May 1, 1956 F. A. KAMAN 2,744,176

SWITCH ACTUATING MECHANISM FOR ELECTRIC TOOLS

Filed Dec. 15, 1954 2 Sheets-Sheet 1

Fig. 1.

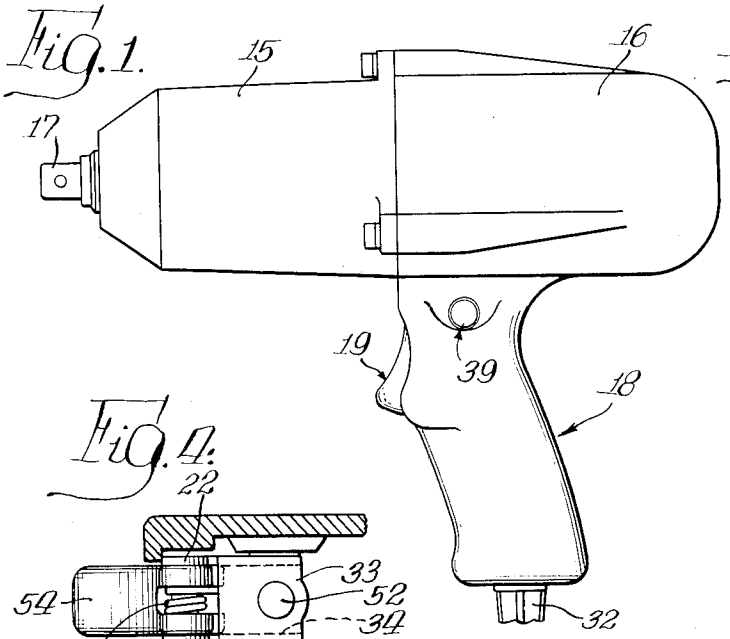


Fig. 2.

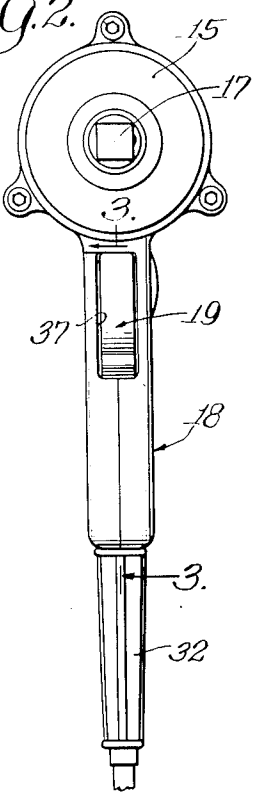


Fig. 4.

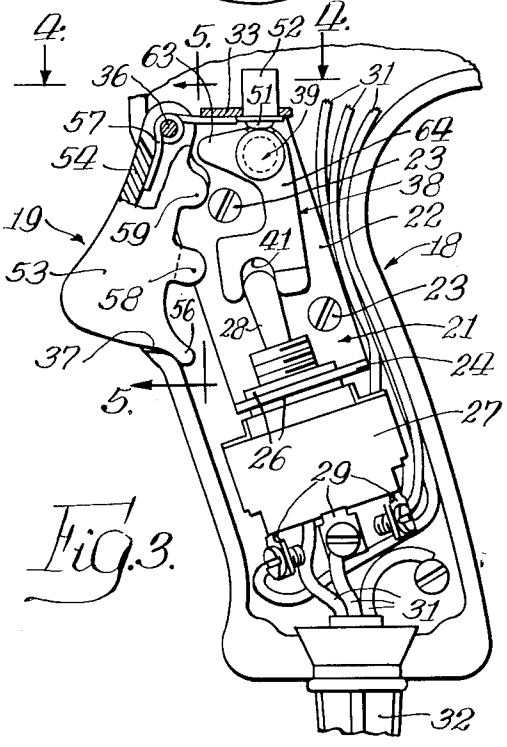
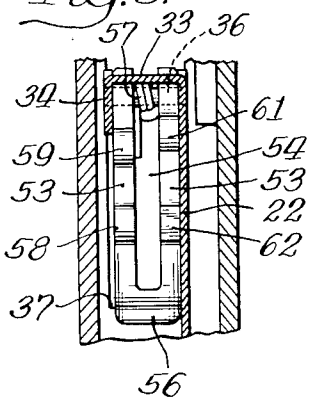


Fig. 3.

Fig. 5.



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SWITCH ACTUATING MECHANISM FOR ELECTRIC TOOLS

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Fig. 6.

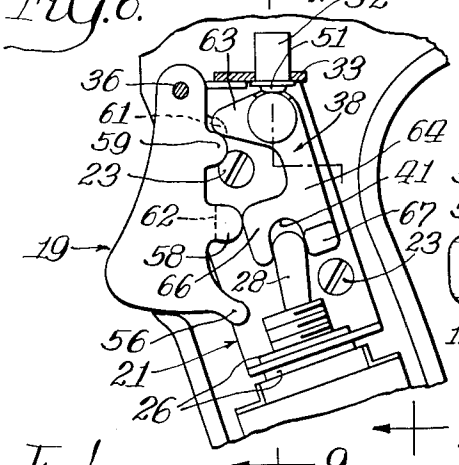


Fig. 10.

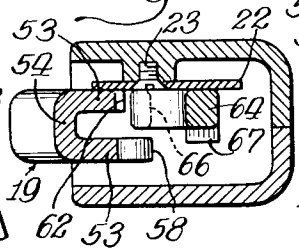


Fig. 7.

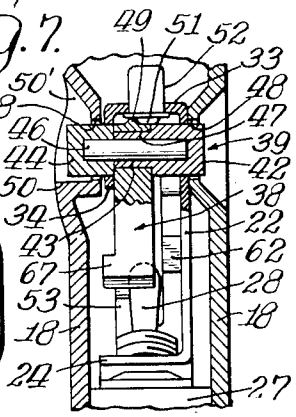


Fig. 8.

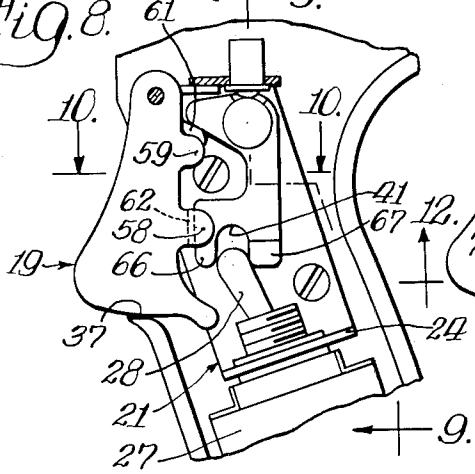


Fig. 11.

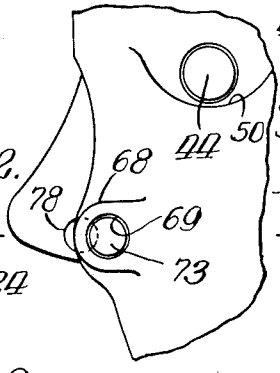


Fig. 9.

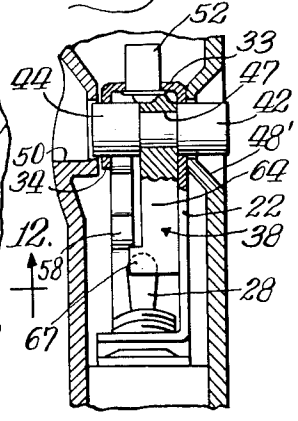


Fig. 12.

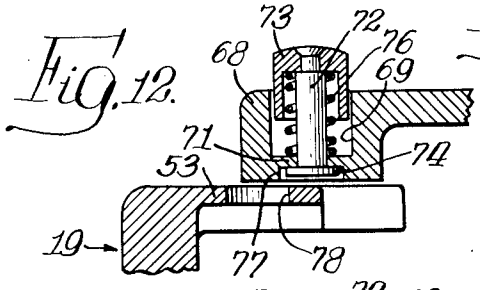


Fig. 14.

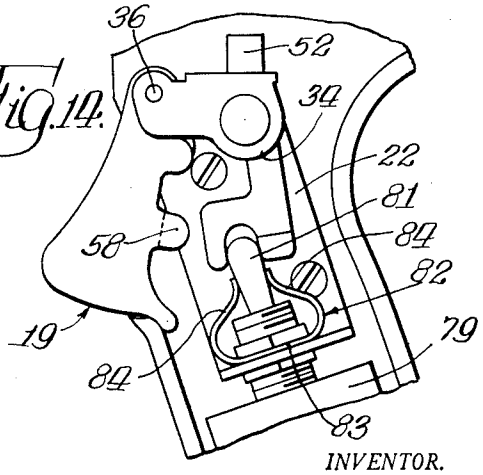
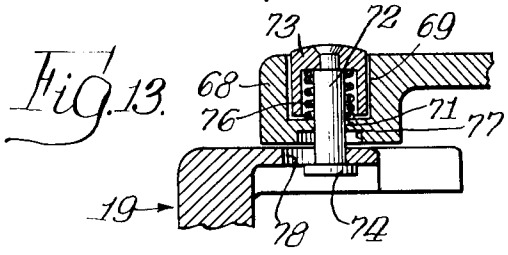


Fig. 13.



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2,744,176

SWITCH ACTUATING MECHANISM FOR ELECTRIC TOOLS

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Application December 15, 1954, Serial No. 475,502

20 Claims. (Cl. 200—61.85)

This invention relates to a novel switch actuating mechanism for portable electric tools and more particularly to a novel reversing means for such tools.

In many types of portable power tools reversible operation of the tool is essential, e. g. in wrenches, nut runners, drills, screw drivers, etc. Heretofore, reversible operation has been provided by a number of different electrical and mechanical schemes but all of them have had disadvantages. For example, one such scheme involves a rotatable ring for shifting the brushes of the tool motor, but this arrangement is not only expensive but is also subject to undesirable breakage. Another arrangement utilizes a separate reversing switch in addition to the usual hand switch for starting and stopping the motor. Obviously, such duplicate switch mechanisms lack simplicity both from a structural and operating viewpoint. Reversing switches have also been provided which are operated by triggers, but these have lacked the desired degree of simplicity of operation since they usually require movement or positioning of the trigger in a different manner for each direction of operation of the tool.

Accordingly, a primary object of the present invention is to provide a novel and improved switch actuating mechanism for controlling the operation of portable electric tools.

A further object of the invention is to provide a novel trigger actuated reversing and control switch mechanism adapted to be mounted within the handle structure of a portable electric tool.

Another object of the invention is to provide novel switch actuating mechanism for portable electric tools whereby starting, stopping, and reversing of the motor can be accomplished by the use of only one hand of the operator.

Still another object of the invention is to provide a novel trigger actuated mechanism of the above mentioned character in which starting and stopping of the motor is effected by depressing the trigger in the same manner for either direction of operation of the tool.

An additional object of the invention is to provide a novel reversing means for portable electric tools which is characterized by a high degree of simplicity of construction and operation, low manufacturing cost, and excellent durability.

Other objects and advantages of the invention will become apparent from the subsequent detailed descriptions taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a small scale side elevational view of a portable electric tool embodying the features of the present invention;

Fig. 2 is an end elevational view as seen from the left in Fig. 1;

Fig. 3 is an enlarged vertical sectional view taken along the line 3—3 of Fig. 2 and showing the switch mechanism of the tool in "off" position;

Fig. 4 is a fragmentary horizontal sectional view as seen along the line 4—4 of Fig. 3;

Fig. 5 is a fragmentary vertical sectional view as taken along the line 5—5 of Fig. 3;

Fig. 6 is a fragmentary view similar to Fig. 3 but showing the switch mechanism in one of its "on" positions for operation of the tool in one direction;

Fig. 7 is a vertical sectional view taken along the line 7—7 of Fig. 6;

Fig. 8 is a view similar to Fig. 6 but showing the switch mechanism in the other of its "on" positions for operation of the tool in the opposite direction;

Fig. 9 is a vertical sectional view taken along the line 9—9 of Fig. 8;

Fig. 10 is a horizontal sectional view taken along the line 10—10 of Fig. 8;

Fig. 11 is a fragmentary side elevational view of the handle and trigger portion of a modified form of the invention having a locking means for releasably holding the trigger in depressed position;

Fig. 12 is a horizontal sectional view taken along the line 12—12 of Fig. 11 and showing the locking means in its normal released position;

Fig. 13 is a view similar to Fig. 12 but showing the locking means in engaged position; and

Fig. 14 is a view similar to Fig. 6 but showing a further modification of the invention.

Referring first to Figs. 1 and 2, the invention is illustrated in connection with a portable electric impact tool including an impact unit 15 at the forward end of the tool and an electric motor section 16 at the rear end of the tool. A rotary spindle 17 which is driven by the impact unit 15 projects forwardly from the latter for mounting a suitable tool member such as a nut or bolt engaging socket (not shown). Depending from the electric motor section 16 is a handle 18 of the pistol grip type having a depressible trigger 19 which is adapted to cooperate with a switch mechanism within the handle 18 for controlling the operation of the electric motor, as hereinafter described in detail.

Referring next to Figs. 3 to 10, the structure and operation of the switch actuating mechanism comprising the subject matter of the present invention will now be described. The pistol grip handle 18 has a hollow two part construction for enclosing the switch and switch actuating mechanism. For mounting the switch and its actuating mechanism in the handle 18, I provide an elongated one piece bracket or support designated generally at 21 and including a generally upright flat strip or body portion 22 which is rigidly secured to the outer wall of the handle portion 18, as by screws 23. A lateral flange or shelf 24 extends outwardly from the lower end of the strip 22 and has rigidly mounted thereon, as by lock nuts 26, an electric switch 27. Although the characteristics of the switch 27 may vary dependent upon the operating characteristics desired in the particular tool involved, the preferred type of switch for reversible operation of the tool is a small fast acting switch of the double pole, double throw variety with a center "off" position and an internal spring return providing momentary "on" positions in each direction. The switch 27 shown herein is of the latter type and has an operating member or toggle 28 extending upwardly from the flange 24. The switch 27 also has a plurality of terminals 29 to which the usual wires or conductors 31 are connected, the latter entering the bottom end of the handle 18 through a cable connector 32.

