controlling and operating the switch are matters of importance in the convenience, workability, accessibility and hence, the low maintenance cost of the tool, and they have an important relation to the compactness and small dimension of the tool in proportion to its power.

It is also of interest that the control member shown in the form of the trigger 65, considering the tool in the upright position in which it is shown in Figures 1, 2, 5, and 9, is in the form shown symmetrical with the vertical axial plane of the motor and spindle; this arrangement provides for the convenient support and direction of the tool by either hand which is available for this purpose grasping the grip 5, the trigger being conveniently pulled by the index finger of either hand holding the grip 5.

In the form of the invention shown, the trigger 65 is in the form of a sliding block mounted in suitable ways 66 (see Figure 9) which in the form shown are partly in the field casing 3, and partly in the brush housing and switch handles 4 and 5.

In the form shown, the ways 66 which are, as aforesaid, substantially parallel to the tool axis, and provided at their forward end with a rearwardly disposed abutment 67, which prevents the trigger 65 from being accidentally released from the ways. The forward end of the trigger block at 68 is formed to fit the inner curve of the finger, and, at its rear end it is grooved in a vertical direction at 69 to engage a ball or other member convenient for this purpose, indicated at 70, and carried on the operating end of the switch actuating mechanism 70'.

The switch assembly 75 is mounted on the plate 76 so that after the connections are made by attaching the wires to the proper terminals 77, 78, the complete assembly including the switch and actuating mechanism, except the trigger, which is already in place, can be slid into place and held rigidly in operative position, the plate 76 being secured by means of the screws 79 (see Figures 9 and 12). The switch proper is of a conventional type obtainable through regular trade channels in the form shown, i. e. assembled and enclosed within a casing 80', from which, in the form shown, there projects the end of an operating lever provided with an outwardly concave cup 81. This enclosed switch unit 80 is provided with the terminals 77 and 78, already described, whereby the wires 95 are connected to the switch and it is formed on, or secured to the plate 76 already described.

The base plate 76 also carries, as an element of the switch assembly, a switch actuating lever 82, which is supported on a transverse shaft 83, shown in the form of a pin mounted in the uprights 84 carried by and extending upwardly from the base plate 76. The lock may be omitted.

As shown, the actuating spring 85 is of U-shape, with the legs of the U remote from the central bend, helically wound about the shaft 83, and the outer ends of the legs at 87 inserted in suitable holes in the stationary uprights 84, the bend 86' of the U being hooked about lever 82 which applies the tension of the spring to the lever 82, tending to open the switch as later described. The lever 82 is shown as of triangular shape, though this particular pattern is not essential, and said lever has an arm 84 intermediately of its length and radially disposed as to the shaft 83, said arm 84 carrying at its outer end a ball 85', which rests in the cup 81. This lever 82 is also provided at its lower end with a hook 86 which contributes to the locking of the switch in closed position, as hereinafter described.

In the form shown, the radius arm of the ball 70 at the upper end of lever about the center of the shaft, or pin 83 and the radius of the point of the hook 86 are separated by an angle of approximately 155 or 160°, but all these details are capable of wide variation. The spring 85 tends to maintain the switch actuating mechanism 81, 82, etc in open position, to be closed by pressure

of the finger on the forward surface 68 of the trigger block 65, which, by transmitting this pressure to the ball 70 rotates the actuating lever 82 in right-handed phase about the shaft, or pin 83, swinging the ball 85' downwardly, likewise moving the cup 81 on the switch unit 80 described as enclosed and sealed within the casing 80' shown, closing the switch.

As the spring 85 tends to maintain the switch open, it is found desirable to provide means for locking the switch in the closed position to provide for continuous operation for a comparatively long period. It will be noted that in the closed position of the switch, the hook 86 is in the left-hand position illustrated in Figure 9, having been rotated clockwise about the shaft 83 by pressure of the finger on the trigger block 65.

For locking the switch, the invention provides a locking pin 88 which is mounted to slide in a vertical direction, the word vertical having reference to the position of the tool as shown in Figure 9. The pin 88 as shown, is supported in bearings, or guides 88' and 88'', and the pin 88 may be provided with an enlarged head or button 89, which fits in the second said bearing, or guide 88'' formed in the plate 76. The enlarged head 89 provides an upwardly disposed shoulder 90 which is engaged by a coil spring 91, which is wound about the shank 92 of the pin 88, and bears at its upper end against the plate 93 in which the bearing or guide 88' is formed which plate 93 is integral with upright 84. The pin 88 is provided above the plate 93 with a nut or suitable enlargement 94 which prevents the pin from being completely withdrawn by the spring 91 and also serves as a convenient engagement for the hook 86.

