

[54] **BELL-CRANK LEVER TRIGGER SWITCH WITH TRIGGER DEPRESSION ADJUSTMENT MEANS**

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[51] Int. Cl. **H01h 9/06**

[58] Field of Search **200/157**

[56] **References Cited**

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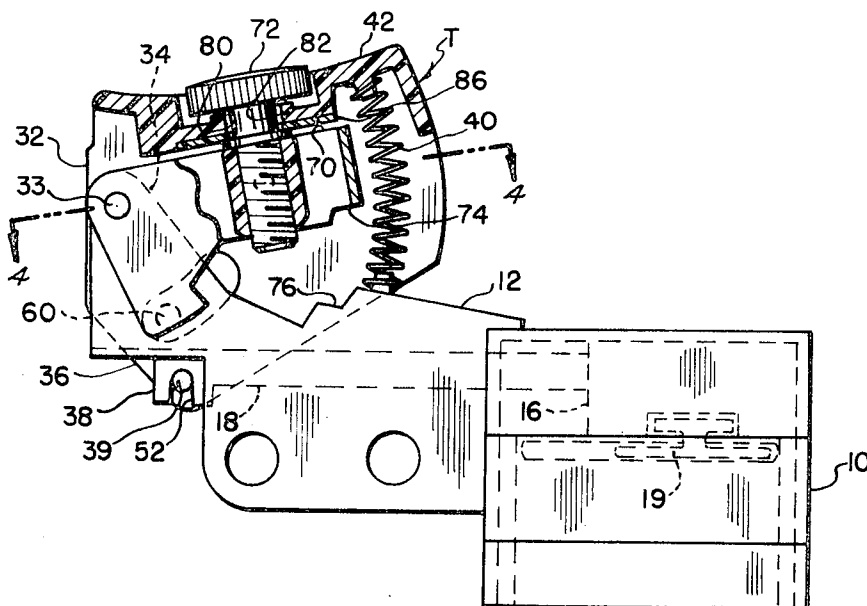
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[57] **ABSTRACT**

A trigger operated electric switch for portable electric

motor-driven tools including a switch casing having an integral extended frame portion with a trigger actuated switch device including a speed control rheostat disposed in the casing. A contact carrier is disposed in the casing and has an integral elongated arm extending outwardly from the carrier in the direction of the frame portion. The contact carrier is disposed in the casing and frame portion for reciprocation therein along the longitudinal axis of the carrier. The contact carrier contains a portion of the switch device whereby reciprocation of the contact carrier actuates the switch device and the speed control rheostat. A bell-crank trigger is pivotally mounted at its apex on the free outer end of the frame portion above the outer end portion of the arm for rotation in the longitudinal vertical plane of the carrier. One end of the bell-crank trigger is pivotally connected to the outer end of the arm. Bias means in the form of a compressed coiled spring is disposed between the frame portion and the outer end portion of the bell-crank trigger to bias the switch device to a first preselected position. Displacement of the outer end portion of the trigger against the action of the spring displaces the contact carrier to a second preselected position. Thus, the trigger is disposed at substantially a right angle to the switch device. Means are provided for adjusting the distance the trigger may be depressed, thereby selectively controlling the speed control rheostat.

