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[56]

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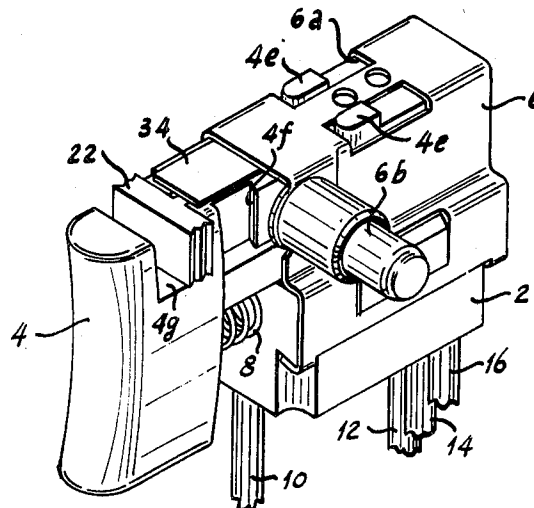
[54] **INTEGRAL REVERSING TRIGGER SWITCHES
FOR SPEED CONTROLLED PORTABLE TOOLS**
12 Claims, 22 Drawing Figs.

[52] U.S. Cl. **200/157,**
200/1 V, 173/170

[51] Int. Cl. **H01h 13/08**

[50] Field of Search **200/157,**
61.85, 1 V; 310/68 A, 50; 173/170

ABSTRACT: A self-enclosed trigger switch adapted for mounting in the handle of a portable tool and having an integral slide button reversing switch built into the upper portion of the trigger above and between the bottom recesses that hold the on-off switch movable contact and the variable resistor movable contact, with the solid-state speed control circuit being housed within the base in the usual manner. Three versions of integral reversing trigger switch are shown.



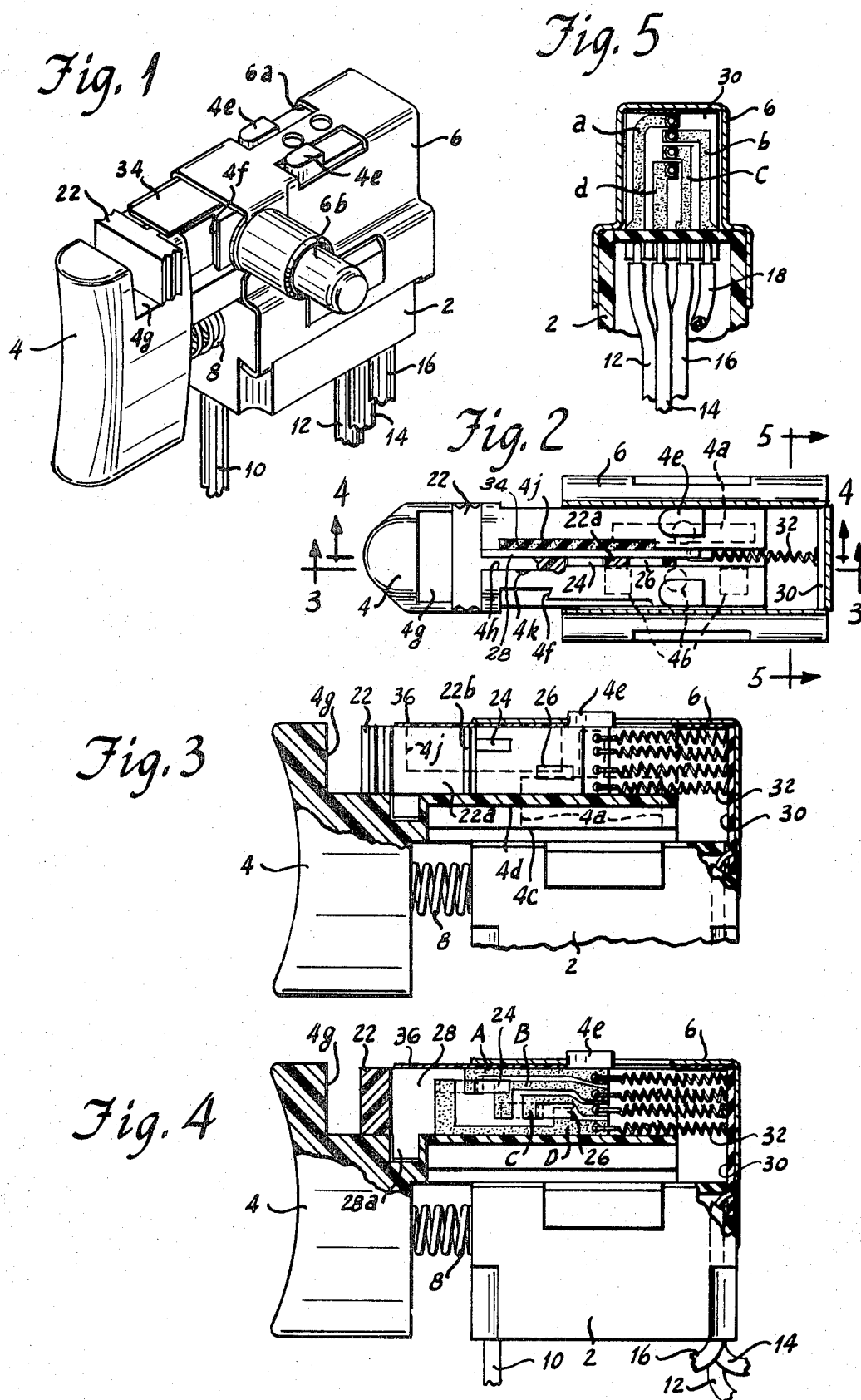


Fig. 6

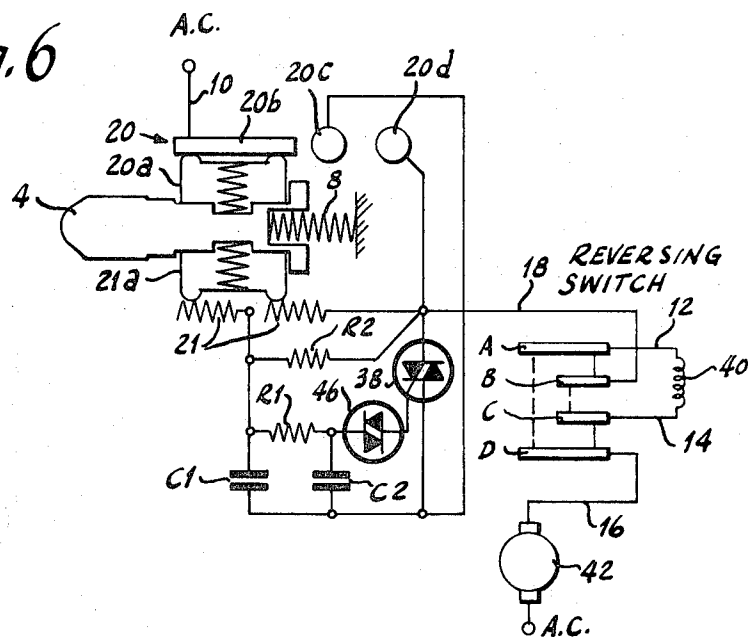


Fig. 7

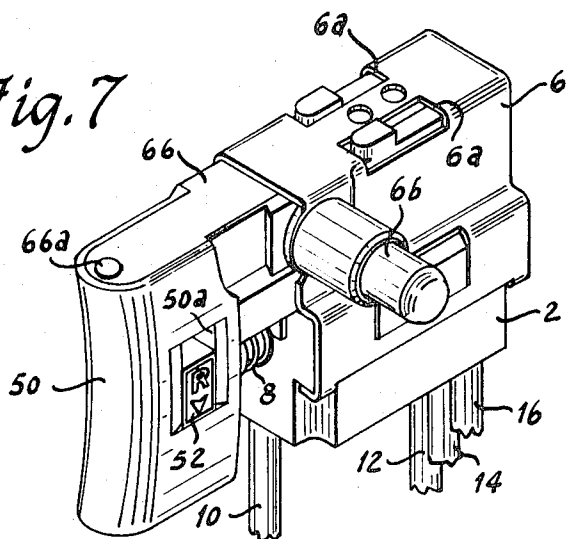


Fig. 9

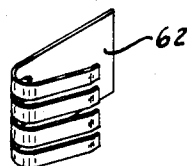


Fig. 8

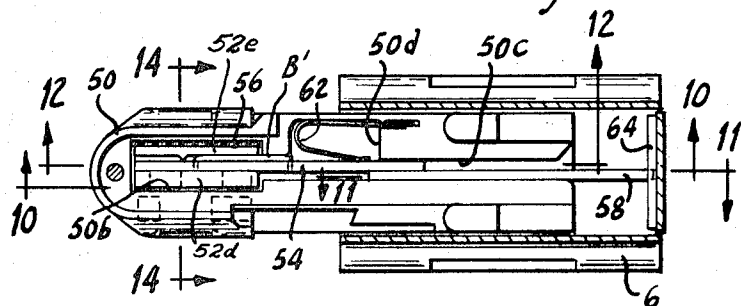


Fig. 10

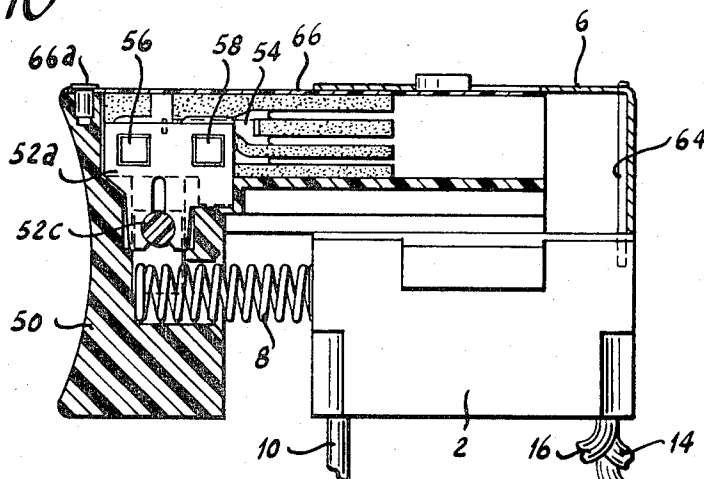


Fig. 11

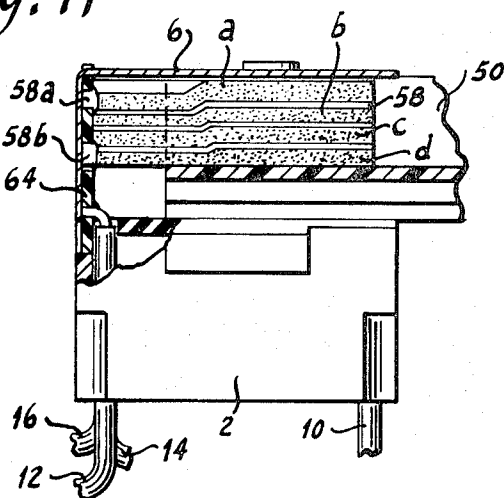


Fig. 13

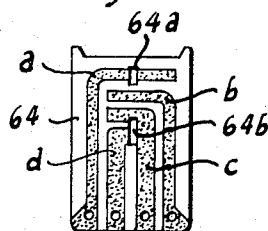


Fig. 12

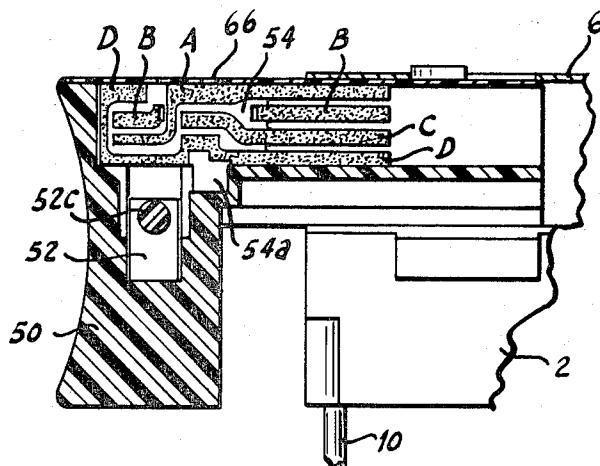


Fig. 14

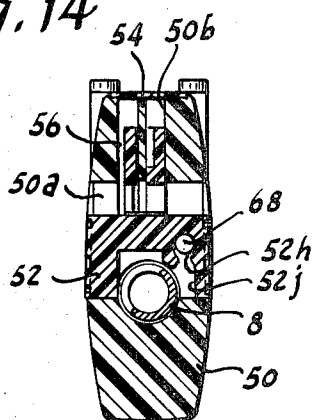


Fig. 15

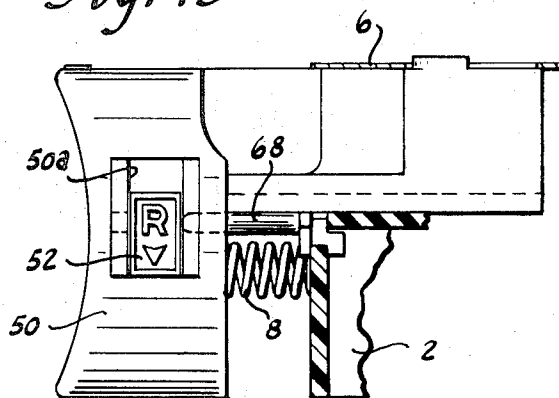


Fig. 16

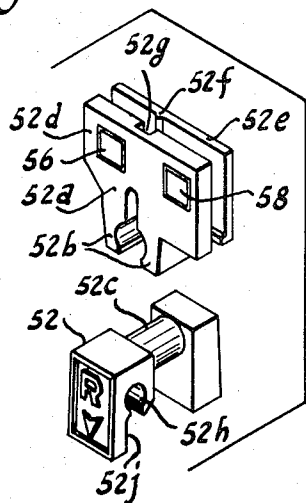


Fig. 17

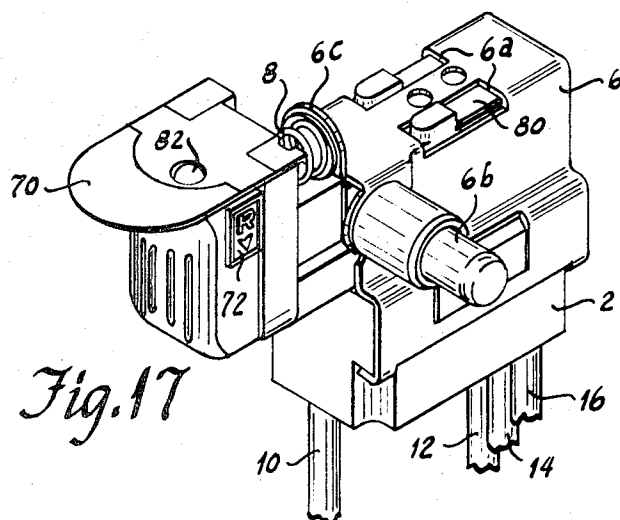


Fig. 18

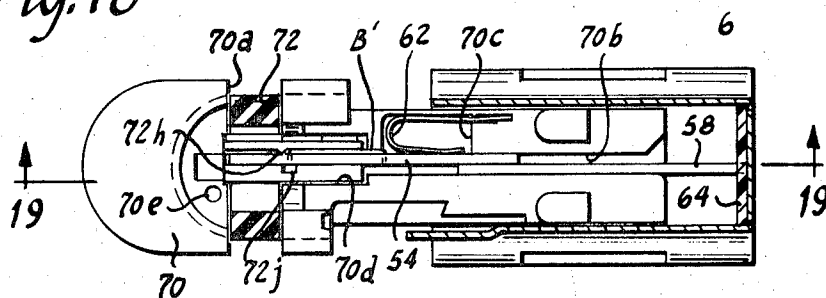


Fig. 19

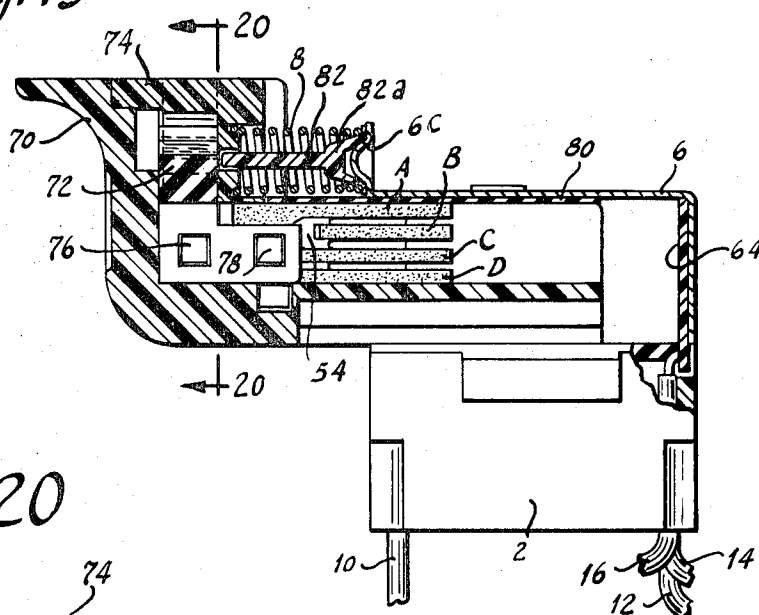


Fig. 20

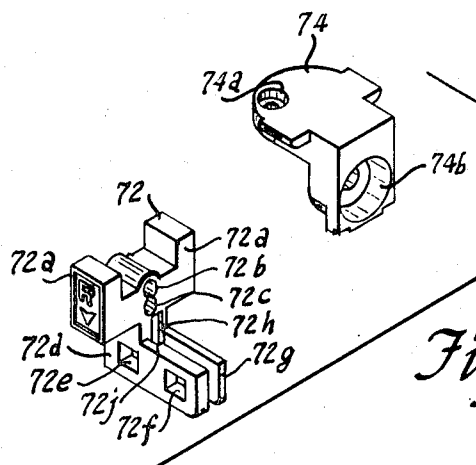
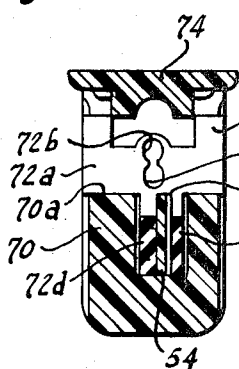
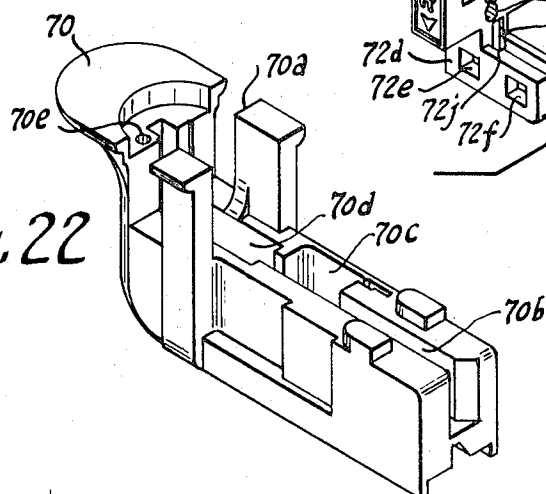


Fig. 21

Fig. 22



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INTEGRAL REVERSING TRIGGER SWITCHES FOR SPEED CONTROLLED PORTABLE TOOLS

BACKGROUND OF THE INVENTION

Nonintegral trigger speed control switches with a separate lever operated reversing switch have been known heretofore. In one version, a small double-pole double-throw switch has been mounted on top of a conventional trigger speed control switch and a pivoted lever has been mounted overlying the trigger for operating the reversing contacts. An interlock mechanism limits reversing lever operation to times when the trigger operated on-off switch is open.

Reversing trigger switches per se have also been known. In one version, a rotary shaft extending through the trigger selects reversing on-off contacts which are then closed by depressing the trigger. An interlock prevents rotation of the selector shaft when the trigger is in depressed position.

While these prior devices have been useful for their intended purposes, this invention relates to improvements thereon.

SUMMARY OF THE INVENTION

An object of the invention is to provide an integral reversing trigger speed control switch for portable tools.

Another object of the invention is to provide an improved integral reversing trigger switch.

A more specific object of the invention is to provide a built-in reversing switch within the trigger of a speed control trigger switch.

Another specific object of the invention is to provide a built-in slide button reversing switch within the trigger of a speed control trigger switch above and between the bottom recesses that hold the movable contacts of the on-off switch and the variable resistor.

Another specific object of the invention is to provide a reversing switch that occupies a very narrow space within the trigger of a speed control trigger switch.

Another specific object of the invention is to provide a trigger switch of the aforementioned type with improved interlocking means preventing operation of the reversing switch when the trigger is depressed.

Other objects and advantages of the invention will hereinafter appear.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1-5 show a first embodiment of the invention;

FIG. 1 is an enlarged isometric view of an integral reversing trigger speed control switch having a "contour" trigger design and a horizontally slidable reversing button;

FIG. 2 is a further enlarged top view of the switch of FIG. 1 with a part of the frame broken away and the insulator plate removed to show the reversing switch;

FIG. 3 is a cross-sectional view taken along line 3-3 of FIG. 2 to show the left side of the reversing switch;

FIG. 4 is a cross-sectional view taken along line 4-4 of FIG. 2 to show the switching PC (printed circuit) board inside the reversing switch; and

FIG. 5 is a cross-sectional view taken along line 5-5 of FIG. 2 to show the connecting wires and terminal board.

FIG. 6 shows a schematic circuit diagram of a reversing speed control system that may be used in any of the three versions of integral reversing trigger speed control switches illustrated;

FIGS. 7-16 show a second embodiment of the invention;

FIG. 7 is an enlarged isometric view of an integral reversing trigger speed control switch having a "contour" trigger design and a vertically slidable reversing button;