As already pointed out, the actuating lever 82, the switch proper enclosed within the casing 80', and the locking pin 88 are all assembled on the switch plate 76, and the wires 95 and 95' are suitably connected to the terminals 77 and 78 while the switch assembly is still outside handle 5. Said assembly is then inserted as shown, the ball 70 entering the groove 69 in the trigger block 65, and the other parts taking the operative positions shown. The plate 76 is then secured by means of screws 79.

When the trigger 65 is pressed rearwardly, and is thus retracted, the lever 82 is rotated clockwise, as already described, and the switch is closed against the tension of the spring 85. If the trigger is then released, the switch is then automatically opened by operation of spring 85.

When desired, as in case an operator expects to be drilling or operating the tool continuously for an extended time, the switch can be locked in closed position, by pressing the button, or head 89 of the locking pin 88, overcoming the outward tendency of spring 91 which causes the nut, or head 94 to enter into engagement with the hook 86, it being understood that the trigger has been held in retracted position. The trigger may now be released and the motor, and hence the tool will continue in operation until the locking pin is in some way withdrawn.

As already pointed out, if the pin 88 is normally withdrawn by the spring 91, and is advanced to locking position against the tension of this spring, when the switch is in locked position, the lever 82, and, particularly, the hook 86, will have moved contraclockwise into contact with the head, or nut 94, and to release the lock, and hence the trigger and open the switch, it is, therefore, only necessary to again press the trigger 65, the pin 88, and particularly the head 94 thereof being released by the consequent rotation of the lever 82 in clockwise direction, the spring 91 with pin 88 being thus released, the spring causes the locking pin to be withdrawn, whereby the trigger is released and the switch is opened.

Reference has been made to the arrangement of the front spindle bearing 29 and the externally threaded nose 30 in which the bearing 29 is mounted, the same being shown in combination with the threaded end 27 of the spindle 4', whereby the chuck 28 is attached, and it has been suggested that this combination and arrangement of the spindle and casing adapt the tool or render the tool adaptable to use either with the chuck as a drill, or similar tool, or without the chuck, but with various attachments adapted to the rotary drive, either for drilling or other portable rotary tool operations. Thus the tool shown becomes a general utility tool, the various attachments being supported on the casing, and, at the same time, connected to the tool spindle in driving relation, it being understood that the screw cap 32 is removed for his purpose.

Figure 16 shows an angle drill attachment, which is particularly adapted to the drilling of holes in confined spaces which cannot be reached by the drill in the normal arrangement as shown in Figure 1, even though it is compact and of small over-all dimension in the direction of the axis. The attachment, Figure 16, is shown in its operative relation to the gear casing 2 which is secured to the field casing 3 by means of screws 97 in accordance with the usual practice, the gear casing being shown fragmentarily in Figure 16.

The angle drilling attachment comprises a main attachment shaft 100 enclosed within a casing 98 which is provided with a base 99 which is enlarged and internally threaded at 100 to engage the thread 31 on the nose 30 of gear case 2, the cap 32 having been first removed and the chuck 28 likewise removed from the spindle 4'. The frame, or casing of the attachment is thus supported on the gear casing 2 which is part of the frame or casing 1 of the tool, parts 2, 3, 4 and 5 of which are rigidly connected. The shaft 100 is also provided with a threaded coupling 101 adapted to engage the thread 27 on the spindle 4', the threads 27 and 31 being of suitable pitch and tendancy, so that both engagements can be made without danger of accidental separation in use. The angle attachment 102, as shown, has the nose 103 of the casing 98, inclined at a suitable angle to the main portion of the casing, which is alligned with the spindle 4' of the drill To make a suitable driving connection to the shaft end 104 on which the chuck 105 of the angle attachment is mounted, there is a stud 106 connected by universal joints 107 and 107' to the shaft 100, and the shaft end 104, respectively.

The attachment shown is merely illustrative of various attachments which may be employed and the threaded connection of the nose and spindle to the attachment may be otherwise arranged.

The improved rotary tool assembly and the nature and operation of the parts thereof and the manner of assembling the same and the known advantages of the improvement disclosed having been fully discussed and described in detail as to their nature and operation, I would have it understood that the invention has been thus described specifically and in detail in order that the manner of constructing, applying, and operating and using the invention may be easily

comprehended, and that the specific terms herein are used in a descriptive rather than in a limiting sense, the scope of the invention being defined in the claims.