As best seen in Figs. 7 and 9, the upper end of the bracket 21 is formed with a laterally extending end wall 33 and an outermost depending flange portion 34 which extends in parallel spaced relation with respect to the upright body or strip portion 22 of the bracket. The trigger 19 is pivotally mounted at the upper end of the bracket 21 by means of a pivot pin 36 extending between the

parallel bracket portions 22 and 34. The trigger 19 projects forwardly through an opening 37 in the forward edge of the handle 18 and is pivotally depressible for operating the switch mechanism. Closely adjacent the trigger 19 and cooperable therewith in a manner more fully described below is an actuating lever, designated generally at 38, which is likewise pivotally supported adjacent the upper end of the bracket 21 by a pivot means 39 extending between the portions 22 and 34 of the bracket rearwardly of the trigger pivot 36 and on an axis parallel therewith. The lower end of the lever 38 is bifurcated, as at 41, for operably receiving and engaging the switch toggle 28.

An important feature of the present invention resides in the fact that the pivot lever 38 is also shiftable laterally or transversely of its plane of pivotal movement for selectively coacting in a different manner with the trigger 19 in each of the opposite transverse positions of the lever 38. To this end, the pivot means 39 for the lever 38 is in the form of an axially shiftable pivot pin or plunger which in this instance has a multiple part construction. Thus, referring particularly to Figs. 7 and 9, the pivot means 39 has a plunger or pin portion 42 with a reduced diameter end 43 and a complementary plunger or cap portion 44, the two portions being frictionally interconnected by means of a lock pin 46 having a tight fit in aligned axial bores provided in the respective plunger portions 42 and 44. The upper end of the lever 38 is formed with an aperture 47 into which the reduced end 43 of the plunger portion 42 is loosely fitted to permit pivotal or rockable movement of the lever 38 thereon. Of course, it will be understood that when the lever and plunger structure is fully assembled, the lever 38 is retained on its opposite side by the plunger portion 44 and the enlarged diameter part of the plunger portion 42 so that the pivot means 39 and the lever 38 are shiftable transversely as a unit.

For permitting transverse shifting movement, the plunger portions 42 and 44 are slidably supported in suitable aligned apertures in the bracket walls 22 and 34, and the opposite extremities of the plunger portions extend outwardly through slightly enlarged openings 48 in the opposite walls of the hollow handle 18. One wall of the handle is countersunk, as at 48' (Fig. 7), and the opposite wall is formed with a shoulder 50 below the plunger and a recess 50' above the plunger so that the ends of the plunger are protected against inadvertent shifting. When the tool is held in the right hand of an operator, it will be seen that one end of the shiftable plunger within the countersunk recess 48' can be actuated by the operator's forefinger while the opposite end of the plunger above the shoulder 50 can be reached by the joint of the operator's thumb for shifting the plunger as required to effect reversible operation. The upper end portion of the lever 38 has a slight protuberance or bump 49 which cooperates with a spring pressed detent 51 having a casing 52 rigidly mounted in the upper end wall 33 of the supporting bracket 21. As will readily be understood, the detent 51 coacts with the protuberance 49 to hold the lever and plunger assembly in either of its transverse positions (Figs. 7 and 9) but is at the same time releasable upon application of axial shifting pressure to the plunger for permitting movement of the same.

The trigger 19 has a generally U-shaped transverse cross-section so as to provide a pair of parallel laterally spaced side walls 53 which are connected at their forward edges by an end wall portion 54, the latter continuing between the side walls 53 along the bottom edges thereof and forming an abutment or stop 56 at the lower inner corner of the trigger 19. In the neutral or "off" position of the switch mechanism, as shown in Fig. 3, the depressible trigger 19 is held in outwardly projected relation through the handle aperture 37 by means of a spring 57 which in this instance is coiled around the pivot pin 36 and coacts at its terminal ends with the bracket upper wall 33 and the forward edge wall 54 of the trigger. The stop or abutment portion 56 on the trigger seats against the forward edge wall of the handle 18 adjacent the opening 37 to limit the extent of outward projection of the trigger whereby to maintain the same in readily accessible position.

At the innermost or rear portion of the trigger 19, the side walls 53 are open and unconnected so as to provide a pair of spaced parallel rear edges adjacent the opposite side walls of the handle 18 (Fig. 5). These rear edges of the walls 53 are formed with suitable cam surfaces and abutments for selective coaction with the pivot lever 38 in the opposite transverse positions of the latter. Thus, one of the trigger edges 53 is formed with a lower cam portion 58 and directly thereabove an upper abutment or stop portion 59. The opposite trigger edge is formed with an uppermost cam projection 61 and directly therebelow a lower abutment or stop portion 62.

The lever 38 has angularly extending arm portions 63 and 64 with the pivotal mounting aperture 47 being disposed therebetween so that the lever 38 is mounted in generally the same manner as a bell crank in this instance (Figs. 3, 6, and 8). As best seen in Figs. 7, 9, and 10, the arm portions 63 and 64 of the lever 38 have a relatively restricted width in the direction of the pivot axis, whereas the lowermost bifurcated end 41 of the lever arm 64 has a narrow forward leg 66 and a rear leg 67 which is substantially wider or laterally extended with the result that in either of the transverse positions of the lever 38 (Figs. 7 and 9) the bifurcated portion 41 is always in actuating engagement with the toggle 28. Moreover, the narrow transverse width of the lever arms 63 and 64 make possible selective registry and coacting engagement of the lever 38 with only one or the other of the actuating rear edge portions 53 of the trigger 19, dependent upon the transverse position of the lever 38. This feature will be more fully expalined in connection with the following description of the operation of the device.

In the use of the device, it will be seen from Fig. 3 that in the normal "off" position of the switch toggle 28 the trigger retraction spring 57 holds the trigger 19 in outwardly projected position as limited by abutment of the trigger portion 56 with the handle wall adjacent the trigger opening 37. In this position, the trigger 19 is completely disengaged from the lever 38 so that the latter is free to be shifted transversely without binding frictional contact with the trigger 19.

Figs. 6 and 7 illustrate the actuation of the switch mechanism for one direction of operation of the tool, which for the sake of convenience will be considered as the forward operating direction. In this situation, the shiftable plunger means 39 and the lever 38 rockably supported thereon are displaced to the left, as seen in Fig. 7, with the protuberance 49 being releasably engaged by the detent 51 for retaining the lever 38 in the left-hand position. From Fig. 7 it will also be seen that the lever 38 is in register only with the left-hand rear edge 53 of the trigger 19. Consequently, when the operator depresses the trigger 19 by finger pressure in the usual manner, only the lower cam portion 58 and the upper abutment 59 will be in operating relation with the lever 38. As seen in Fig. 6, depression of the trigger 19 brings the lower cam portion 58 into direct engagement with the forward leg 66 of the bifurcated end 41 of the lever 38 thereby pivoting the latter in a counterclockwise direction, as seen in Fig. 6, and moving the switch toggle 28 rearwardly whereby to complete the electrical circuit of the tool for forward operation thereof. At the same time, as the lever 38 pivots in a counterclockwise direction, the angularly extending lever arm 63 pivots downwardly and engages the upper trigger abutment 59 so as to limit the extent of pivotal movement of the lever 38, thereby protecting the switch 27 from damage due to over-travel of the toggle 28. Because of the leftward transverse position

of the lever 38 as seen in Fig. 7, the trigger portions 61 and 62 clear the lever 38 during inward depression of the trigger.

As hereinbefore described, the switch 27 is preferably of the internal spring return type with momentary "on" positions in either direction of operation of the tool. Consequently, the operating condition shown in Figs. 6 and 7 will continue as long as pressure is maintained on the trigger 19, but as soon as the trigger pressure is released the internal spring action of the switch 27 will cause the toggle 28 and the interengaged lever 38 to return to the neutral or "off" position shown in Fig. 3. Of course, the spring 57 will return the trigger 19 to its Fig. 3 position in which it is completely disengaged from the lever 38 in order to facilitate free shifting of the latter.

In order to reverse the operation of the tool, the plunger 39 is shifted to the right, as seen in Fig. 9, and the lever 38 is thereby in its right-hand transverse position and is in selective register only with the right-hand rear edge 53 of the trigger 19 having the cam portion 61 and the abutment 62. Because of the location of the reversing plunger 39 in close proximity to the trigger 19, it will be understood that reversal of the tool can be accomplished in an exceedingly simple and rapid manner. With the lever 38 in its right-hand Fig. 9 position as releasably retained by the detent 51 coacting with the protuberance 49, the trigger 19 is again depressed by the operator as shown in Fig. 8. In this case, however, the upper cam portion 61 of the trigger 19 directly engages the lever arm 63 and pivots the lever 38 in a clockwise direction, as seen in Fig. 8, so that the laterally widened rear leg 67 of the bifurcated lower end of the lever engages the toggle 28 and shifts the latter forwardly for completing the reverse operating circuit in the tool. The switch 27 is again protected against over-travel of the toggle 28 by engagement of the forward leg 66 on the lower end of the lever 38 with the abutment 62 on the trigger. The trigger portions 58 and 59 at the left-hand rear edge 53 of the trigger clear the lever 38 because of the right-hand transverse location of the latter. As previously mentioned, the rear leg portion 67 of the bifurcated end of the lever 38 is wide enough to insure engagement with the toggle 28 in the right-hand Fig. 9 position of the lever 38, but the forward leg 66 is sufficiently narrow so that the trigger portion 58 does not engage the lever 38 during the Fig. 8 reverse operation of the tool. As before, the operating condition of Fig. 8 is maintained only as long as finger pressure is held against the trigger 19 and upon release of the trigger the internal spring return of the switch 27 automatically restores the mechanism to the Fig. 3 "off" position.

In Figs. 11, 12, and 13, I have shown a modification wherein temporary locking means is provided for holding the trigger 19 in depressed relation without prolonged finger pressure. In this instance, the locking means is in the form of a releasable spring pressed detent mounted in the handle 18 adjacent the trigger 19. The wall portion of the handle 18 is provided with a bos 68 having a recess 69 with an internal shoulder or restriction 71. A lock pin 72 is disposed for axial movement within the recess 69 and carries an outermost cup-shaped button or cap 73. The inner end of the lock pin 72 has an enlarged flange or head portion 74 which is normally held in seated relation against the shoulder 71 by the action of a spring 76 which surrounds the lock pin 72 and coacts between the shoulder 71 and the button 73. Thus, the lock pin 72 is normally held in outwardly projected position as seen in Fig. 12, and in this position the lock pin head 74 is recessed within a depression 77 so that there is no interference with free pivotal movement of the trigger 19.

To effect and maintain a locked "on" position of the switch for either direction of operation of the tool, the button 73 is pressed inwardly while the trigger 19 is depressed whereby to project the lock pin head 74 through

a slightly larger aperture 78 in the adjacent side wall 53 of the trigger 19. Then, while the lock pin is still held in inwardly depressed position, finger pressure of the trigger 19 is released slightly to allow the trigger 19 to make a slight return movement thereby permitting the lock pin 72 to abut against the side edge of the trigger opening 78 with the head portion 74 seating against the inside of the trigger wall 53 upon release of inward pressure on the lock pin. Thus, the trigger 19 is held in depressed position as shown in Fig. 13. Operation of the tool can thereafter be stopped by effecting slight depression of the trigger 19 sufficient to register the trigger opening 78 with the lock pin head 74 whereupon the spring 76 automatically retracts the lock pin assembly to its Fig. 12 position and further release of the trigger 19 causes the switch mechanism to be returned automatically to the Fig. 3 "off" position.

In Fig. 14 still another modification is shown wherein the switch, designated at 79, is of the same general double pole, double throw type as hereinbefore described except that it does not have an internal spring return. In other words, the switch 79 has a toggle 81 with three positions as before but each of the positions is a set position so that there is no momentary "on" condition for each direction of operation. In order to provide the same general operation hereinbefore described, an external spring member 82 is provided. The spring member 82 has a central portion 83 rigidly mounted on the switch and a pair of upwardly and inwardly extending resilient end portions 84 which bear against opposite sides of the toggle 81 for spring loading the latter in both directions of operation. It will be evident without further description that the action of the return spring 82 provides sufficient force to return the toggle 81 to its neutral or "off" position upon release of finger pressure from the trigger 19.

From the foregoing, it will be seen that my invention provides an exceedingly simple switch actuating mechanism for controlling starting, stopping and reversal of an electric tool. The structure is economical to manufacture and is sufficiently compact to be located entirely in the handle portion of the tool. At the same time, the arrangement is quite durable and rugged so as to withstand the severe usage encountered in the tools of this type. A further important advantage of the invention is found in the ease and simplicity with which the reversing operation can be carried out. In my invention the reversing element is located closely adjacent the tool trigger so that only a single hand of the operator is required for complete control of the tool. Moreover, the operation of the trigger is always the same for either direction of the tool. As herein described, the invention utilizes a double pole, double throw electric switch to obtain reversible operation of the tool. However, an important advantage of the invention resides in the fact that the same switch actuating mechanism can be used for non-reversible operation of the tool merely by changing the switch 27.

Although the invention has been described with reference to certain specific structural embodiments thereof, it will be understood that various modifications and alternative structures may be resorted to without departing from the scope of the invention as defined in the appended claims.

I claim:

1. Switch actuating mechanism for an electric tool having a reversing switch including a pivotal operating member movable in opposite directions for forward and reverse operation of the tool, said mechanism comprising a depressible trigger, a lever pivotally mounted adjacent said trigger and engageable with the switch operating member for moving the latter in either direction in response to depression of the trigger, and shiftable means for bodily moving said lever transversely to the plane of pivotal movement thereof, said trigger and said lever having coacting portions selectively engageable for piv-

oting said lever in opposite directions corresponding to opposite transverse positions of said lever.

2. Switch actuating mechanism for an electric tool having a reversing switch including a pivotal operating member movable in opposite directions for forward and reverse operation of the tool, said mechanism comprising a depressible trigger, a lever adjacent said trigger and engageable with the switch operating member for moving the latter in either direction in response to depression of the trigger, and a laterally shiftable pivot having said lever pivotally supported thereon, said lever being shiftable back and forth with said pivot transversely to the plane of pivotal movement of the lever, and said trigger and said lever having coacting portions selectively engageable for pivoting said lever in opposite directions corresponding to opposite transverse positions of said pivot.

3. Switch actuating mechanism for an electric tool having a hollow handle portion with a reversing switch including a toggle member movable in opposite directions for forward and reverse operation of the tool, said mechanism comprising a pair of coacting trigger and lever members pivotally mountable within the handle portion of the tool with the lever member engageable with the switch toggle member for moving the latter in either direction in response to actuation of the trigger, and shiftable means for moving the lever member transversely to the plane of pivotal movement thereof, said trigger and lever members having coacting cam portions selectively engageable in different transverse positions of the lever member for pivoting said lever member in opposite directions whereby to effect forward or reverse operation of the tool.

