

April 17, 1945.

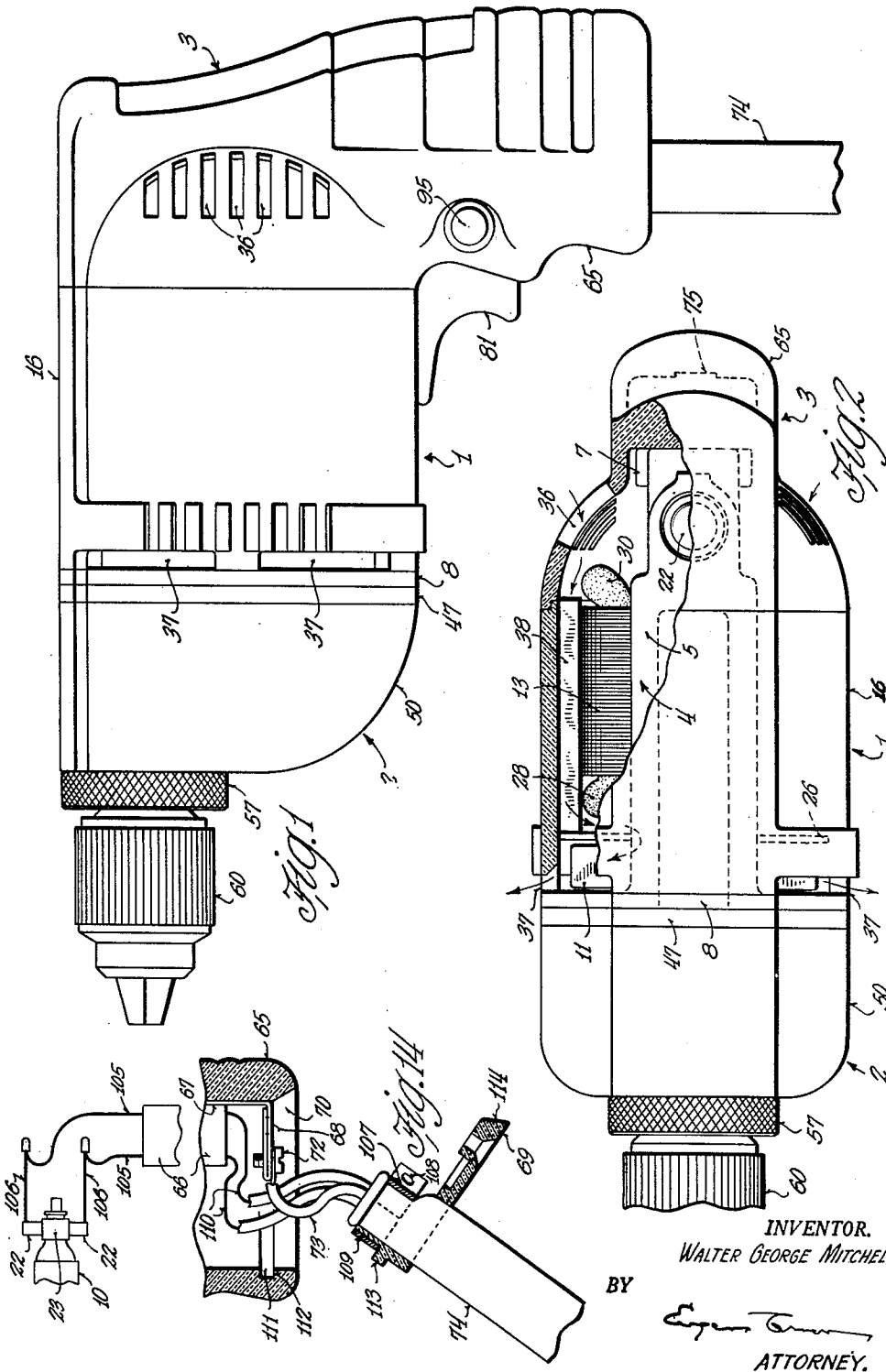
W. G. MITCHELL

2,373,842

PORTABLE HAND HELD ELECTRIC TOOL

Filed Oct. 16, 1942

3 Sheets-Sheet 1



April 17, 1945.