What I claim as new and desire to secure by Letters Patent is:

1. A manually portable and manually controlled electric tool of the rotary type having an electric motor and a sectional casing enclosing the motor and comprising a field casing, a motor shaft having a rear bearing and a housing therefor, a support for the brushes in the form of a ring encircling the bearing housing, the ring having means and the field casing having cooperating means, serving to position the brushes in their angular relation to the field and commutator, the field casing also having an abutment transverse to the axis of the motor to position said brush support in the direction of the axis, the sectional casing also comprising a brush housing with means for locating the same in relation to the field casing and securing it thereto, said brush housing having an abutment opposite to the abutment on the field casing and cooperating therewith and engaging the opposite side of the brush support to position said brush support in its relation to the field casing.

2. In an electric motor having a sectional casing comprising a field casing and a brush housing, a stationary rigid bracket projecting rearwardly from the field casing into the brush housing and having a rearwardly disposed positioning surface transverse to the motor axis, the brush housing having an oppositely disposed similarly transverse positioning surface and a brush support clamped and positioned between said oppositely disposed surfaces.

3. In an electric motor having a sectional casing comprising a field casing and a brush housing secured to the rear of the field casing, the field casing having a rigid bracket projecting into the brush housing, said bracket having a brush ring supporting member extending rearwardly parallel to the motor axis, said bracket also having top and bottom positioning surfaces parallel to the motor axis, a brush ring encircling said brush ring supporting member, said brush ring having forwardly projecting portions with positioning surfaces parallel to the axis and engaging the top and bottom surfaces of said bracket.

4. In an electric motor having a sectional casing comprising a field casing and a brush housing secured to the rear of the field casing, a rear bearing housing for the motor shaft bearing having a support rigidly connected to the field casing, said support having opposite surfaces parallel to the motor axis, a ring like member having brush supports thereon and encircling said bearing housing, said ring member having forwardly projecting portions with opposite positioning surfaces parallel to the motor axis and engaging the positioning surface on said bearing support to position the brushes, said bearing support having a rearwardly disposed surface transverse to the axis, engaged by the front of said ring member and the brush housing having an opposite transverse surface engaging the rear side of said ring member, whereby the latter is located in operative position in the direction of the motor axis.

5. In a manually portable and manually controlled electric tool of the rotary type having an electric motor with a sectional casing comprising a field casing, said motor also having a shaft with a rear bearing and a housing therefor, said bearing housing having supports rigid with and extending outwardly from the field casing, a brush support for the motor in the form of a ring encircling the bearing housing, the ring having positioning means projecting towards the field in the direction of the motor axis with positioning surfaces thereon spaced apart and disposed toward the ring axis and the said bearing supports having positioning surfaces in co-operation with those on the ring, spaced similarly to those on the ring and outwardly disposed, said co-operating surfaces being adapted for mutual engagement to position the brushes in their angular relation to the field and commutator.

6. A manually portable and manually controlled electric tool of the rotary type having an electric motor with a commutator and brushes and a sectional casing, said casing comprising a field casing and a brush housing, the latter enclosing the commutator and brushes, a motor shaft having a rear bearing housing with outwardly extending supports integral with the field casing, a brush support for the motor in the form of a ring like member encircling the bearing housing, the ring member having horizontal flat surfaces extending toward the axial center of the motor in the direction of said axis and disposed toward the motor axis and the bearing housing supports having flattened portions externally exposed and engaging the flat surfaces of the ring and serving to position the brushes in their angular relation to the field and commutator, the bearing housing supports also having means for positioning said brush support in the direction of the axis of the motor.

7. In a portable electric tool of the rotary type having an electric motor with a rotor and a commutator, a sectional casing comprising a field casing and a brush housing, a cylindrical member having supports whereby it is carried by the field casing said cylindrical member being located in the brush housing and coaxially arranged with respect to the rotor, a ring having brush carriers thereon, said ring closely encircling and engaging said cylindrical member, and positioning means projecting from said ring forwardly toward said rotor and cooperating positioning means on the supports engaged by said first mentioned positioning means for determining the angular relation of the brushes to the field casing.

8. In a portable electric tool of the rotary type having an electric motor with a rotor and a commutator, a sectional casing enclosing the motor and comprising a field casing, and a brush housing, secured to the field casing by means of bolts extending parallel to the motor axis, a cylindrical member carried by the field casing rearwardly of the same and coaxially arranged with respect to the rotor, a ring having brush supports thereon, said ring closely encircling and engaging said cylindrical member, and positioning means projecting in an axial direction from said ring and cooperating positioning means carried by the field casing and engaged by said first mentioned positioning means for determining the angular relation of the brushes relatively to the field casing, the field casing, the ring and the brush housing having mutually engaging surfaces transverse to the axis whereby the ring is automatically positioned as the brush housing is drawn toward the field casing by tightening the screws.

GLENN C. WILHIDE.