FIG. 8 is a further enlarged top view of the switch of FIG. 7 with a part of the frame broken away and the insulator plate removed to show the reversing switch;

FIG. 9 is a5 isometric view of the contact pressure spring of the switch;

FIG. 10 is a cross-sectional view taken along line 10-10 of FIG. 8 to show the left side of the reversing switch;

FIG. 11 is a partial cross-sectional view taken along line 11-11 of FIG. 8 to show the right side of the commutating PC (printed circuit) board;

FIG. 12 is a partial cross-sectional view taken along line 12-12 of FIG. 8 to show the left side of the switching PC board;

FIG. 13 is a front view of the terminal PC board that is also at the extreme right end in FIG. 8;

FIG. 14 is a cross-sectional view taken along line 14-14 of FIG. 8 to show the reversing button and interlock;

FIG. 15 is a left side view of the switch of FIG. 8 partly in section to show the interlock; and

FIG. 16 is an exploded isometric view of the reversing button parts of the switch of FIG. 8.

FIGS. 17-22 show the third embodiment of the invention;

FIG. 17 is an enlarged isometric view of an integral reversing trigger speed control switch having a so-called "bathtub" trigger design and a vertically slidable reversing button;

FIG. 18 is a further enlarged top view of the switch of FIG. 17 with a part of the frame broken away and the insulator plate removed to show the reversing switch;

FIG. 19 is a cross-sectional view taken along line 19-19 of FIG. 18 to show the left side of the reversing switch;

FIG. 20 is a cross-sectional view taken along line 20-20 of FIG. 19 to show the reversing button and interlock;

FIG. 21 is an exploded isometric view of the reversing button and retainer parts of the switch of FIG. 18; and

FIG. 22 is an isometric view of the trigger of the switch of FIG. 17.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1-5, there is shown a first embodiment of an integral reversing trigger speed control switch in accordance with the invention.

As shown in FIG. 1, the switch comprises a molded base 2 of insulating material that houses the solid state speed control circuit shown in FIG. 6. A slidable trigger 4 is mounted on top of the base and is held thereon by a metal frame 6, being biased in the forward direction by a helical compression spring 8. A conductor 10 extends down through the bottom of the forward part of base and is adapted to connect the speed control circuit to one side of an alternating current power supply as shown in FIG. 6. Three conductors 12, 14 and 16 extend down through the bottom of the rear part of the base and are adapted to connect three of the reversing switch contacts A, C and D to the motor field and armature windings, the fourth reversing switch contact B being connected through conductor 18 internally to the speed control circuit as shown in the circuit diagram in FIG. 6. The other side of the armature winding is connected to the other side of the AC power supply.

As shown in FIGS. 1-4, the forward part of the trigger is provided with a contoured part that is engaged by the forefinger of the user to pull the trigger in operation against the bias of spring 8. The bottom of the part of the trigger that slides over the base is provided with the conventional recesses shown in broken lines in FIG. 2 and illustrated in more detail in FIGS. 4-7 of H. W. Brown et al. U.S. Pat. No. 3,447,057 dated May 27, 1969, and assigned to the assignee of this invention. Recess 4a accommodates movable contact 20a FIG. 6, of on-off switch 20 with its bias spring being placed in the deeper round hole at the center. Recesses 4b accommodate sliding contact 21a, FIG. 6, of the variable resistor 21 with its bias spring being positioned in the round center recess. Shallow recess 4c provides clearance for the on-off contacts and resistor strips, and center groove 4d receives an insulating barrier between the on-off switch and the variable resistor as shown in the aforementioned Brown et al. patent.

The top of the trigger is provided with a pair of integrally molded upward projections 4e that extend up through rectangular apertures 6a in the frame to function as stops against the ends of these apertures in known manner.

The frame is provided with the usual mounting bushing 4 for a lock button 6b that engages a shoulder rf in the left side of the trigger to lock the trigger in its depressed position, this lock button being spring biased to cause it to snap out for automatic release upon slight further depression of the trigger.

The reversing switch is entirely housed within the upper part of the trigger. This reversing switch comprises a generally T-shaped slide button 22 most clearly shown in FIG. 2, two movable bridging contacts 24 and 26 held in a pair of apertures in the shank of the T-shaped slide button most clearly shown in FIG. 3, a reversing PC (printed circuit) board 28 most clearly shown in FIG. 4, and a terminal PC board 30 most clearly shown in FIG. 5. This reversing switch also comprises electrical connectors in the form of four helical tension springs 32 connecting the contact strips on the reversing PC board to the respective connector strips on the terminal PC board, the reversing PC board being movable with the trigger and the terminal PC board being stationary. This reversing switch further comprises biasing means such as a foam or sponge pressure pad 34 providing contact pressure between the bridging contacts and the contact strips on the reversing PC board as shown in FIG. 2. While a pressure pad has been shown, it will be apparent that other biasing means such as a leaf spring or the like could be used in place thereof.

Considering the aforementioned parts of the reversing switch in more detail, the T-shaped slide button is mounted on its back on the trigger with its T-bar in a transverse slot 4g that extends through the top of the contoured part of the trigger. As shown in FIGS. 1-4, this slot in the trigger is wide enough so that the slide button can be slid forward from the position in which it is shown sufficiently to change the contact bridging from contact strips A-B and C-D shown in solid lines in FIGS. 4 and 6 to contact strips A-D and B-C shown in dotted lines in FIGS. 4 and 6. This effects a reversal of the motor field energization thereby to reverse the motor direction of rotation.

The aforesaid T-shaped slide button is also provided with a flat shank 22a that is slidably mounted in a narrow channel 4h in the top of the trigger as shown in FIGS. 2 and 3. This narrow channel is wide enough left to right to accommodate also reversing PC board 28. A part 4j of this narrow channel indicated by broken lines in FIG. 3 is slightly wider to receive the aforementioned pressure pad 34. As shown in FIG. 3, this part 4j of the narrow channel stops short of recess 4a that holds the movable contact of the on-off switch, showing that there is enough room in this trigger for all the parts as described. To provide detent positioning of the slide button, the left surface of this narrow channel is provided with two spaced vertical V-shaped grooves 4k shown in FIG. 2 for receiving a complementary V-shaped rib 22b integrally molded on the shank of the slide button forwardly of the movable contact apertures as shown in FIGS. 2 and 3. Thus, the rib will enter one groove when the slide button is pushed forward and will enter the other groove when the slide button is pushed rearward to hold it in either operating position.

Reversing PC board 28 is a generally rectangular flat insulating board on which are mounted four printed circuit contact strips A, B, C and D as shown in FIG. 4. This reversing board has one ear 28a and its lower forward corner that enters a recess within the trigger to secure it in the trigger. A spring 32 connects each of the contact strips to a respective connector strip a, b, c, and d on terminal board 30 as shown in FIGS. 4 and 5.

As shown in FIG. 5, terminal PC board 30 has the four connector strips a, b, c, and d mounted thereon and this board is rigidly mounted in the rear of the frame back of the trigger. Since the trigger moves and this terminal PC board is stationary, the helical springs constitute convenient means for making the electrical connections therebetween. A suitable insulator plate 36 is placed between the top of the trigger and the frame to close channel 4h and to insulate the uppermost helical spring 32 from the frame. As shown in FIG. 5, four insulated wires 12, 14, 16 and 18 are connected to connector strips a, b, c, and d, respectively, and serve to connect the reversing

switch to the speed control circuit and motor as shown in FIG. 6.

From the foregoing, it will be apparent that reversing button 22 is operated to preselect the direction of motor operation. Thereafter, the trigger is pulled to close the on-off switch to start the motor running and to adjust the variable resistor to vary the motor speed.

Referring to FIG. 6, it will be seen that when on-off switch 20 is closed by depression of trigger 4, current will flow from the upper side of the AC power supply through conductor 10, contacts 20a-c, triac 38, conductor 18, contact strips B and A, conductor 12, field winding 40, conductor 14, contact strips C and D of the reversing switch, conductor 16 and armature winding 42 to the lower side of the AC power supply. It will be apparent that if the reversing switch had been operated to the dotted line position instead of the solid line position, the current would have flowed up through the field winding instead of down while continuing to flow in the same direction through the armature winding, thereby causing the motor to run in the other direction. When the trigger is depressed further, slider 21a of the variable resistor 21 reduces the resistance in the circuit to accelerate the motor. This comes about by the reduced resistance allowing a greater current to flow to capacitor C1 and through resistor R1 to capacitor C2 to charge the latter sooner and to cause breakover of trigger diode 46 sooner on each half-cycle of the alternating voltage. Resistor R2 is a trimming resistor. When the trigger is depressed still further, the on-off switch at contact 20d shunts the solid state speed control circuit to put the motor across the power line for maximum speed. Reference may be had to the aforementioned Brown et al. patent for a fuller description of operation of this circuit.

The second embodiment of the invention shown in FIGS. 7-16 is generally similar to the first embodiment in that it is applied to a contour trigger but differs in that the reversing switch button is arranged to move up and down instead of forward and rearward. Also, there is provided an interlock mechanism to prevent movement of the reversing switch slide button when the trigger is in depressed position. In this second version of integral reversing trigger speed control switch similar parts have been given reference characters like those in the first embodiment.

As shown in FIG. 7, this second version has a base 2 and a frame 6 like those in FIG. 1, the frame having stop apertures 6a formed therein and a lock button 6b mounted thereon. Also, a similar conductor 10 extends out through the forward bottom of the base and conductors 12, 14, and 16 extend out through the rear bottom of the base. And a similar trigger return spring 8 of the helical compression type is positioned between the forward wall of the base and the trigger.

As shown in FIGS. 7, 14 and 15, trigger 50 is provided at its forward forefinger engaging portion with a generally rectangular aperture 50a longer vertically than horizontally to permit upward and downward sliding of a reversing button 52 mounted therein. The left and right finger-engaging sides of this button are substantially coextensive with the surfaces of the trigger but the sides of the aperture are beveled in as shown in FIGS. 7 and 8 to allow gripping of the slide button with the fingers. Another aperture 50b extends down from the top of the trigger into aperture 50a for accommodating the contact carrying portion of the reversing slide button.

This reversing button 52 is a two-piece structure as shown in FIG. 16 having in addition to the finger engaging portion an upper bifurcated contact carrying portion 52a. This slide button is molded of suitable insulating molding material having sufficient resiliency so that the two legs 52b of the contact carrying portion snap onto cylindrical connecting portion 52c of the finger engaging portion in gripping assembled relation after the two parts have been inserted within the trigger.

The upper laterally bifurcated portion 52a has a generally flat left part 52d and a generally flat right part 52e as shown in FIG. 16 separated by a narrow space wide enough to receive a switching PC board 54 as shown in FIGS. 8 and 14. As shown

in FIG. 10, left part 52d has two apertures for retaining bridging contacts 56 and 58 that are confined laterally between the left internal wall of aperture 50b of the trigger and the switching PC board as shown in FIGS. 8 and 14. The right part 52e has a central vertical rib 52f molded integrally thereon that presses against the back of switching PC board 54 to take up any tolerances and to press the contact strips against the bridging contacts. The trigger has a narrow channel 50c along the top part thereof, being wider at its forward end where it combines with aperture 50b, to receive the bifurcated portion of the slide button, the forward end of the switching PC board and a pressure pad 56 which except for its size is similar to pressure pad 34 hereinbefore described in connection with FIG. 2. As will be apparent, this pressure pad provides the required contact pressure between the bridging contacts and the printed circuit contact strips of the reversing switch.

The rearward part of channel 50c in the trigger is sufficiently wide to accommodate the rear part of switching PC board 54 and a commutating PC board 58 in relatively slidable overlapping relation as shown in FIG. 8. A pocket 50d is formed in the right wall of this channel for holding a leaf spring 62 (FIGS. 8 and 9) or the like having four resilient fingers that apply a force against the back of the fingers of the switching PC board where it overlaps the commutating PC board so as to insure good electrical contact between the contact strips on the former and the respective connector strips on the latter.

The rear end of commutating PC board 58 is rigidly secured to a terminal PC board 64 mounted transversely at the rear of the switch frame as shown in FIGS. 8 and 11. And the four connector strips on the commutating PC board are electrically connected as by soldering to respective connector strips on the terminal PC board shown in FIG. 13, the latter being connected by wires to the speed control and external circuits as herein after more freely described.

Referring more specifically to switching PC board 54 as shown in FIG. 12, it is generally rectangular and flat, divided into four fingers at its rear end, and is provided with four contact strips A, B, C and D on the left surface thereof equivalent to those shown schematically in FIG. 6. Whereas the contact strips in the first embodiment shown in FIG. 4 were arranged for horizontal movement of the bridging contacts, in this second embodiment these contact strips are arranged for vertical movement of the bridging contacts. The two parts of contact strip B shown in FIG. 12 are connected by a jumper B' shown in FIG. 8 extending along the back of the PC board with its ends coming through to the front through two small holes and being soldered to the two strips B. Thus, it will be seen that when the slide button is in its lower position as shown, contact 56 will bridge contact strips A and B and contact 58 will bridge contact strips C and D as shown by solid lines in FIG. 6. This will cause operation of the motor in one direction. When the slide button is moved to its upper position, contact 56 will bridge contact strips B and D and contact 58 will bridge contact strips A and C. While this connection is not shown in FIG. 6, it will be apparent that it will cause reversal of the motor provided the connections of conductors 12 and 18 are interchanged. This switching PC board is held fixed in the trigger by a downwardly projecting ear 54a that fits in a slot in the trigger as shown in FIG. 12.

