CONTACT-AND CIRCUIT-MOUNTING BOARD FOR TRIGGER-OPERATED SWITCH UNIT

11 Claims, 6 Drawing Figs.

ABSTRACT: A contact- and circuit-mounting board of unitary construction is contained within the housing of the switch unit. This board mounts fixed contacts which cooperate with other contacts carried by a reversing lever mounted adjacent the trigger. This board also mounts contact strips which are slidably engaged by contact fingers carried by the trigger thereby to define an on-off switch, a bypass switch and a variable resistor forming part of a speed control circuit. The elements of the circuit are contained on a printed circuit board, the latter being secured to the mounting board.
CONTACT-AND CIRCUIT-MOUNTING BOARD FOR TRIGGER-OPERATED SWITCH UNIT

OBJECTS OF THE INVENTION

A primary object of the present invention is the provision of a new and improved contact and circuit-mounting board for a trigger-operated speed control switch or the like.

Another object of the invention is the provision of a mounting board of the type described wherein such board supports first and second contact means cooperating respectively with third and fourth contact means, the latter being carried by a reversing lever and the trigger, respectively.

Still another object of the present invention is the provision of a mounting board of the type described, wherein such mounting board includes contact strips arranged to be slidable engaged by contact fingers carried by the trigger, one of such fingers and one of such strips defining a variable resistor forming part of a speed control circuit.

Another object of the present invention is the provision of a new and improved mounting board according to the foregoing object, wherein a printed circuit board is secured to such mounting board, the printed circuit board carrying the contact strip which defines the variable resistor as well as the various circuit elements defining the speed control circuit.

These and other objects and advantages of the invention will become apparent from the following specification disclosing a preferred embodiment shown in the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a trigger-operated switch unit embodying the present invention, with an outer housing member being removed to expose one side of the unitary contact and circuit mounting board;
FIG. 2 is a side elevational view similar to FIG. 1 with the mounting board being removed to expose the contacts carried by the reversing lever and the trigger;
FIG. 3 is a section taken along the line 3-3 of FIG. 1;
FIG. 4 is a fragmentary section taken along the line 4-4 of FIG. 3;
FIG. 5 is an elevation of the side of the contact and circuit mounting board opposite the side thereof shown in FIG. 1; and
FIG. 6 is an electrical schematic of the trigger-actuated switch unit connected with the motor of a portable electric tool or the like.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring particularly to FIG. 2, the trigger-operated switch unit of the present invention includes a housing member

position. Abutting engagement of trigger surface 32 with housing wall surface 32a serves as a stop to limit outward movement of the trigger.

The trigger may be provided with adjustable stop and lock means as disclosed and claimed in Frenzel U.S. Pat. No. 3,309,484. To this end, the trigger mounts an adjustment knob or button 33 which rotates a screw (not shown) in threading engagement with a lug 34 for moving the latter longitudinally of the trigger stem and relative thereto. This lug, which is arranged to abut stop means (not shown), acts as an adjustable stop to define the length of the trigger stroke. This lug also includes a latch surface 34a adapted to be engaged by the locking pin 35 (FIG. 4) so as to lock the trigger in any of its fully depressed positions. A locking button 36 is secured to the locking pin 35 and a coil spring 37 is provided for urging the locking button to its outermost position.

The trigger 28 carries a contact, generally designated 40, which contact includes three contact fingers 41, 42 and 43. As will be explained herein, these contact fingers engage fixed contacts supported by the mounting board which forms part of the present invention. As noted in FIG. 4, the contact 40 is received within a slot 44 formed in the trigger stem. The tension of the contact fingers is such that the latter, by reason of their engagement with the fixed contacts to be referred to hereinbelow, serve to retain the contact 40 in slot 44 without the aid of fastening means.

The unitary contact and circuit mounting board of the present invention is generally designated 45. As noted in FIG. 3, this board is secured to the housing member 10 and forms with the latter a closed housing space. Referring to FIG. 5, the mounting board 45 supports a horizontal row of equally spaced contacts 46-50. Different pairs of these contacts are engaged by the contact balls 21, 22 in response to movement of the reversing lever 19 as will be explained below.

The mounting board 45 further supports a first contact strip 52, another contact strip 53, and a contact button 54. It will be understood that the contact finger 41 is arranged for wiping engagement with the contact strip 52 and that the contact finger 42 is arranged for sliding or wiping engagement with the contact strip 53. When the trigger is fully depressed, the finger 42 separates from the strip 53 and comes into engagement with the contact button 54.

A printed circuit board, generally designated 57, is secured, as by means of an adhesive, to the mounting board 45. This circuit board is preferably of the type disclosed and claimed in the copending application of Conrad D. Robertson, Ser. No. 845,317, filed July 28, 1969, Case No. 690,503. To this end, the circuit board 57 supports a contact strip 58 formed of resistance material; this strip is engaged by the contact finger 43 and cooperates with the latter to define a variable resistor.

The circuit board 57 also mounts (FIG. 6) a fixed resistor 59, an unencapsulated capacitor 60, a chip-type diode 61, a chip-type trigger device 62 and a chip-type semiconductor 63, each of which is a silicon controlled rectifier.