8 Claims, 8 Drawing Figures



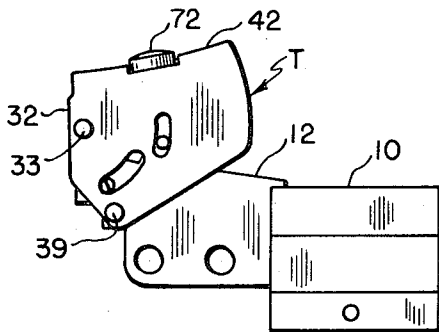


Fig. 1

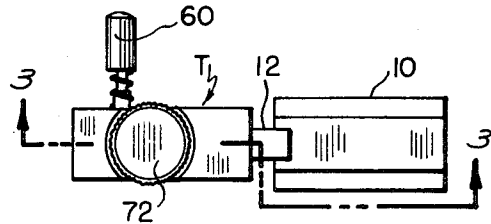


Fig. 2

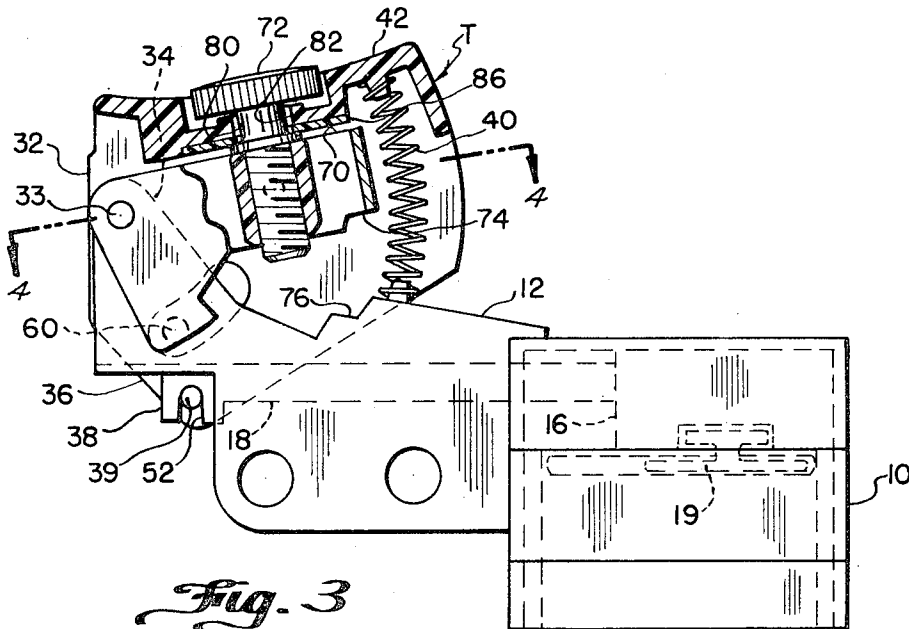


Fig. 3

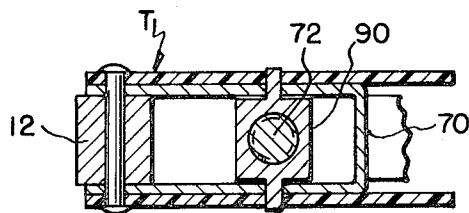
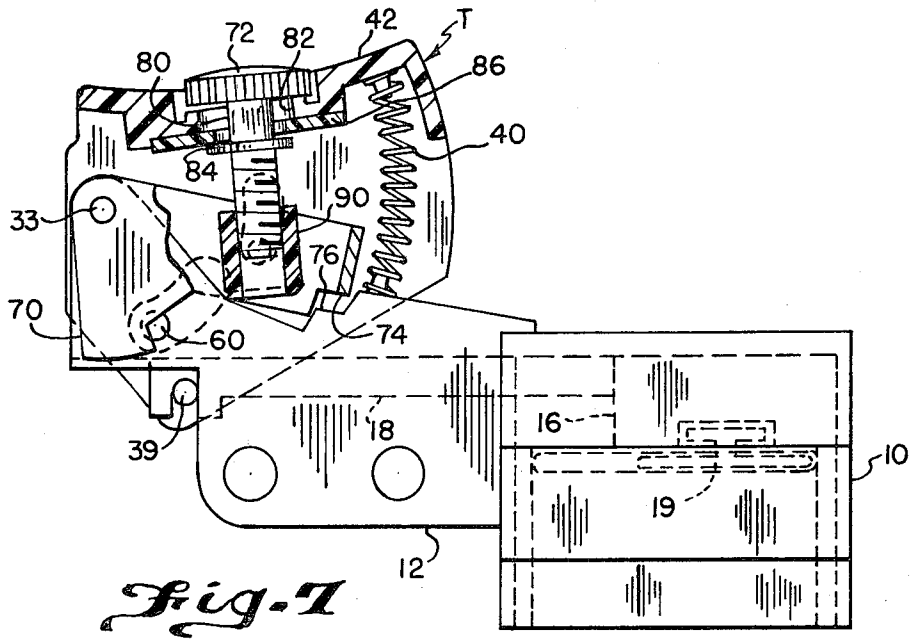
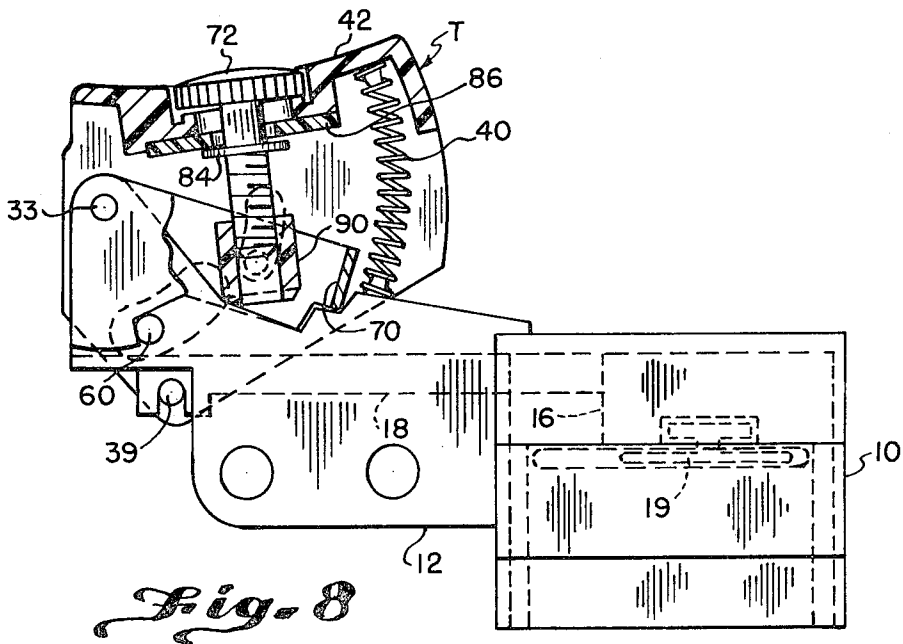


Fig. 4

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BELL-CRANK LEVER TRIGGER SWITCH WITH TRIGGER DEPRESSION ADJUSTMENT MEANS

This invention relates to electric switches, and more particularly, to right angle trigger electric switches operable by pressure on a finger piece or trigger available outside of the handle or casing of the electric device controlled by the switch while the switch is contained inside the housing or handle.

Specifically, the invention relates to an electrical switch device preferably for portable electric motor-driven tools to control the application of electrical energy from an energy source to the motor. In many such applications, there is a need for a trigger switch wherein the trigger is disposed at substantially a right angle to the switch mechanism.

Additionally, there has long been a need for a simple, efficient, trigger-actuated switch for variably controlling the motor speed in portable electric tools and appliances such as, for example, an electric drill, food mixer and/or similar devices.

The switch device of the invention is intended to be connected in controlling relation with the appliance and the electrical energy source to which it is connected, as for example in the handle of the portable electric tool, so as to be conveniently actuated by the operator thereof to variably control the application of such energy to the motor of the tool.

It is therefore a primary object of the present invention to provide an electrical switch device for controllably varying the application of electrical energy from an energy source to a connected load and which switch device is intended to be manually operable to controllably vary the application of said energy to the appliance.

Another object of the present invention is to provide a new and novel electrical switch device for controllably varying the application of electrical energy from an energy source to a connected load such as a hand-held electric drill, food mixer or like appliance, and which switch is also adjustable to provide a predetermined magnitude of energy to be applied to the connected load when the switch device is in its full "on" position.

A further object of the invention is to provide a trigger operated hand drill switch having its trigger disposed at substantially a right angle to the switch mechanism.

A further object of the invention is to provide a hand tool trigger switch of the above type having a contact carrier with an extended arm which is pivotally connected to the trigger.

A further object of the invention is to provide a portable tool switch that is simple in construction, inexpensive to manufacture, and highly effective in operation.

Briefly, the foregoing objects are accomplished by the provision of a right angle trigger operated electric switch for portable electric motor-driven tools including a switch casing having an integral extended frame portion with a trigger actuated switch device disposed in the casing. The switch device includes a contact carrier which is disposed in the casing. The contact carrier has an integral elongated arm extending outwardly from the carrier in the direction of the frame portion, and is disposed in the casing and frame portion for

reciprocation therein along the longitudinal axis of the carrier. The contact carrier contains a portion of the switch device including a speed control rheostat whereby reciprocation of the contact carrier actuates the switch device and the rheostat. A bell-crank trigger is pivotally mounted at its apex on the free outer end of the frame portion above the outer end portion of the arm for rotation in the longitudinal vertical plane of the carrier. One end of the bell-crank trigger is pivotally connected to the outer end of the arm, and bias means is disposed between the frame portion and the outer end portion of the bell-crank trigger to bias the switch device to a first preselected position. The trigger is thus disposed at substantially a right angle to the switch device. Displacement of the outer end portion of the trigger against the action of the bias means displaces the contact carrier to a second preselected position.

Manually adjustable elongatable means are provided between the outer end portion of the bell-crank trigger and the adjacent frame portion to selectively adjust the distance between such outer end portion and the adjacent frame portion when the trigger is fully displaced thereby selectively controlling the associated speed control device. In the preferred form such means includes an elongated yoke lever pivoted at one end to the extended frame portion adjacent its outer end for rotation in the longitudinal plane of the extended frame portion, whereby the outer end portion of the lever abuts the extended frame portion in one rotative position of the lever. A bolt or adjustment screw is rotatably secured at its one end to the outer end portion of the trigger, and the other end of the bolt is threadably secured to the outer end portion of the lever, whereby circumferential rotation of the bolt selectively spaces the outer end portion of the lever from the outer end portion of the trigger thereby varying the rotative displacement distance of the trigger to selectively control the speed control means.

Thus, there is provided a simple hand tool right angle trigger switch of positive action, high reliability, and which effects precise speed control and may be produced with considerable economy.

Other objects and advantages of the invention will be apparent from the following description taken in conjunction with the drawings wherein:

FIG. 1 is a side elevational view of a trigger switch construction in accordance with the invention;

FIG. 2 is a top plan view of the switch shown in FIG. 1;

FIG. 3 is an enlarged side elevational view taken along the line 3—3 of FIG. 2;

FIG. 4 is a sectional fragmentary view taken along the line 4—4 of FIG. 3;

FIG. 5 is a view similar to FIG. 3, but showing the trigger in fully depressed position;

FIG. 6 is a sectional view taken along the line 6—6 of FIG. 5;

FIG. 7 is a view similar to FIG. 3, but showing a modification of the invention; and

FIG. 8 is a view similar to FIG. 7, but showing the trigger in partially depressed position.

Although the invention is shown and described herein with reference to its application in a portable electric drill it will be understood that it may be used in any application to variably control the application of electrical energy to an applied load.

The terms and expressions which have been employed are used as terms of description, and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of the invention claimed.

Referring now to the drawings, the switch device of the present invention includes a switch casing or body 10 which encases a trigger actuated mechanism or device that is disclosed and claimed in the assignee's application, Ser. No. 702,272 entitled "Electric Switch," and filed on Feb. 1, 1968, now U.S. Pat. No. 3,536,973 issued Oct. 27, 1970. Such switch device will not be further described in detail as the same, per se, forms no part of the present invention.

The switch casing 10 has an extended frame portion 12 formed integral with the casing. A movable contact carrier 16 is disposed in the casing 10 and has an integral elongated arm 18 extending outwardly from the carrier in the direction of frame portion 12. The contact carrier 16 (and its arm 18) is disposed in the casing 10 and its frame portion 12 for reciprocation therein substantially along the longitudinal axis of the carrier. The contact carrier 16 contains a portion of the switch device including speed control means in the form of a speed control rheostat 19, whereby reciprocation of the contact carrier actuates the switch device and the rheostat 19.

A bell-crank trigger generally designated as T, is pivotally mounted at its apex 32 by means of the pin 33 on the free outer end 34 of the frame portion 12 above the outer end portion of the arm 18 for rotation in the longitudinal vertical plane of the carrier 16. One end 36 of the bell-crank trigger T is pivotally connected to the outer end 38 of the arm 18 by the rod or pin 39.

Suitable bias means in the form of the compressed coil spring 40 is disposed between the frame portion 12 and the outer end portion 42 of the bell-crank trigger T to bias the switch device to a first preselected position (shown in FIG. 3). Displacement of the outer end portion 42 of the trigger T against the action of the bias means 40 displaces the contact carrier 16 to a second preselected position shown in (FIG. 5).

The outer end portion 38 of the arm 18 is bifurcated (FIGS. 3 and 5) forming a U-shaped slot 52 with the open end of the "U" facing away from the one end 36 of the bell-crank trigger T. Such end 36 of the bell-crank trigger has the transverse pin or rod 39 thereon operatively disposed in the U-shaped slot 52 to form a pivotal connection between the trigger T and the arm 18.

Suitable pushbutton means 60 is disposed on the frame portion 12 and coacts with the trigger T to selectively retain the trigger in a second preselected position (FIG. 5). The pushbutton 60, per se, forms no part of the present invention and is described in detail in the aforementioned U.S. Pat. No. 3,536,973.

When the trigger T is in the position shown in FIG. 3, the switch in the casing 10 is in "OFF" position. When the trigger is depressed only slightly, the switch is in "ON" position and the slide rheostat 19 commences actuation. When the trigger is fully depressed as shown in FIG. 5, the switch is still "ON" and the rheostat is in full speed position. Accordingly, intermediate positions of the trigger effect corresponding intermediate speed control.

Manually adjustable elongatable means in the form of the yoke lever 70 and its coacting adjustment screw or bolt 72 are disposed between the outer end portion 42 of the bell-crank trigger T and the adjacent extended frame portion 12 to selectively adjust the distance between such outer end portion and the adjacent frame portion when the trigger is partially or fully displaced or depressed thereby selectively controlling the associated speed control device 19.

More specifically, the adjustably elongatable means includes the elongated yoke lever 70 pivoted at one end by pin 33 to the extended frame portion 13 adjacent its outer end 34 for rotation in the longitudinal plane of the extended frame portion, whereby the outer end portion 74 of the lever 70 abuts the extended frame portion at 76 in one rotative position of the lever, as shown in FIG. 5. A bolt or adjusting screw 72 is rotatably secured at its one or upper end to the outer end portion 42 of the trigger. This structure is effected by the bolt restricted neck portion 80 being disposed in the trigger aperture 82 and retained therein by the annular bolt flange 84 which abuts against the coacting oversize washer 86. The other or lower end of the bolt is threadedly secured to the nut 90, which is pivotally secured to the outer end portion of the lever 70 (FIG. 4), whereby circumferential rotation of the bolt 72 selectively spaces the outer end portion 74 of the lever 70 from the outer end portion of the trigger thereby varying the rotative displacement or depressing distance of the trigger to selectively control the speed control means 19.

In FIGS. 3 and 5, the bolt 72 is fully threaded into the nut 78 thereby effecting maximum trigger displacement to provide maximum motor speed via the speed control 19 when the trigger T is fully depressed as shown in FIG. 5.

In FIGS. 7 and 8, the bolt 72 is only slightly threaded into the nut 90 thereby effecting minimum trigger displacement to provide minimum motor speed via speed control 19 when the trigger T is fully depressed as shown in FIG. 8.

Between such maximum and minimum speeds above-described, any number of intermediate speeds may be selected by corresponding intermediate adjustments of the adjusting screw 72 in the nut 90.

When the trigger is fully depressed in any of the above-described positions, the trigger may be held in any such position by the "hold" pushbutton 60 as outlined in the aforescribed U.S. Pat. No. 3,536,973.

In summary, the invention covers a right angle trigger switch including a switch device with a reciprocal contact carrier having speed control means 19, a depressible trigger T disposed at substantially a right angle to the switch device, connecting means 18 operatively connecting the trigger with the switch device whereby when the trigger is depressed it activates the switch device and its speed control means 19, and means 72 for adjusting the distance the trigger is depressed thereby selectively controlling the speed control means. It will be understood that the arm 18 may be a separate link that connects the trigger to the contact carrier.

Thus, the invention provides a simplified, inexpensive, right angle hand tool trigger switch that provides precise and positive preselected speed control with a simple and quick manual operation.

What is claimed is:

1. An electric switch for portable electric motor-driven tools comprising, a switch casing having an extended frame portion formed integral with the casing, a trigger actuated switch device including speed control means disposed in the casing, a contact carrier disposed in said casing for reciprocation therein along the longitudinal axis of the carrier, said contact carrier containing at least a portion of the switch device whereby reciprocation of the contact carrier actuates the switch device and speed control means therein, a bell-crank trigger pivotally mounted at its apex on the free outer end of the frame portion for rotation in the longitudinal vertical plane of the carrier, elongated connecting means secured at one end to the contact carrier and pivotally connected at its other end to one end of the bell-crank trigger, bias means disposed between the frame portion and the outer end portion of the bell-crank trigger to bias the switch device to a first preselected position whereby displacement of the outer end portion of the trigger against the action of the bias means displaces the contact carrier to a second preselected position, and manually adjustable elongatable means connected to said bell-crank trigger between the outer end portion of the bell-crank trigger and the adjacent frame portion for pivotal movement with said bell-crank trigger and engageable with said adjacent frame portion upon pivotal movement of the bell-crank trigger toward the adjacent frame portion to selectively adjust the distance between such outer end portion and the adjacent frame portion when the trigger is fully displaced thereby selectively controlling the associated speed control device.