Commutating board 58 is generally rectangular and flat and is provided with four connector strips a-d extending along the right surface as shown in FIG. 11 and positioned so that the respective contact strips A-D on the four fingers of the switching PC board slide therealong when the trigger is depressed. In this way, electrical connection is maintained between the stationary and movable parts. The rear end of this commutating PC board is provided with two spaced projections 58a and 58b shown in FIG. 11 that fit into complementary holes 64a and 64b in the terminal PC board shown in FIG. 13 to rigidly secure the two boards together in T-formation as viewed from the top in FIG. 8. Connector strips a-d are ar-

ranged on this terminal board so that they line up with the corresponding connector strips on the commutating PC board and are respectively soldered together. The inner wall of the left bifurcation of contact carrier 52d has a vertical groove 52g providing clearance for the soldered left end of jumper B'. The lower ends of the connector strips on the terminal board are connected to wires 12, 14 and 16 and internal wire 18 as shown in FIG. 11 whereby the reversing switch is connected to the motor speed control system.

As shown in FIGS. 7 and 10, the top of the trigger is covered by an insulating plate 66 that is held to the trigger by a drive screw 66a or the like at its forward end. This plate insulates the reversing switch parts from frame 6.

This second embodiment of the switch is also provided with an interlock mechanism shown in FIGS. 14 and 15. This interlock mechanism comprises a pin 68 mounted to the base and arranged to enter one of two holes 52h or 52j in the reversing button when the trigger is depressed to prevent movement of the reversing button. Thus, when the reversing button is in its lower position as the trigger is depressed, pin 68 enters upper hole 52h as shown in FIG. 14. The construction below this hole prevents sliding of the button upward as long as the trigger is depressed. When the reversing button is in its upper position as the trigger is depressed, pin 68 enters in the space 52j below the constriction whereby the latter prevents sliding the button down as long as the trigger is held in. This prevents reversal of the power to the motor when it is running and permits lower rating reversing contacts since they are operated only when the power is off at the on-off switch.

The lower part of the trigger has not been shown as it is the same as thereinbefore described in connection with the first embodiment and includes the recesses for the on-off switch and variable speed control resistor. And the switch base may house a speed control circuit as shown in FIG. 6.

The third embodiment of the invention differs from the others in that a "bathtub" shaped trigger is used. It has the similarity to the second embodiment in that the reversing button is moved vertically. In FIGS. 17-22 reference characters similar to those in the earlier figures are used for like parts.

Referring to FIG. 17, this version of integral reversing trigger speed control switch has a base 2 and conductors 10, 12, 14 and 16 exiting from the bottom thereof like those hereinbefore described. Frame 6 is also similar and has a lock button 6b mounted thereon and apertures 6a but differs only in that it additionally has an upstanding tab 6c forming a retainer for the trigger return spring 8. Because in this style of trigger, the forefinger engageable portion extends up rather than down as in the contour type of trigger in FIGS. 1-16, the trigger return spring must be located above the top of the frame as shown in FIGS. 17 and 19 rather than between the front wall of base and the trigger as in FIG. 3 and 10.

The recesses in the bottom of the trigger portion that slides over the base and which retain the movable contacts of the on-off switch and variable resistor are like those hereinbefore described and illustrated by dotted lines in FIG. 2.

Referring to FIGS. 17-22 showing the third version of integral reversing trigger speed control switch trigger 70 is of the general configuration shown in H. W. Brown U.S. Pat. No. 3,329,842, dated July 4, 1967. In this version, the reversing slide button 72 is inverted as compared to the second embodiment of the invention in that button is above and the contact carrying part is below it as shown in FIGS. 19-21.

Trigger 70 has a through slot 70a, left to right, for holding slide button 72 as shown in FIG. 20. A retainer 74 shown in FIGS. 19-21 retains the reversing button in place and allows it to be slid up and down to reverse the motor.

The trigger also has a narrow channel 70b shown in FIG. 22 extending rearward along its top from the through slot for accommodating a switch PC board 54 and a commutating PC board 58 shown in FIG. 18 similar to those shown in FIGS. 11 and 12 of the second embodiment of the invention. Also, a spring 62 similar to that shown in FIGS. 8 and 9 is confined in a pocket 70c in FIG. 18 to apply connector pressure between

the switching and commutating PC boards. A terminal board 64 shown in FIG. 18 similar to that hereinbefore described is similarly arranged and connected at the rear of the frame for like purposes.

The parts that differ from the second embodiment will now be described. As shown in FIG. 21, slide button 72 is a one piece structure or molding of electrically insulating material having the two finger-engageable parts 72a that extend to the left and right sides of the trigger. Between these two parts, there are two holes 72b and 72c one above the other, for receiving an interlocking pin hereinafter described. Below these two holes, the slide button is laterally bifurcated with rearward projections for proper orientation of the bridging contact holes. This bifurcated part extends down into a widened section 70d of channel 70b shown in FIGS. 18 and 22. The left member 72d of the bifurcation has two holes 72e and 72f for retaining the two bridging contacts 76 and 78 shown in FIG. 19. The right member 72g of the bifurcation is spaced enough from the left member to provide tight-fitting space for the switching PC board. This right member is provided at its center with a vertical rib 72h shown in FIGS. 18 and 20 that presses against the back of the switching PC board to take up tolerances and to provide contact pressure between the bridging contacts and the contact strips of the switching PC board. The inner wall of left member 72d has a vertical groove 72j shown in FIGS. 18 and 21 to provide clearance for the soldered left end of jumper B' where it comes through the switching PC board.

A suitable insulating flat plate 80 lies over the trigger to insulate the reversing switch from the top of frame 6 as shown in FIG. 19.

Retainer 74 shown in FIG. 21 is a generally angular shaped molded member that holds the slide button in place. The upper part of this retainer is provided with a screw hole 74a through which a screw 82 is inserted and threaded into a hole 70e in the trigger as shown in FIGS. 17 and 18. The downward angle of retainer 74 is provided with a round recess 74b for retaining the forward end of trigger return spring 8 while the spring is held in compression between it and tab 6c of the frame.

This trigger return spring provides a convenient receptacle for an interlock pin 82 as shown in FIG. 19. This pin has an enlarged concave rear end 82a that fits around a bead formed on table 6c and is surrounded by and held against this tab by spring 8. The front end of this pin extends to but is clear of slide button 72 when the trigger is undepressed thereby allowing movement of the slide button as desired. When the trigger is depressed, the front end of this interlock pin enters hole 72b or hole 72c in the slide button depending upon the position of the latter to prevent operation of the reversing switch when the on-off switch is closed.