4. The device of claim 3 further characterized in that said trigger member is provided with spring means normally urging the trigger member outwardly for projecting the same from the handle portion in readily accessible depressible position and in disengaged relation with respect to said lever member.

5. Switch actuating mechanism for an electric tool having a hollow handle portion with a reversing switch including a toggle member movable in opposite directions for forward and reverse operation of the tool, said mechanism comprising a support rigidly mountable within the handle portion, a trigger pivotally mounted on said support and adapted to project from the handle portion in depressible relation, a lever pivotally mounted on said support adjacent said trigger for pivotal movement about an axis parallel to the pivot axis of the trigger, said lever being engageable with the switch toggle member for moving the latter in either direction in response to depression of the trigger, and pivot means shiftably mounted on said support and pivotally carrying said lever, said pivot means and the lever carried thereon being shiftable transversely relative to said trigger and to the plane of pivotal movement of the lever, and said trigger and said lever having coacting portions selectively engageable in different transverse positions of the lever for pivoting the lever in opposite directions whereby to effect forward or reverse operation of the tool.

6. Switch actuating mechanism for an electric tool having a hollow handle portion with a reversing switch including a toggle member movable in opposite directions for forward and reverse operation of the tool, said mechanism comprising an elongated bracket having a mounting portion adapted to be rigidly fastened within the handle portion, flange means at one end of said bracket for rigidly supporting the switch, a trigger pivotally mounted at the opposite end of said bracket, a lever pivotally mounted adjacent said trigger at said opposite end of said bracket and engageable with the switch toggle member for moving the latter in either direction in response to depression of the trigger, and laterally shiftable pivot means slidably supported in said bracket at said opposite end thereof and pivotally carrying said lever, said pivot means and the lever carried thereon being shiftable transversely relative to said trigger and to the plane of pivotal movement of the lever, and said trigger and said lever having coacting portions selectively engageable in different transverse positions of the lever for pivoting the lever in opposite directions whereby to effect forward or reverse operation of the tool.

7. In an electric tool having a hollow handle portion, a switch mechanism comprising an elongated bracket rigidly mounted within said handle portion, a reversing switch rigidly supported at one end of said bracket and having a toggle operating member extending therefrom and movable in opposite directions for forward and reverse operation of the tool, a pair of coacting trigger and lever members pivotally supported at the opposite end of said bracket with the lever member extending into operating engagement with said toggle member for moving the latter in either direction in response to actuation of the trigger member, and laterally shiftable pivot means slidably supported in said bracket at said opposite end thereof and pivotally carrying said lever member, said pivot means and the lever member carried thereon being shiftable transversely relative to said trigger member and to the plane of pivotal movement of the lever member, and said trigger and lever members having coacting portions selectively engageable in different transverse positions of the lever member for pivoting the latter in opposite directions whereby to effect forward or reverse operation of the tool.

8. Switch actuating mechanism for an electric tool having a reversing switch including a pivotal operating member movable in opposite directions for forward and reverse operation of the tool, said mechanism comprising a depressible trigger, an actuating lever in coacting position adjacent said trigger and having a pair of angularly extending arm portions, pivot means swingably supporting the lever between said arm portions, one of said arm portions being engageable with the switch operating member for moving the latter in either direction in response to depression of the trigger, and means providing lateral shifting movement of said pivot means whereby said lever is shiftable transversely to the plane of pivotal movement thereof, said trigger having coacting abutment surfaces selectively engageable in opposite transverse positions of the lever with one or the other of said arm portions for pivoting the lever in opposite directions whereby to effect forward or reverse operation of the tool.

9. The device of claim 8 further characterized in that said one arm portion of said lever has a bifurcated end portion adapted to fit over the switch operating member for moving the latter in either direction, said bifurcated end portion being engageable with the switch operating member in all transverse positions of said lever.

10. Switch actuating mechanism for an electric tool having a reversing switch including a pivotal operating member movable in opposite directions for forward and reverse operation of the tool, said mechanism comprising a depressible trigger, a lever adjacent said trigger and engageable with the switch operating member for moving the latter in either direction in response to depression of the trigger, a laterally shiftable pivot having said lever pivotally supported thereon, said lever being shiftable back and forth with said pivot transversely to the plane of pivotal movement of the lever, and means operably coacting with said lever for releasably holding the lever in either of its transverse positions, said trigger and said lever having coacting portions selectively engageable for pivoting the lever in opposite directions corresponding to opposite transverse positions of said pivot.

11. The device of claim 5 further characterized in that said support also has mounted thereon adjacent said pivot means a spring pressed detent operatively coacting with said lever for releasably holding the lever in either of its transverse positions.

12. The device of claim 2 further characterized in that said pivot comprises a pair of axially connected pin

and cap members slidably supported for axial shifting movement and pivotally carrying said lever therebetween.

13. Switch actuating mechanism for an electric tool having a hollow handle portion with a reversing switch including a toggle member movable in opposite directions for forward and reverse operation of the tool, said mechanism comprising a pair of coacting trigger and lever members pivotally mountable within the handle portion of the tool with the lever member engageable with the switch toggle member for moving the latter in either direction in response to actuation of the trigger, and elongated pivot means slidably mounted for lateral shifting movement and adapted to extend through the opposite walls of the handle portion, said pivot means having said lever member pivotally supported thereon and being shiftable with said lever member transversely to the plane of pivotal movement of the lever member, said trigger and lever members having coacting portions selectively engageable in different transverse positions of the lever member for pivoting said lever member in opposite directions whereby to effect forward or reverse operation of the tool.

14. Switch actuating mechanism for an electric tool having a reversing switch including a pivotal operating member movable in opposite directions for forward and reverse operation of the tool, said mechanism comprising a depressible trigger, a lever pivotally mounted adjacent said trigger and engageable with the switch operating member for moving the latter in either direction in response to depression of the trigger, and shiftable means for bodily moving said lever transversely to the plane of pivotal movement thereof, said trigger having a pair of laterally spaced cam portions selectively engageable with different portions of said lever, one of said cam portions being engageable with one portion of said lever in one transverse position thereof for pivoting the lever in one direction and the other of said cam portions being engageable with another portion of said lever in the opposite transverse position thereof for pivoting the lever in the opposite direction.

15. Switch actuating mechanism for an electric tool having a reversing switch including a pivotal operating member movable in opposite directions for forward and reverse operation of the tool, said mechanism comprising a depressible trigger, a lever pivotally mounted adjacent said trigger and engageable with the switch operating member for moving the latter in either direction in response to depression of the trigger, and shiftable means for bodily moving said lever transversely to the plane of pivotal movement thereof, said lever having upper and lower actuating portions for rotating the lever in opposite directions and said trigger having coacting upper and lower cam portions and upper and lower abutments selectively engageable with the actuating portions of said lever, said cam portions and said abutments being laterally arranged so that in one transverse position of said lever said lower cam portion of the trigger registers with and engages the lower actuating portion of the lever for pivoting the lever in one direction with the upper abutment on the trigger being engageable by the upper actuating portion of the lever for limiting the extent of pivotal movement of the lever in said one direction and in the other transverse position of said lever said upper cam portion of the trigger registers with and engages the upper actuating portion of the lever for pivoting the lever in the opposite direction with the lower abutment on the trigger being engageable by the lower actuating portion of the lever for limiting the extent of pivotal movement of the lever in said opposite direction.

16. Switch actuating mechanism for an electric tool having a reversing switch including a pivotal operating member movable in opposite directions for forward and reverse operation of the tool, said mechanism comprising a depressible trigger, a lever pivotally mounted adjacent said trigger and engageable with the switch operating member for moving the latter in either direction in response to depression of the trigger, and shiftable means for bodily moving said lever transversely to the plane of pivotal movement thereof, said trigger and said lever having coacting portions selectively registrable and engageable in opposite transverse positions of said lever for pivoting the lever in opposite directions, and said trigger and said lever also having coacting abutment means for limiting the extent of pivotal movement of the lever in either direction whereby to protect the switch from damage due to over-travel of the switch operating member.

17. In an electric tool having a hollow handle portion, a reversing switch mounted in said handle portion and having a toggle operating member shiftable from forward to off to reverse positions and vice versa, spring means normally returning said toggle from forward or reverse positions to off position, a depressible trigger operably mounted in said handle portion, a lever pivotally mounted in said handle portion adjacent said trigger and engaging said toggle for moving the latter to either forward or reverse position in response to depression of the trigger, and shiftable means for moving said lever transversely to the plane of pivotal movement thereof, said trigger and said lever having coacting portions selectively registrable and engageable in opposite transverse positions of said lever for pivoting the lever in opposite directions, and said lever and said trigger being automatically returnable to neutral position by the action of said spring means on said toggle upon release of said trigger.

18. The device of claim 17 further characterized in that releasable locking means is provided coacting between said handle portion and said trigger for holding the latter in depressed position.

19. In an electric tool having a hollow handle portion, a reversing switch mounted in the handle portion, a toggle operating member on said switch, a transversely shiftable actuating lever in pivotal engagement with said toggle for movement thereof in forward or reverse directions, and a depressible trigger carried by said handle portion and engageable with said lever in opposite transverse positions of the latter for effecting pivotal movement of the lever in opposite directions whereby said tool is reversible by transverse shifting of said lever.

20. Switch actuating mechanism for an electric tool having a reversing switch including a switch operating member movable to a first position for forward operation of the tool and movable to a second position for reverse operation thereof, said mechanism comprising a depressible trigger, a movable actuating element mounted adjacent said trigger and engageable with the switch operating member for moving the latter either to its first position or to its second position in response to depression of the trigger, and shiftable means for bodily moving said actuating element transversely to the direction of its switch actuating movement, said trigger and said actuating element having coacting portions selectively engageable for movement of the switch operating member to its first or second positions corresponding to opposite transverse positions of said actuating element.

No references cited.