2. The structure of claim 1 wherein said adjustably elongatable means includes an elongated yoke lever pivoted at one end to the extended frame portion adjacent its outer end for rotation in the longitudinal plane of the extended frame portion, whereby the outer end portion of the lever abuts the extended frame portion in one rotative position of the lever, and a bolt rotatably secured at its one end to the outer end portion of the trigger, the other end of the bolt being threadedly secured to the outer end portion of the lever, whereby circumferential rotation of the bolt selectively spaces the outer end portion of the lever from the outer end portion of the trigger thereby varying the rotative displacement distance of the trigger to selectively control the speed control means.

3. The structure of claim 2 and further including pushbutton means disposed on said frame portion and coacting with said yoke lever to retain the trigger in preselected position.

4. A right angle electric trigger switch for portable electric motor-driven tools comprising, a switch casing having an extended frame portion formed integral with the casing, a trigger actuated switch device including a speed control means disposed in the casing, a contact carrier disposed in the casing and having an integral elongated arm extending outwardly from the carrier in the direction of the frame portion, said contact carrier being disposed in said casing and frame portion for reciprocation therein along the longitudinal axis of the carrier, said contact carrier containing at least a portion of the switch device whereby reciprocation of the contact carrier actuates the switch device and its speed control means, a bell-crank trigger pivotally mounted at its apex on the free outer end of the frame portion

above the outer end portion of the arm for rotation in the longitudinal vertical plane of the carrier, one end of the bell-crank trigger being pivotally connected to the outer end of the arm, bias means disposed between the frame portion and the outer end portion of the bell-crank trigger to bias the switch device to a first preselected position, whereby displacement of the outer end portion of the trigger against the action of the bias means displaces the contact carrier to a second preselected position, and means for adjusting the displacement distance of the trigger to selectively control the speed control means, said adjusting means including elongatable means connected to said bell-crank trigger between the outer end portion of the bell-crank trigger and an adjacent frame portion for pivotal movement with said bell-crank trigger and engageable with said adjacent frame portion upon pivotal movement of the bell-crank trigger toward the adjacent frame portion to selectively adjust the distance between such outer end portion and the adjacent frame portion when the trigger is fully displaced thereby selectively controlling the associated speed control device.

5. The structure of claim 4 wherein said bias means is a compressed coiled spring.

6. The structure of claim 4 wherein the outer end portion of the arm is bifurcated forming a U-shaped slot with the open end of the "U" facing away from the one end of the bell-crank trigger, and said one end of the bell-crank trigger has a transverse rod thereon operatively disposed in the U-shaped slot to form a pivotal connection between the trigger and the arm.

7. The structure of claim 4 and further including pushbutton means disposed on said frame portion and coacting with said trigger to selectively retain the trigger in said second preselected position.

8. An electric switch for portable electric motor-driven tools comprising, a switch casing having an extended frame portion formed integral with the casing, a trigger actuated switch device including speed control means disposed in the casing, a contact carrier disposed in said casing for reciprocation therein along the longitudinal axis of the carrier, said contact carrier containing a portion of the switch device whereby reciprocation of the contact carrier actuates the switch device and speed control means therein, a bell-crank trigger pivotally mounted at its apex on the free outer end of the frame portion for rotation in the longitudinal vertical plane of the carrier, elongated connecting means secured at one end to the contact carrier and pivotally connected at its other end to one end of the bell-crank trigger, bias means disposed between the frame portion and the outer end portion of the bell-crank trigger to bias the switch device to a first preselected position whereby displacement of the outer end portion of the trigger against the action of the bias means displaces the contact carrier to a second preselected position, and manually adjustable elongatable means disposed between the outer end portion of the bell-crank trigger and the adjacent frame portion to selectively adjust the distance between such outer end portion and the adjacent frame portion when the trigger is fully displaced thereby selectively controlling the associated speed control device, said adjustable elongatable means including an elongated yoke lever pivoted at one end to the extended frame portion ad-

jacent its outer end for rotation with the trigger in the longitudinal plane of the extended frame portion, the outer end portion of the lever having abutment means thereon to abut the extended frame portion in one rotative position of the lever, and a bolt rotatably secured at its one end to the outer end portion of the trigger, the other end of the bolt being threadedly secured to the

outer end portion of the lever, whereby circumferential rotation of the bolt selectively spaces the outer end portion of the lever from the outer end portion of the trigger thereby varying the rotative displacement distance of the trigger to selectively control the speed control means.

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