From the foregoing, it will be apparent that the invention provides a compact reversing switch for a trigger operated device that is entirely enclosed within the trigger except for the left and right ends of its slide button that may be gripped by the thumb and forefinger to operate the reversing switch from one position to another. The several embodiments of the invention show how it can be applied to two well-known trigger styles that have been used in speed control trigger switches. These embodiments also show how the invention can be applied to afford either a horizontally slidable or a vertically slidable reversing button. In addition, the second and third embodiments show that a number of the parts can be made so that they can be used in either of the trigger styles.

While the apparatus hereinbefore described is effectively adapted to fulfill the objects stated, it is to be understood that the invention is not intended to be confined to the particular preferred embodiments of integral reversing trigger switches for speed controlled portable tools disclosed, inasmuch as they are susceptible of various modifications without departing from the scope of the appended claims.

I claim:

1. In a trigger switch having a base and a spring biased trigger and means mounting the trigger for reciprocal movement on the base and including an on-off switch adapted to be operated by the trigger, the improvement comprising:

an integral reversing switch built into the trigger and comprising:

a plurality of contacts and means mounting said contacts within the trigger;

at least one movable contactor mounted within the trigger;

a contact actuator mounted within the trigger and being exposed for movement by the fingers of the user and adapted to move said movable contactor so as to make a first or a second connection between said contacts;

stationary terminals mounted to said base;

and commutating means maintaining electrical connections between said contacts and the respective stationary terminals.

2. The invention defined in claim 1, wherein said plurality of contacts and means mounting said contact within said trigger comprise;

a printed circuit board on which said contacts are formed as contact strips;

and a channel within said trigger rigidly retaining said printed circuit board from movement relative to the trigger.

3. The invention defined in claim 1, wherein said contact actuator comprises:

a slide button having portions exposed on two sides of the trigger adapted to be gripped by the thumb and forefinger of the user for sliding the same;

and a contact carrier portion wherein the trigger having a hole for retaining said movable contactor.

4. The invention defined in claim 1, wherein said commutating means comprises:

a plurality of tension springs connected between said contacts and the respective stationary terminals forming resilient electrical connections therebetween to allow movement of the trigger.

5. The invention defined in claim 1, wherein said stationary terminals mounted to said base comprise:

a printed circuit board mounted to said base at the rear of the trigger and having terminal strips formed thereon for the respective contacts.

6. An integral reversing trigger switch comprising:

an insulating base;

a spring biased trigger;

an on-off switch mounted on said base and adapted to be operated by said trigger;

means mounting said trigger for reciprocal movement on said base for operation of said on-off switch when said trigger is depressed and for restoration of said on-off switch when said trigger is released for return under spring force;

and an integral reversing switch within said trigger comprising;

means mounting a plurality of contact members within said trigger;

a pair of movable bridging contacts within said trigger;

a contact actuator comprising a contact carrying portion within said trigger adapted to move said bridging contacts from a position where they engage first pairs of said contact members to a reversing position where they engage different pairs of said contact members;

said contact actuator also comprising a slide button portion substantially coextensive with the surfaces of said trigger and exposed for movement by the fingers of the user;

and connector means maintaining electrical connections between said contact members within said movable trigger and electrical leads within said base.

7. The invention defined in claim 6, together with,

interlocking means operative when said trigger is depressed for preventing movement of said contact actuator thereby to prevent operation of said reversing switch when said on-off switch is closed.

8. The invention defined in claim 6, wherein:
 said slide button portion of said contact actuator is arranged
 to move in a direction transverse to the direction of
 trigger movement;
 together with interlocking means comprising a pin that en- 5
 ters a hole in said slide button portion when said trigger is
 depressed to prevent operation of said reversing switch
 when said on-off switch is closed.

9. The invention defined in claim 6, wherein said spring
 biased trigger comprises; 10
 a contour trigger form having a forefinger engageable por-
 tion extending down alongside the front of said base in
 which said slide button portion of said contact actuator is
 slidably mounted.

10. The invention defined in claim 6, wherein said spring 15
 biased trigger comprises:
 a bathtub trigger form having its forefinger engageable por-
 tion extending upwardly of said base in which said slide
 button portion of said contact actuator is slidably 20
 mounted.

11. In an integral reversing trigger for speed controlled
 portable tools, the combination comprising:
 an insulating base;
 a solid state speed control circuit mounted within said base;
 a spring biased trigger; 25
 an on-off switch and a variable resistor mounted on said
 base and having movable contacts held in recesses in the
 bottom of said trigger whereby they are adapted to be
 operated by said trigger;
 said on-off switch and variable resistor being electrically 30
 connected to said solid state speed control circuit;
 means mounting said trigger for reciprocal movement on

said base for operation of said on-off switch and said vari-
 able resistor when said trigger is depressed and for
 restoration of the same when said trigger is released for
 return under spring force;
 and an integral reversing switch within said trigger above
 and between said bottom recesses comprising:
 a reversing switch actuator having a button portion exposed
 at the surface of said trigger for movement between a first
 and a second position and a contact carrying portion
 within said trigger;
 a pair of bridging contacts mounted on said contact carrying
 portion;
 an insulating board held within a channel in said trigger and
 having reversing contact strips mounted thereon;
 means biasing said bridging contacts against respective first
 pairs of said reversing contact strips when said button
 portion of said actuator is in said first position and biasing
 said bridging contacts against respective different pairs of
 said reversing contact strips when said button portion is
 moved to said second position;
 and connector means maintaining electrical connections
 between said reversing contact strips within said movable
 trigger and said solid state speed control circuit and exter-
 nally extending leads adapting the latter to be connected
 to the tool motor.

12. The invention defined in claim 11, wherein said connec-
 tor means comprises:
 a printed circuit commutator board fixed relative to said
 base and having connector strips formed thereon making
 sliding contact with respective reversing contact strips
 throughout said trigger operation.

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