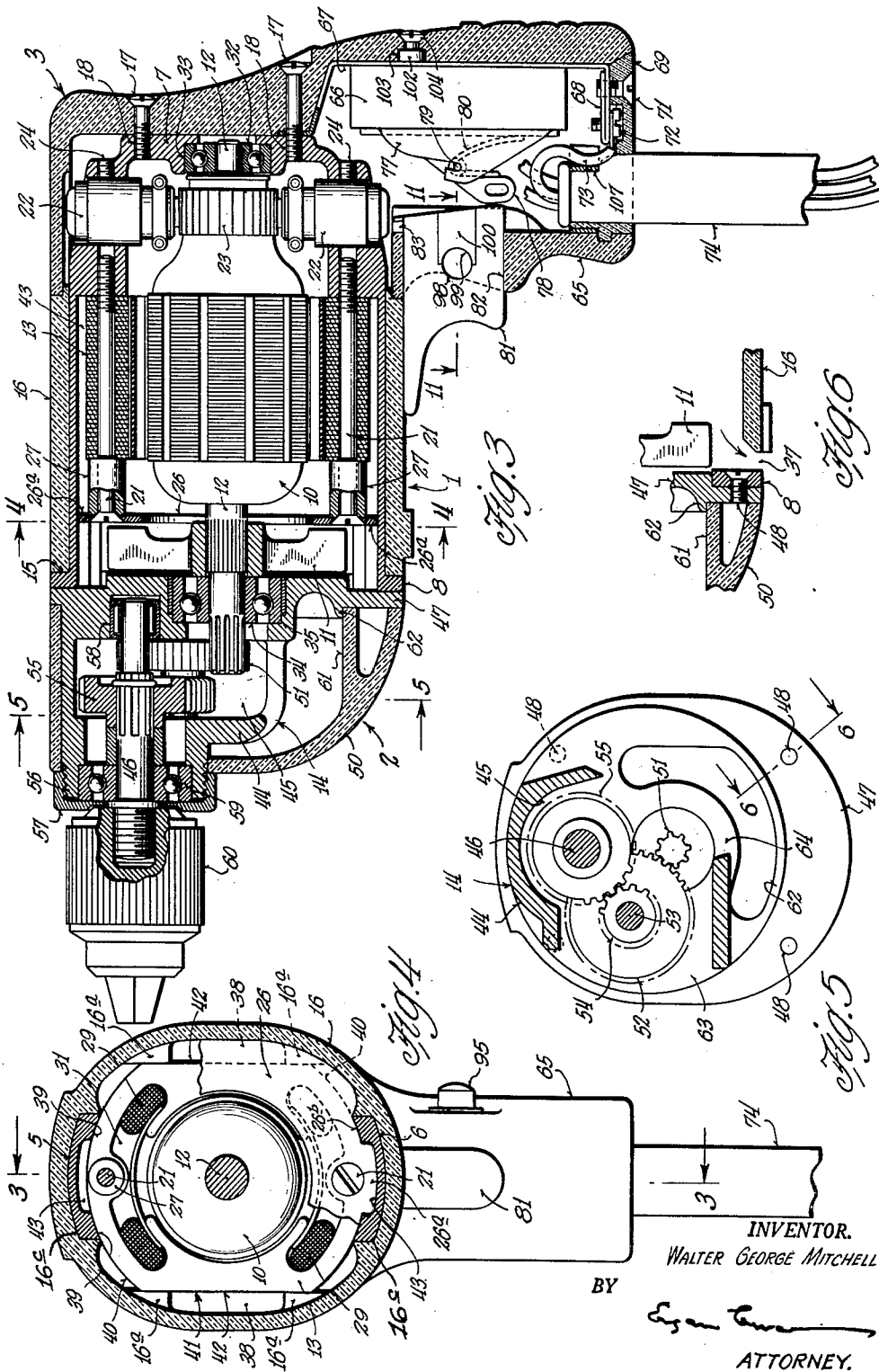
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3 Sheets-Sheet 2



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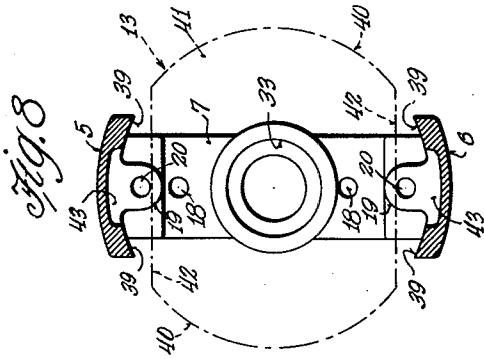
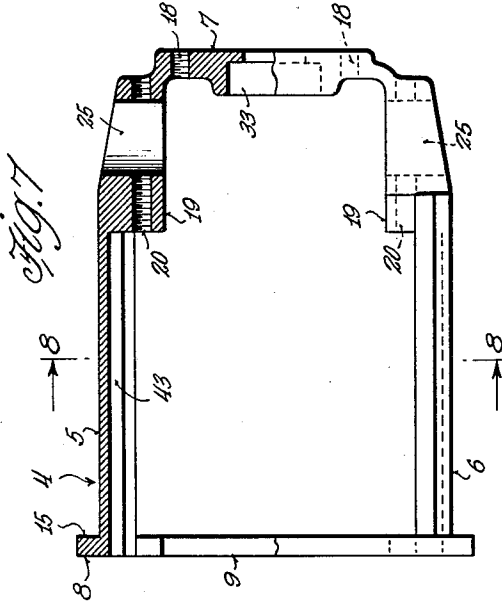
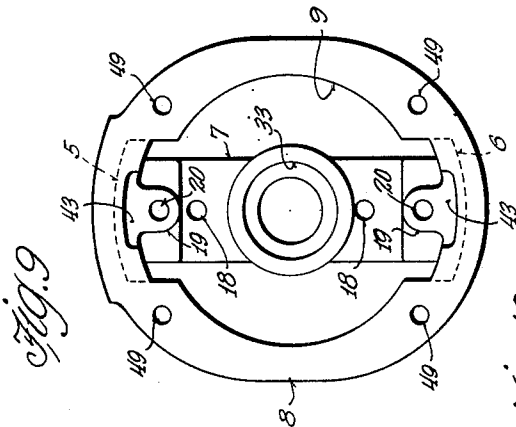
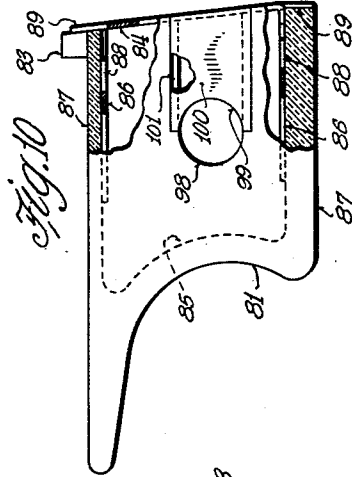
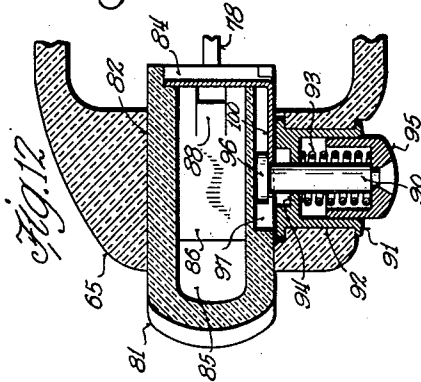
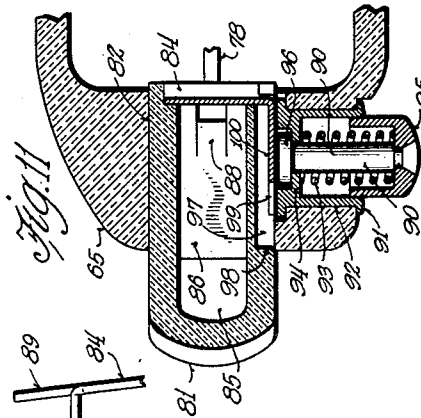
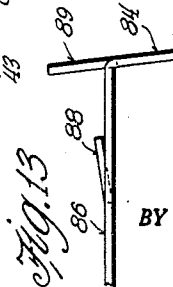
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PORTABLE HAND HELD ELECTRIC TOOL

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,373,842

PORTABLE HAND HELD ELECTRIC TOOL

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Application October 16, 1942, Serial No. 462,244

15 Claims. (Cl. 172—36)

This invention relates to improvements in portable hand held electric drills and similar tools.

The general purpose and object of my invention is to provide an electric drill or like tool adapted for industrial uses, but sufficiently small in size and weight that it may be easily and conveniently held and manipulated in one hand and be continuously used over extended periods in production work especially by female workers without undue fatigue.

A further object of my invention is to provide the tool with a substantially U-shaped strong, but light metal frame rigid at its opposite ends to support the tool motor and the spindle and the reducing gear drive therebetween whereby relatively light and inexpensive cover and handle members of sheet metal or plastic or other moldable non-metallic material may be employed to house the tool parts in lieu of aluminum casings heretofore employed, which latter material due to the present war effort has its uses considerably restricted.

A further object of my invention is to have the stator of the tool motor insertable into and out of the supporting frame through either of the open sides thereof in assembling and disassembling the parts instead of axially through one end of the frame so that rigid connections may be employed at the opposite ends of the frame to provide the supports for the rear end of the motor shaft and the gear housing, respectively.

A further object of my invention is to provide the releasable connection aforesaid for the stator with the frame in a form providing for the turning of the stator into either of two rotative positions, one for the release of the stator from the frame, and the other for the support of the stator within the frame.

A further object of my invention is to mount the switch device for the motor within the hollow grip portion of the tool handle independently of the current supply cable for the tool motor and the closure element which carries the cable clamp and closes the cable receiving opening in the handle to facilitate the renewal of a cable without removing the switch or disturbing the assembled relation of the switch within the handle.

A further object of my invention is to ground the motor supporting frame and the gearing through the bracket which mounts the switch device within the tool handle by providing the bracket at its lower end with a binding screw for the ground lead within the supply cable and connecting the upper end of the bracket to the frame through at least one of the screw mem-

bers which secure the handle member to the frame at the rear end of the tool, thereby protecting the operator holding and manipulating the tool from shocks due to accidental grounding of the motor current and without requiring a tool housing wholly or partly of an insulating material or insulating the parts within the tool to augment its cost or overall dimensions.

A further object of my invention is to employ a plastic or other moldable non-metallic trigger block for operating the switch device from the handle of the tool and provide a metal fixture carried by the trigger block for co-action with a spring urged locking plunger on the tool handle to lock the trigger block in its depressed or inward position to keep the switch closed when continuous running of the tool motor is desired.

A further object of my invention is to have the bracket lock the closure plate in closing relation in the opening in the handle through which the switch device and the bracket are inserted in assembling the tool independently of inserting and mounting the switch device and the bracket in the handle.

A further object of my invention is to provide a screw cap on the front end of a tubular extension on the gear case housing to hold in place both the bearing for the spindle within said extension and the front cover section of the tool housing over the gear casing.

Other and further objects of my invention will appear from the following specification taken in connection with the accompanying drawings in which—

Fig. 1 is a side view of my improved portable hand held electric tool;

Fig. 2 is a top plan view of the tool with the cover and handle sections broken away to show the motor supporting frame;

Fig. 3 is a longitudinal sectional view of the tool to show its details of construction, parts being shown in elevation and in section, respectively;

Fig. 4 is a cross-sectional view taken on line 4—4 of Fig. 3;

Fig. 5 is a similar sectional view taken on line 5—5 of Fig. 3 with the cover section omitted for sake of illustration;

Fig. 6 is a fragmentary sectional view taken on line 6—6 of Fig. 5 to show a detail of construction;

Fig. 7 is a side view partly in section of the motor supporting frame removed from the tool;

Fig. 8 is a cross-sectional view taken through said frame on line 8—8 of Fig. 7;

Fig. 9 is a front view of said frame;

Fig. 10 is a side view of the trigger block removed from the tool and partly broken away and in section, respectively, to show the holding fixture for the plunger lock;

Fig. 11 is a sectional view in respect to the trigger block taken on line 11-11 of Fig. 3, the trigger block being shown in its normally outwardly projected position;

Fig. 12 is a similar sectional view of the same parts showing the plunger lock for the trigger block holding the latter in its depressed position to keep the motor switch closed;

Fig. 13 is a side view of a detail of construction to be later described; and

Fig. 14 is a sectional view showing the cable clamp and the closure plate for the cable receiving opening in the tool handle, plus a wiring diagram to be hereinafter referred to.

In the drawings, I have shown a portable hand held electric tool of the pistol grip type having a motor section 1, a reducing gear section 2 and a handle section 3. These sections are secured together in the assembled relation shown and contain the operative parts of the machine. In the embodiment shown, the cover elements for these respective sections are comprised of a relatively light and inexpensive plastic material formed to the desired size and shape. The concept here is to replace the presently restricted aluminum casings heretofore employed for these tools with plastic cover and handle sections while reducing the weight of the tool and retaining the full power of the previous tools.

The support for the motor comprises an integral U-shaped skeleton metal frame 4 having substantially parallel arm portions 5, 6 and connecting end wall portions 7, 8 at the opposite ends of the frame. The wall portion 7 is in the form of a cross-web at the rear end of the frame, while the wall portion 8 has a ring formation at the front end of the frame. The ring 8 has a center opening 9 large enough to pass the motor armature or rotor 10, the air circulating fan 11, and the armature shaft 12 all as an assembled unit, but not the field coil and stator assembly 13.

The stator 13 is releasably mounted within the frame 4 between the arms 5, 6 in the manner to be later described. The ring 8 is rigidly fixed to the outer ends of the frame arms 5, 6 and extends on opposite sides thereof to provide a seat on the front side of the ring for the gear case housing 14 and a shoulder 15 on the rear side of the ring for the front end of the plastic cover 16 which fits about the frame and the motor as shown in Fig. 3.

The frame 4 extends back into the handle section 3 which is made hollow to receive the rear end of the frame and is secured thereto by fastening screws 17, 17 which screws take into tapped openings 18, 18 in the web-wall 7 of the frame. The handle 3 is secured to the frame 4 after the cover 16 has been applied over the rear end of the frame and holds the cover against the shoulder 15 as shown in Fig. 3.

The inner end portions of the frame arms 5, 6 are formed to provide diametrically disposed inwardly extending lugs 19, 19 having tapped openings 20, 20 parallel to the arms. These openings 20 receive the long fastening screws 21, 21 which secure the stator 13 within the frame 4. The lugs 19 also provide supports for the cartridge type brush units 22, 22 for the tool motor, the carbon rods of the brush units being spring urged against the commutator 23 of the motor as indicated in Fig. 3. Set screws 24, 24 secure the

brush units 22 in the lugs 19, each of the latter having a brush receiving opening 25, as shown in Fig. 7. The tapped openings for the screws 21 and 24 intersect the brush receiving openings 25 from the opposite sides thereof and being in alignment are made in a single drilling operation. The headed ends of the screws 21 engage a ring element 26 which by sleeves 27, 27 on the screws space the ring with respect to the fan 11 to provide the rear wall of the fan chamber and deflect the incoming air to the center intake of the fan. The baffle 26 fits against the inner surface of the motor cover 16 on opposite sides of the frame arms 5, 6 for this purpose as shown in Fig. 4. The sleeves 27 also space the baffle plate 26 sufficiently forward of the motor 10 to provide a space for the front loops 28 of the stator winding 29 as shown in Fig. 2. The handle section 3 being hollow takes care of the rear loops 30. The stator plates are slotted as at 31 in Fig. 4 to mount the winding 29.

The ball bearing unit 32 for the rear end of the armature shaft 12 is mounted in a recess 33 in the web-wall 7 of the frame 4. The bearing unit 34 for the front end of the shaft 12 is mounted in a recess 35 in the gear case housing 14.

The fan 11 is splined on the front end portion of the shaft 12 between the ring members 8 and 26 which provide the front and rear walls of the fan chamber. Air intake openings 36 for the fan are in the handle section 3, while the air discharge openings 37 for the fan are in the forward edge of the motor cover 16 in the form of slots at the periphery of the fan as shown in Fig. 1. The cover section 16 has inside ribs 16a, 16a which fit against the adjacent side portions of the stator 13 to hold it in place and provide channels 38, 38 therebetween for the flow of cooling air over the outer side of the stator. The path of the air flow is from the rear to the front of the motor as indicated by the arrows in Figs. 2 and 6.

The releasable mounting for the stator 13 within the frame 4 comprises arcuate surfaces 39, 39 on the inner sides of the frame arms 5, 6 on the same radius as the outer curved edges 40, 40 of the stator plates 41. The side portions of the stator plates are cut away, so to speak, to provide flat surfaces 42, 42 which make the stator crosswise less than its full diameter. With flat sides 42, the stator 13 may be turned from a position supported by the frame arms as shown in Figs. 3 and 4 to a position with the flat sides opposite to said frame arms. In the latter position, as indicated by the broken line representation in Fig. 3, the stator is free of the arms and may be shifted laterally into and out of the frame 4 through either of the open sides thereof in assembling and disassembling the stator with respect to the frame. After the stator has been inserted into the frame, the stator is turned to bring its curved edges 40 into engagement with the complementary edges 39 of the frame arms and then the screws 21 are applied to secure the stator within the frame. Removing the screws and turning the stator to present its flat sides 42 opposite to the frame arms provides for the lateral shifting of the stator out of the frame. With this manner of mounting the opposite end portions of the frame 4 may have the rigid connections 7 and 8 to support the rear bearing for the motor and the gear housing, respectively.

As shown in Fig. 4, the frame arms 5, 6 are channeled as at 43, 43 between the inner curved surfaces 39 to reduce the amount of machining and grinding required in making the curved sur-

faces on the arms. The channels 43 also aid in reducing the weight of the frame and allow the cooling air to flow between the parts. The baffle plate 26 has diametric lugs 26a, 26a fitting within the channels 43 to center the plate and to close the air flow from the channels to the fan except at its center opening.

The gear case housing 14 is a metal casting in one piece to eliminate the need for a separate end plate between the motor and the gear housing as in the previous tools. The one-piece gear housing 14 also permits the front and rear bearings therein for the spindle and intermediate shafts of the tool drive to be made in perfect alignment in single drilling operations. This feature is described and claimed in my co-pending application Serial No. 475,367, filed Feb. 10, 1943.

The housing 14 is formed to provide a hollow body portion 44 providing a chamber 45 to house the gears which drive the tool spindle 46 from the armature shaft 12. The rear end wall 47 of the housing 14 fits against the front face of the frame ring 8 and is secured thereto by screws, one of which is shown at 48 in Fig. 6. The ring 8 has tapped openings 49, 49 for these screws as shown in Fig. 9. The connection is made before the stator cover 16 is applied over the frame 4 and before the handle section 3 is secured to the frame by the screws 17. The screws 48, as indicated in Fig. 6, are applied from the rear side of the ring so that the front side of the ring may provide a flat seat for the plastic cover section 50 for the gear housing 14.

The gear housing wall 47 conforms to the size and contour of the ring 8 and has its center portion fitting within the center opening 9 of the ring to interfit and align the parts when assembled.

The armature shaft 12 extends through the bearing unit 34 into the chamber 45 in the gear housing 14 and is there provided with gear teeth providing a pinion 51 in mesh with a gear wheel 52 on an intermediate shaft 53 located within the chamber 45 and having its opposite ends journaled in the housing 14 in the manner disclosed and claimed in my aforesaid co-pending application. The shaft 53 is mounted in ball bearing units as shown in said co-pending application. The gear 52 rotates a gear pinion 54 on the shaft 53 and said pinion 54 meshes with and drives a gear wheel 55 fixed on the tool spindle 46 as shown in Fig. 5. The front end of the housing 14 has a tubular extension 56 through which the spindle 46 extends and is externally screw threaded to receive a cap-nut 57.

Mounted in the end wall 47 is a roller bearing 58 for the inner end of the spindle shaft 46, the front bearing unit 59 for said spindle being mounted within the tubular projection 56. The screw cap 57 engages said front bearing 59 for holding it in place. The spindle 46 extends out of the housing 14 at its front end beyond the screw cap 57 and there mounts a chuck 60.

The outer cover 50 for the gear case housing 14 is made of plastic, as heretofore mentioned, and is clamped against the gear case wall 47 by the screw cap 57. This is provided by having the front end of the cover overlapped by the screw cap and the rear end of the cover abutting against the front face of the wall 47 as shown. At this point, the cover 50 has an interior wall portion 61 seating against the wall 47 beneath a centering rib 62.

The body portion 44 is provided with side

openings 63, 64 as shown in Fig. 5, whereby the gears may be inserted within the housing and be removed therefrom. This feature is also claimed in my co-pending application as aforesaid. A shield element, not shown herein, may be fitted over the body portion 44 of the housing 14 to cover the side openings 63, 64 against the escape of grease packed within the housing chamber 45 for the gears. This feature of the shield is shown and claimed in my co-pending application Serial No. 475,367.

The handle section 3 closes the rear end of the tool and is provided with a depending hollow pistol grip portion 65. A switch device 66 is mounted within the hollow pistol grip 65 by a bracket 67. The latter is in the form of a flat metal strip having its upper end engaged by the lower fastening screw 17 as shown in Fig. 3. The lower end of the strip 67 is provided with a folded over angular portion 68 to support a plastic closure 69 for the opening 70 in the lower or butt end of the pistol grip 65. A screw 71 secures the cover 69 to the bracket end 68 and the latter carries a binding screw 72 for the ground lead 73 in the current supply cable 74 for the tool motor.

The bracket strip 67 seats in a channel 75 in the rear wall of the handle grip 65 as shown in Fig. 2. The channel extends the full length of the grip and the strip is held therein by the switch device 66 which overlaps the strip and the channel. The switch device is secured to this part of the strip and the grip 65 by a screw and boss to be presently described. The switch device carries on its front side a superstructure 77 equipped with an operating lever 78 on a fulcrum 79. The lever is of the bell-crank type having one arm co-acting with the spring action within the switch device to open the switch when the lever swings outwardly and to close the switch when the lever is forced inwardly. This accords to the conventional switch action of the type depicted, the switch unit with the lever 78 being procurable on the market as a complete fixture. A spring 80 forming part of the switch unit about the fulcrum 79 forces the lever 78 against a trigger block 81 with which the tool is provided to operate the switch. The trigger block 81 is slidably mounted in a rectangular opening 82 in the tool handle 65 just below the frame 4 and the cover section 16 so that the trigger block 81 may be conveniently and easily engaged by the finger of the operator's hand grasping the tool handle 65. The trigger block 81 has the same shape as the opening 82 in which it is mounted and is normally urged outwardly by the switch spring 80 pressing the outer end of the lever 78 against the inner end of the trigger block. The latter has a stop lug 83 at its upper inner end to engage the handle section 65 to limit the outward projection of the trigger block by the spring. The front end of the trigger block is curved to fit the operator's finger engaging the same. Pressing the trigger block 81 inwardly closes the switch 66 and supplies the operating current to the tool motor. Releasing the trigger block causes the spring 80 to automatically open the switch and project the trigger block outwardly to its normal position as shown in Figs. 4 and 11.

The inner end of the trigger block 81 is beveled inwardly and downwardly so that the lever 78 may ride on the trigger block in the operation thereof. The trigger block at this point carries a metal wear plate 84 for contact with the lever

78, the trigger block being made of a plastic material similar to that of the cover and handle sections of the tool. The wear plate 84 constitutes a part of a metal fixture applied to the trigger block as shown in Figs. 10 to 12. As there illustrated, the trigger block is made hollow providing a chamber 85 opening through the rear end of the block to receive the aforesaid metal fixture. The latter is generally U-shaped in form having its arm portions 86, 86 extending into the chamber 85 and engaging against the upper and the lower wall portions 87, 87 thereof with a slight spring tension, the fixture being a sheet metal stamping. The arm portions 86 may be provided with struck-out tangs 88, 88 facing the open end of the chamber 85 for holding the fixture therein. The wear plate 84 has end extensions 89, 89 to overlap the upper and lower end portions of the block, said extensions 89 being struck-out from the arms portions 86 as shown. These extensions 89 continue the wear plate 84 the full height of the block, the wear plate being an integral part of the fixture.

Normally, the trigger block 81 is projected outwardly by the switch spring 90. To releasably lock the trigger block in its inwardly depressed position to keep the switch device 66 closed as required for a continuous running of the tool motor, I provide a locking plunger 90 at one side of the block and slidably mounted in a bushing 91 fitted within an opening 92 in the adjacent portion of the handle grip 65. A coiled spring 93 about the plunger 90 normally urges it outwardly or into its release position. The spring 93 seats at its inner end against the bushing at its crosswall 94 and at its outer end against a push button 95 carried by the plunger 90 at its outer end.

The plunger 90 is provided at its inner end with a flat, circular disc-like head 96 which takes into a longitudinal groove 97 in the adjacent side of the trigger block 81. The inner end of this groove is semicircular as at 98, the remainder 99 of the circular form being completed by a flange-like extension 100 on the fixture above referred to and overlying the front side of the groove 97 from the wear plate 84. The upper and lower edges of the groove 97 are channeled as at 101 to seat the flange 100 in outwardly spaced relation to the bottom of the groove as shown in Fig. 10. This allows the head 96 of the plunger 90 to enter the groove and engage behind the flange 100 at the circular opening which the flange and groove provide for the circular head 96. This can occur when the parts are in register, the plunger 90 being pressed into the groove and when released will engage behind the flange 100 to lock the plunger in its depressed position as shown in Fig. 12. The switch spring 90 presses the flange 100 against the stem of the plunger 90 and the switch 66 is held closed until the trigger block 81 is again depressed to free the head 96 of the plunger from the flange, whereupon the plunger spring 93 projects the plunger away from the flange and on release of the trigger block 81 the switch spring 90 returns the block to its outwardly projected position as shown in Fig. 11. The spring 93 holds the head 96 of the plunger 90 against the bushing wall 94 and the plunger does not ride on the fixture flange 100 in the inward and outward movement of the trigger block in closing and opening the switch 66.

In assembling the tool and more particularly connecting the motor and switch units in the supply circuit, the procedure is substantially as fol-

lows: The motor and the gear case sections are secured together in the assembled relation shown in Fig. 3. Before the handle section 3 is secured in place against the rear end of the motor supporting frame 4, the bracket strip 67 and the switch unit 66 are inserted into the hollow grip portion 65 of the handle 3 through the opening 70 at its lower or butt end. The bracket is positioned with its upper end to be engaged by the lower of the handle screws 17 and its lower end 68 at the opening 70. The switch is positioned on the bracket with the lever 76 extending towards the opening 70 and the boss 102 on the rear side of the switch case in an aperture in the bracket to seat in a recess 103 in the rear wall of the handle grip 65 when these parts reach their final positions as shown in Fig. 3. Then a screw 104 is inserted through the handle and engaged with the boss, which is tapped, to secure the switch and the strip in the handle. Before the switch unit is inserted in the handle, the wires 105, 105 for the upper terminals for the switch are connected thereto. The trigger block 81 is inserted into the slot 82 from within the handle member before the switch and the bracket are applied and the stop 83 on the trigger block prevents the latter from dropping out of the handle.

Next, the supply cable 74 is inserted through an opening in cover plate 69 while removed from the tool and secured to the plate by the cable clamp comprising a split band 107 and its screw 108. The band embraces an anchoring wall 109 integral with the plate and conforming to about half of the cable opening to expose the cable to be clamped by the band. Then the supply wires 110, 110 carried by the cable 74 are connected with the lower terminals of the switch unit 66 within the handle and the ground wire 73 of the cable is connected to the bracket 67 by its terminal screw 72. The cover plate 69 carrying the cable 74 is now inserted into closing relation in the handle opening 70 independently of the switch.

It will be noted from Fig. 14 that the handle section 65 about the opening 70 opposite the lower end 68 of the bracket strip 67 has an arcuate groove 111 having a horizontal bottom wall 112. The portion of the cover plate 69 has a rib projection 113 complementary to the groove 111 so that the parts may interfit when engaged. This is done by disposing the plate 69 on an angle and inserting the plate with a tilting action into the opening 70, first engaging its rib 113 into groove 111 and then swinging the plate into closed relation in the opening 70, its free edge 114 being inclined to engage a complementary edge of the opening 70 as indicated in Fig. 14. Then the screw 71 is applied and the cover 69 is locked in closed position by the bracket 67. It will be noted that the closure 69 has a recess on its inner side to accommodate the head of the binding screw 72.

Lastly, the handle 3 is brought sufficiently close to the rear end of the tool for a connection to be made between the switch wires 105, 105 and the motor brush leads 106, 106 as shown in Fig. 14. The handle section 3 may now be secured to the motor frame 4 by the screws 17, 17. To accommodate the frame arms 5, 6, the baffle plate 26 has recesses 26b, 26b on opposite sides of its lugs 26a, 26a, as shown in Fig. 4.

With the gear housing 14 in the form of a one-piece casting and secured to the front end of the motor supporting frame 4 by the screws 48 as

shown herein, the frame member 4 not only provides a support for the motor 10 and its stator 13, but supports the gear housing 14 and its gear train and the tool spindle 46, independently of the cover and handle sections 16, 50 and 3, respectively, of the tool housing as shown in Fig. 3. Hence, these cover and handle sections may be made in separable form for individual handling in assembling and disassembling of the tool and when opening the tool for inspection of its motor and gear reducing and spindle sections without disturbing their connected operative relation or the support thereof by the frame 4 as will be apparent from Figs. 1 to 4. It will be particularly noted from these figures that the cover sections 16 and 50 for the motor and the reducing gear assemblies, respectively, are each made in one-piece, open ended, substantially cylindric or tubular form to completely and continuously surround their respective tool sections when applied thereto and are slidable on and off the associated ends of the frame in applying the cover sections to and removing them from the frame. The advantage of this arrangement is that the tool may be readily and easily opened for inspection by merely removing the cap-nut 57 at the front end of the tool and the handle 3 at its rear end whereupon the cover sections are slidable off the frame 4 to expose the tool mechanism without taking the cover and handle sections apart or disturbing the mounting of the motor and the reducing gear or the spindle on the supporting frame 4. To provide the sliding connection for the cover section 16 on the frame 4, said cover section is provided with inside grooves or channels 16c, 16c to receive the frame arms 5, 6 as shown in Fig. 4. This arrangement provides interfitting parts on the frame and the cover section 16 for their relative sliding movement and to hold the cover in non-rotatable connection with the frame.

The tool shown and described has the power factor required for industrial uses, is light in weight for ease in handling and balance and is small in size for convenient grasping and manipulation, all contributing to the effectiveness of the tool for production work over extended periods. The details of construction and arrangement of parts shown and described may be variously changed and modified without departing from the spirit and scope of my invention, except as pointed out in the appended claims.

I claim as my invention:

1. A portable hand held electric tool having a rotatable spindle, a U-shaped metal frame within the tool having substantially parallel arm portions extending lengthwise of the tool and metal end wall portions rigidly connecting the arm portions at the front and rear ends of the frame, an electric motor supported within the frame by the arm portions and having an armature shaft journaled in the rear end wall of the frame and having gear teeth at the front end of the frame, a gear train connecting the gear teeth with the spindle for driving the same, a gear casing about the gear train and secured to and supported by the front end wall of the frame and providing a support for the spindle, a housing for the tool having a cover section about the gear case and the frame and a handle section at the rear end of the tool, said handle and cover sections being supported by the frame and comprised of a relatively thin material, and a switch device for the motor carried by and operable from the exterior of the handle.

2. A portable hand held electric tool having a

rotatable spindle and an electric motor for driving the same, a U-shaped metal frame within the tool having substantially parallel arm portions providing a support for the motor and the spindle, a housing for the tool having a handle section secured to the frame at the rear end of the tool and a cover section held by the handle section about the motor and the frame, a fan element located within the cover section and driven by the motor for cooling the same, said fan having a center intake and a peripheral discharge, a baffle plate supported within the cover section at one side of the fan and engaging the inner surface of the cover on opposite sides of the frame arms for deflecting the incoming air to the center intake of the fan, said baffle plate having an interlocked connection with the frame arms, and a switch device for the motor carried by and operable from the exterior of the handle.

3. A portable hand held electric tool having an electric motor, a rotatable spindle, a U-shaped metal frame within the tool providing a support for the motor, a drive connection from the motor to the spindle and having a surrounding casing secured to the frame, said casing having a tubular extension at its front end about the spindle, a housing for the tool having a handle section at the rear end of the tool and front and intermediate cover sections enclosing the casing and the frame and the motor, respectively, said handle section being secured to the frame at the rear end of the tool, and a clamp element mounted on the tubular extension of the drive casing about the spindle and engaging the front cover for holding the same about the casing.

4. A portable hand held electric tool having a rotatable spindle and an electric motor for driving the same, a metal frame within the tool providing a support for the motor and the spindle, a housing for the tool comprising a handle section at the rear end of the tool and a cover section surrounding the motor and the frame, fastening members for securing the handle section to the rear end of the frame, said handle having a depending hollow pistol grip portion extending below the cover section and the frame, and a switch device and a supporting bracket therefor secured within the grip portion of the handle, said switch device being operable from the exterior of the handle for controlling the operation of the motor, said bracket being connected to the frame by one of the handle fastening members and providing a ground connection for the motor.

5. A portable hand held electric tool having a rotatable spindle and an electric motor for driving the same, a metal frame within the tool providing a support for the motor and the spindle, a housing for the tool comprising a cover section surrounding the motor and the frame, and a handle section at the rear end of the tool, said handle section being secured to the frame and having a hollow grip portion at the rear end thereof, a manually operable switch device for the motor and a supporting bracket therefor secured within the grip portion of the handle and inserted therein through an opening in the handle, said bracket being connected at its upper end with the frame and having its lower end at the opening and providing a ground connection for the motor, and a closure plate for said opening carrying a supply cable for the motor and secured to the lower end of the bracket independently of inserting and securing the switch device and the bracket within the handle.

6. A portable hand held electric tool having a

rotatable spindle and an electric motor for driving the same, a metal frame within the tool providing a support for the motor and the spindle, a housing for the tool comprising a handle section at the rear end of the tool and a cover section surrounding the motor and the frame, said handle being secured to the frame and having a depending hollow pistol grip portion at the rear end thereof, a manually operable switch device for the motor and a supporting bracket therefor secured within the hollow grip portion of the handle and insertible therein through an opening at the butt end of the handle, said bracket comprising a metal strip seated within a channel in the grip portion of the handle and connected at its upper end to the frame and having a ground providing flange portion at its lower end at said opening, and a closure plate for said opening carrying a supply cable for the motor and locked in closing relation in said opening by the flanged end of the bracket.

7. In a portable hand held power operated tool, a driving motor therefor, a substantially U-shaped frame having longitudinally extending arm portions providing a support for the motor within the tool, a housing having a cover section about the motor and the frame and a handle section at the rear end of the frame and secured thereto for holding the cover section on the frame, said cover section being in one-piece, open ended, substantially cylindric form to completely and continuously surround the motor and the frame and slidable thereon over the rear end of the frame in applying the cover section to and removing it from the frame, and interfitting means on the cover and the frame arms for slidably and non-rotatably supporting the cover section on the frame.

8. In a portable hand held power operated tool, a driving motor therefor, a substantially U-shaped metal frame having longitudinally extending arm portions providing a support for the motor within the tool, a housing for the tool having a cover section about the motor and the frame and a handle section at and secured to the rear end of the frame for holding the cover section thereon, said cover section being in one-piece, open ended, substantially cylindric form to completely and continuously surround the motor and the frame and slidable thereon over the rear end of the frame in applying the cover section to and removing it from the frame, said cover section having channels therein to receive the frame arms to slidably and non-rotatably mount the cover on the frame.

9. In a portable hand held power actuated tool, a motor and a spindle driven thereby, a frame supporting the motor and the spindle and the driving connection therebetween, a housing for the tool supported by the frame and having separable motor and spindle enclosing sections and a handle section at the rear end of the tool, said cover sections being in one-piece, open ended, substantially cylindric form to completely and continuously surround the motor and the spindle sections of the tool and slidable over the associated ends of the frame in applying the cover sections to and removing them from the frame, said handle engaging the motor enclosing section for holding the same on the frame, means for releasably securing the spindle enclosing and the handle sections to the opposite ends of the frame whereby the cover sections may be individually applied to and removed from the frame without

disturbing the mounting of the motor and spindle and the drive therebetween on the frame.

10. A portable hand held electric tool having a rotatable spindle, a metal frame having substantially parallel arm portions extending lengthwise of the tool and metal end wall portions rigidly connecting the arm portions at the front and the rear ends of the frame, a gear frame secured to the metal frame at its front end and having an end wall portion extending between said arm portions, an electric motor supported within the metal frame by the arm portions thereof and having an armature shaft journaled at its opposite ends in the respective end wall portions of the gear frame and at the rear end of the metal frame, said gear frame supporting the spindle and a gear drive from the shaft to the spindle, cover and handle sections for the tool of a relatively light plastic material, said cover section being in one-piece, open ended, tubular form to completely and continuously surround the motor and the metal frame and slidable on and off the arm portions thereof over one end of the metal frame in applying the cover section to and removing the latter from said metal frame, said handle section being secured to the metal frame and holding the cover section thereon, and a switch device for the motor carried by and operable from the exterior of the handle.

11. A portable hand held electric tool having a rotatable spindle, a metal frame having substantially parallel arm portions extending lengthwise of the tool and metal end wall portions rigidly connecting the arm portions at the front and the rear ends of the frame, a gear frame secured to the front end of the metal frame and having an end wall portion extending between said arm portions, an electric motor supported within the metal frame by the arm portions thereof and having an armature shaft journaled at its opposite ends in the respective end wall portions of the gear frame and at the rear end of the metal frame, said gear frame supporting the spindle and a gear drive from the shaft to the spindle, separable cover and handle sections for the tool of relatively light plastic material, said cover section being in one-piece, open ended, tubular form to continuously and completely surround the motor and the metal frame and slidable on and off the arm portions thereof over the rear end of the metal frame in applying the cover section to and removing the latter from said metal frame, said handle section being secured to the rear end wall of the metal frame in closing relation to the cover section and engaging the same for holding the cover section on the metal frame, and a switch device for the motor carried by and operable from said handle.

12. A portable hand held electric tool having a rotatable spindle, a metal frame having substantially parallel arm portions extending lengthwise of the tool and metal end wall portions rigidly connecting the arm portions at the front and the rear ends of the frame, a gear frame secured to the front end of the metal frame and having an end wall portion extending between said arm portions, an electric motor supported within the metal frame by the arm portions thereof and having an armature shaft journaled at its opposite ends in the respective end wall portions of the gear frame and at the rear end of the metal frame, said gear frame supporting the spindle and a gear drive from the shaft to the spindle, cover and handle sections for the tool of a relatively light plastic material, said cover section being in

one-piece, open ended, tubular form to completely and continuously surround the motor and the metal frame and slidable on and off the arm portions over the rear end of the metal frame in applying the cover section to and removing the latter from the metal frame, said handle section being secured to the rear end of the metal frame and holding the cover section against a stop at the front end of the metal frame, and a switch device for the motor carried by and operable from said handle.

13. A portable hand held electric tool having a rotatable spindle, a substantially U-shaped metal frame having substantially parallel arm portions extending lengthwise of the tool and metal end wall portions rigidly connecting the arm portions at the front and the rear ends of the frame, a one-piece gear frame having an end wall portion extending between the arm portions of the U-shaped frame and secured to and fitting against the front end wall portion of the latter, an electric motor supported within the U-shaped frame by the arm portions thereof and having an armature shaft journaled at its opposite ends in the respective end wall portions of the gear frame and at the rear end of the U-shaped frame, said gear frame supporting the spindle and a gear drive from the shaft to the spindle, a housing for the tool having cover and handle sections of a relatively light material, said cover section being in one-piece, open ended, tubular form to completely and continuously surround the motor and the U-shaped frame and slidable on and off the arm portions over the rear end of the U-shaped frame in applying the cover section to and removing the latter from said U-shaped frame, said handle section being secured to the rear end wall of said U-shaped frame and holding the cover

section about the same, and a switch device for the motor carried by and operable from the handle.

14. A portable hand held electric tool having a supporting frame provided with substantially parallel, rigid, arm portions extending lengthwise of the tool and rigid end wall portions connecting the arm portions at the front and the rear ends of the frame, a gear frame secured to the supporting frame at its front end having an end wall portion extending between said arm portions, an electric motor having a stator provided with a turnable connection with the frame arms providing for the release of the stator in one rotative position and a support for the stator in another rotative position thereof, an armature shaft for the motor journaled in the said end wall portion of the gear frame and at the rear end of the supporting frame, respectively, a rotary spindle supported by the gear frame, a driving connection from the shaft to the spindle, said supporting frame being open along at least one side whereby the stator when turned to its release position is shiftable laterally into and out of the frame in assembling and disassembling the stator with respect to the frame, and handle and cover sections for the tool disposed on the supporting frame.

15. A portable hand held electric tool as defined in claim 14 characterized by the fact that the front end wall portion of the supporting frame is provided with an opening of sufficient size to pass the armature and its shaft endwise out of the frame to release the stator for its shifting movement with respect to the frame in an assembling and disassembling operation.

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