Reference should be had to the aforesaid Robertson application for a more detailed description of the electronic components on the circuit board 57 and the manner in which they are electrically connected. Preferably, the electronic elements on such board define a nonfeedback type of speed control system as disclosed and claimed in Gawron U.S. Pat. No. 3,209,228.

As shown in FIG. 6, the trigger-actuated switch is connected with a suitable motor of the reversible type having respective armature and field windings 65 and 66. The switch unit, when mounted in a tool and connected with the motor, may be energized from a suitable source of alternating current indicated by the lines 67, 68. The operation of the switch is as follows:

When the trigger is in its fully extended position, the contact finger 41 is separated from the strip 52, thereby breaking the circuit to the motor and defining an "off" position. After the trigger is depressed just a short distance, the finger 41 comes into sliding engagement with the contact strip 52, thereby completing a circuit to the motor through the speed control
We claim:

1. In a trigger-operated switch unit for installation in a portable electric tool or the like, the improvement comprising:
   a. said unit including a housing;
   b. a trigger movably mounted by said housing;
   c. a reversing lever movably mounted by said housing;
   d. first and second contact means in said housing and carried respectively by said trigger and said reversing lever for movement therewith;
   e. means in said housing defining a unitary contact and circuit mounting board;
   f. third and fourth contact means fixed to said mounting board and arranged for respective engagement by said first and second contact means;
   g. first circuit elements on said board cooperating with said first and third contact means to define a circuit for energizing the associated tool motor upon actuation of said trigger;
   h. second circuit elements on said board cooperating with said second and fourth contact means to define a circuit for establishing the direction of rotation of the associated tool motor upon actuation of said reversing lever.

2. The improvement according to claim 1 further defined by:
   a. said second contact means being defined by a pair of contact elements carried by the reversing lever;
   b. said fourth contact means being defined by five contact members mounted on said board in spaced relation from each other;
   c. said pair of contact elements establishing a current path through said said first and second contact members and another current path through said third and fourth contact members when said reversing lever is in one of two positions thereof, said pair of contact elements establishing a current path through said second and third contact members and another current path through said fourth and fifth contact members when said reversing lever is in the other of its two positions.

3. The improvement according to claim 1 further defined by:
   a. said first contact means including a plurality of contact fingers carried by said trigger for movement therewith;
   b. said third contact means including a plurality of contact strips on said board arranged for being slidably engaged by respective contact fingers.

4. The improvement according to claim 3 wherein one of said fingers and one of said contact strips cooperate to define a variable resistor forming part of a variable speed control circuit constituting said first mentioned circuit.

5. The improvement according to claim 4 further defined by, a printed circuit board secured to said mounting board, said circuit board carrying said one contact strip.

6. The improvement according to claim 5 wherein said first circuit elements are mounted on said circuit board.

7. The improvement according to claim 1 further defined by:
   a. said second contact means being defined by a pair of contact elements carried by the reversing lever;
   b. said fourth contact means being defined by five contact members mounted on said board in spaced relation from each other;
   c. said pair of contact elements establishing a current path through said first and second contact members and another current path through said third and fourth contact members when said reversing lever is in one of two positions thereof, said pair of contact elements establishing a current path through said second and third contact members and another current path through said fourth and fifth contact members when said reversing lever is in the other of its two positions;
   d. said first contact means including a plurality of contact fingers carried by said trigger for movement therewith; and
e. said third contact means including a plurality of contact strips on said board arranged for being slidably engaged by respective contact fingers.

8. The improvement according to claim 7 wherein one of said contact fingers and one of said contact strips cooperate to define a variable resistor forming part of a variable speed control circuit constituting said first mentioned circuit.

9. The improvement according to claim 8 further defined by, a printed circuit board secured to said mounting board, said circuit board carrying said one contact strip.

10. The improvement according to claim 7 wherein said circuit board mounts said first circuit elements.

11. In a trigger-operated switch unit for installation in a portable electric tool or the like, the improvement comprising:
   a. said unit including a housing;
   b. a trigger movably mounted by said housing;
   c. a reversing lever movably mounted by said housing;
   d. first and second contact means in said housing which are moved in response to movements of said trigger and said reversing lever, respectively;
   e. said first contact means including a wiper finger;
   f. means in said housing defining a unitary contact and circuit mounting board;
   g. third and fourth contact means fixed to said mounting board and arranged for respective engagement by said first and second contact means;
   h. a printed circuit board secured by said mounting board with the former in coextensive physical contact with a portion of the latter, said printed circuit board carrying a plurality of elements defining a speed control circuit, one of such elements being a resistance strip slidably engaged by said wiper finger upon movement of said trigger; and
   i. other circuit elements on said board in direct physical contact therewith and cooperating with said second and fourth contact means to define a circuit for establishing the direction of rotation of the associated tool motor upon actuation of said reversing lever.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,590,194
Dated June 29, 1971

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and
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It is certified that errors appear in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 25, insert a period (.) after "position"; delete "to" and insert --To--.

Column 4, line 33, after "one" insert --of two--.

Signed and sealed this 14th day of March 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents