United States Patent

[11] 3,590,193

[72] Inventor Carl J. Frenzel
Chicago, Ill.

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Division of Ser. No. 733,044, May 29, 1968.
[45] Patented June 29, 1971
[73] Assignee Skil Corporation
Chicago, Ill.

[54] **TRIGGER-ACTUATED SWITCH DEVICE WITH ADJUSTMENT MEANS FOR ESTABLISHING A PLURALITY OF PREDETERMINED TRIGGER POSITIONS**

5 Claims, 12 Drawing Figs.

[52] U.S. Cl. 200/157, 310/68
[51] Int. Cl. H01h 13/08
[50] Field of Search 200/157; 310/50, 68, 68.1; 318/330, 349

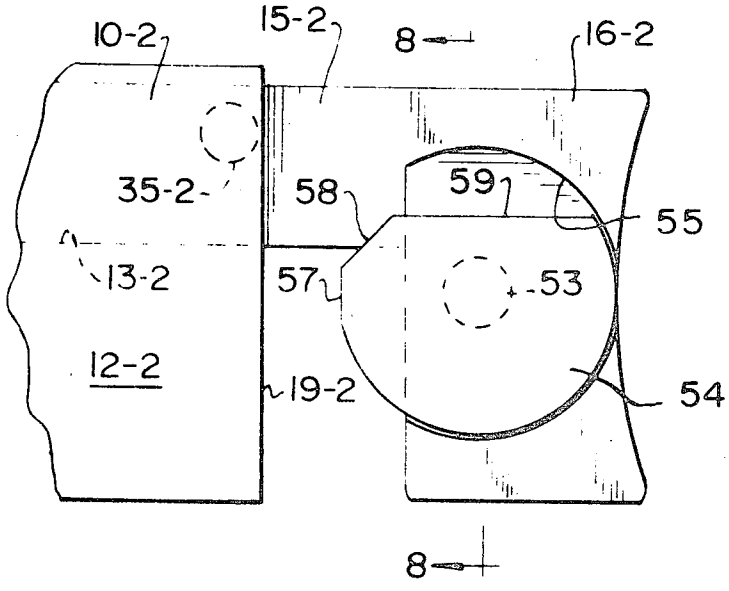
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Primary Examiner—Robert K. Schaefer
Assistant Examiner—Robert A. Vanderhye
Attorney—McDougall, Hersh & Scott

ABSTRACT: The trigger-actuated switch device includes a casing movably mounting a trigger. Resilient means are interposed between the casing and the trigger for urging the latter to an extended position. According to certain embodiments of the invention, the casing includes a fixed abutment surface and the trigger mounts a movable abutment surface for movement relative to the trigger, such abutment surfaces being arranged for abutting engagement when the trigger is depressed. The position of the movable abutment surface determines the extent of movement of the trigger when the same is squeezed or depressed. According to other embodiments, the same result is achieved by mounting the fixed abutment surface on the trigger and the movable abutment surface on the casing. A lock button construction is provided for locking the trigger in its fully depressed position and in its intermediate position or positions determined by engagement of the abutment surface.



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SHEET 1 OF 2

FIG. 1

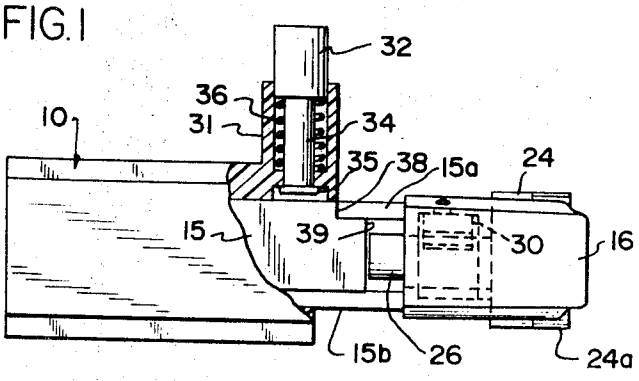


FIG. 3

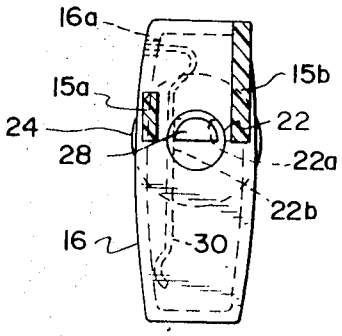


FIG. 2

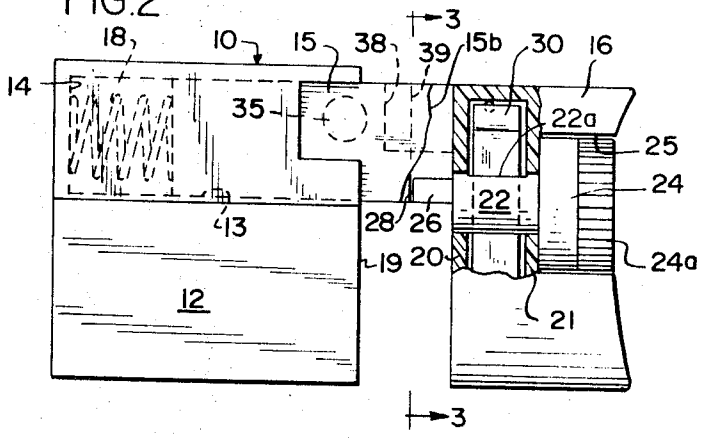


FIG. 4

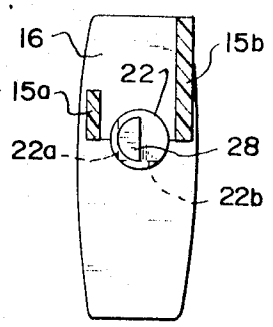


FIG. 5

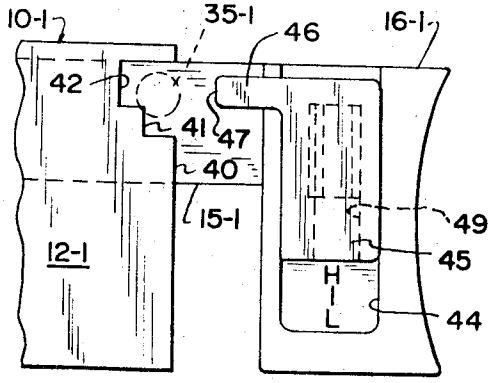
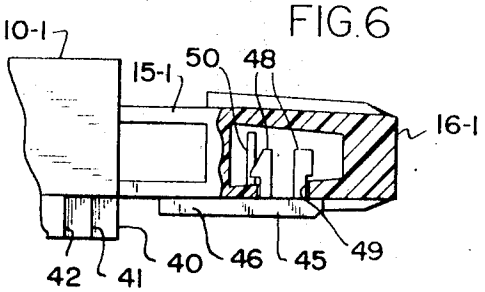


FIG. 6



INVENTOR.
CARL J. FRENZEL

BY McDougall, Housh & Scott

ATTORNEYS.

FIG. 7

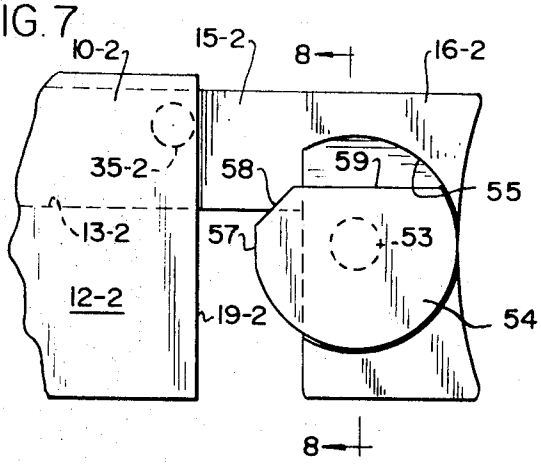


FIG. 8

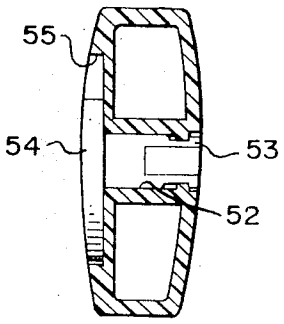


FIG. 9

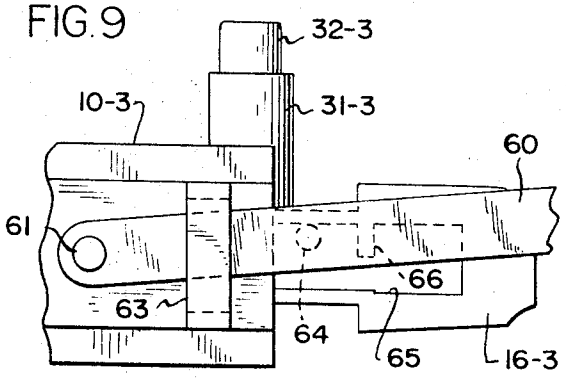


FIG. 11

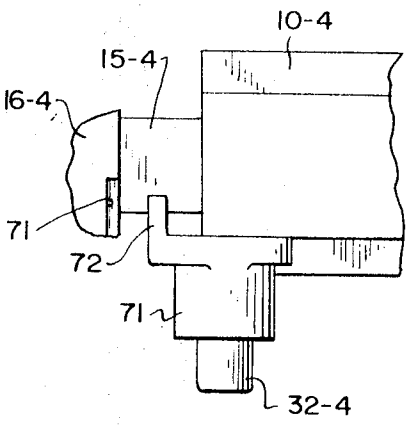


FIG. 10

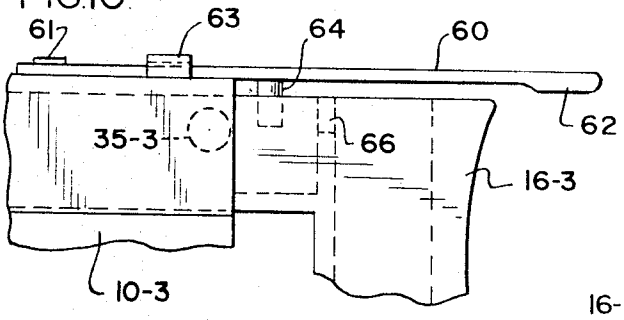
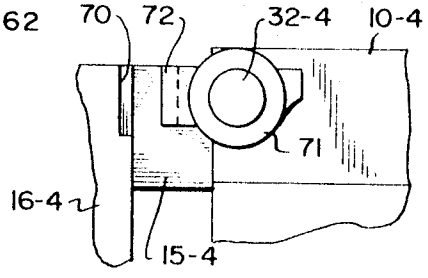


FIG. 12



INVENTOR.
CARL J. FRENZEL

BY McDougall, Hoch & Scott

ATTORNEYS.

TRIGGER-ACTUATED SWITCH DEVICE WITH ADJUSTMENT MEANS FOR ESTABLISHING A PLURALITY OF PREDETERMINED TRIGGER POSITIONS

OBJECTS OF THE INVENTION

This application is a division of my U.S. Pat. application filed May 29, 1968, Ser. No. 733,044.

A primary object of the present invention is the provision of a new and improved trigger-actuated switch device of simplified construction which is adapted to operate the motor of an associated tool at a plurality of predetermined speeds.

Another object of the present invention is the provision of a switch device of the type described, which device includes a casing member and a trigger member mounted for movement relative thereto, one of the members including a fixed abutment surface and the other of such members including a movable abutment surface.

Still another object of the present invention is the provision of a switch device according to the foregoing object wherein the fixed abutment surface is on the casing and the movable abutment surface is on the trigger either in the form of a rotatable knob or wheel or a reciprocally mounted button.

Another object of the invention is the provision of a switch device of the type described wherein the fixed abutment surface is carried by the trigger and wherein the movable abutment surface is carried by the casing and is associated with unique manual adjustment means for movement of such movable abutment surface.

Still another object of the invention is the provision of a new and improved switch device of the type described, wherein such switch device includes locking means for locking the trigger in its fully depressed position and also in an intermediate position or positions defined by abutting engagement of the fixed and movable abutment surface.

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

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of one embodiment of the switch device according to the present invention, with a portion of the casing wall being broken away for purposes of better illustration of certain of the parts;

FIG. 2 is a side elevational view of the switch device shown in FIG. 1, with a portion of the trigger wall being broken away to show certain of the components therein;

FIG. 3 is a section taken along line 3–3 of FIG. 2;

FIG. 4 is a section similar to FIG. 3 and showing the movable abutment surface in a position different from that shown in FIG. 3;

FIG. 5 is a fragmentary side elevational view of another embodiment of the present invention;

FIG. 6 is a top plan view of the switch device shown in FIG. 5 with a a portion of the trigger wall being broken away to illustrate certain of the components within the trigger;

FIG. 7 is a fragmentary side elevational view of still another embodiment of the present invention;

FIG. 8 is a section taken along line 8–8 of FIG. 7;

FIG. 9 is a fragmentary top plan view of a further embodiment of the present invention;

FIG. 10 is a fragmentary, side elevational view of the switch device shown in FIG. 9;

FIG. 11 is a fragmentary top plan view of a still further embodiment of the present invention; and

FIG. 12 is a fragmentary side elevational view of the switch device shown in FIG. 11.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1 and 2, one embodiment of the switch device according to the present invention includes a casing 10 of hollow construction and including a lower compartment 12. The upper portion of the casing is defined by a channel 13 closed at one end thereof by a wall 14 and open at the other end thereof for slidably receiving the stem 15 of a trigger 16. The trigger 16 is urged to its extended position by a coil spring 18, opposite ends of the latter respectively engaging the wall 14 and the inner end of the stem 15. Suitable stop means (not shown) are provided to limit outward or extended movement of the trigger. The casing 10 has a front wall 19 contained in a plane perpendicular to the direction of trigger movement; this wall defines a fixed abutment surface.

The trigger, which is of hollow construction, includes a rear wall 20 and an intermediate wall 21 having aligned bores rotatably mounting a cylindrical element 22, the latter having at one end thereof an enlarged, coaxial portion defining a knob 24. This knob is freely received within a cavity 25 in the trigger 16, the knob preferably including a knurled annular formation 24*a* to facilitate manual rotation thereof. The other end of the rotatable element 22 includes an integral, semicylindrical extension 26 having an end surface 28 defining a movable abutment surface which is disposed between wall portions 15*a* and 15*b* of the trigger stem 15.

The cylindrical formation 22 includes flat faces 22*a*, 22*b* disposed at generally right angles with each other for being alternately engaged by a spring 30, the upper end of which is suitably secured in a notch or opening 16*a* in the trigger. This spring serves to detent the element 22 in both of its positions shown in FIGS. 3 and 4 for releasably holding the movable abutment surface 28 in each of the positions shown.

It will be understood that when the knob 24 is rotated to position the movable abutment surface 28 in the position thereof shown in FIGS. 1—3, such abutment surface will clear the fixed abutment surface 19 when the trigger is depressed thereby allowing the trigger to be depressed a maximum direction. Movement of the trigger in this case is stopped by abutting engagement of the trigger wall 20 with the fixed abutment surface 19. When the knob 24 is rotated to locate movable abutment surface 28 in the position thereof shown in FIG. 4 such movable abutment surface will strike or abut the fixed abutment surface 19 when the trigger is depressed thereby limiting movement of the trigger to an intermediate distance or position. In the embodiment shown for purposes of illustration, this intermediate position is approximately one-half the distance the trigger is moved when the same is allowed to move through it maximum distance.

It will be understood the compartment 12 of the switch device will include suitable contacts (not shown) to make advantageous use of the two positions of the trigger as just explained. Since the arrangement of these contacts can take a variety of forms as known to those skilled in the art, the arrangement of such contacts will not be described in detail herein.

The switch device according to the present invention has particular applicability with portable electric tools, such as saws and drills. When the trigger is depressed to its intermediate position established by abutting engagement of the surfaces 19 and 28, the contacts within the casing may establish a circuit to the tool motor through a half-wave rectifying device, such as a diode, for operating the tool motor at a speed less than its maximum speed. When the know 24 is rotated to allow the trigger to be depressed to its maximum position, the contacts may be arranged for bypassing such diode thereby to operate the tool motor at full speed from full wave, line current. The aforementioned diode as well as any other circuit components may be conveniently mounted within the compartment 12.

The switch device preferably includes locking means for locking the trigger in each of its positions. To this end, the casing 10 includes an integral, cylindrical formation 31 slidably

receiving a locking button 32, the latter having a reduced-in-diameter extension 34. The distal end of this extension includes an annular lip 35. A coil spring 36 encircles the button portion 34, opposite ends of this spring respectively abutting the casing and the annular shoulder defined by the button portions 32 and 34 for urging the button 32 outwardly.

The stem 15 of the trigger includes a first catch surface 38 and a second catch surface 39 these surfaces being contained in spaced, parallel planes which are perpendicular to the direction of movement of the trigger. When the knob 24 is rotated to locate the movable abutment surface 28 in the position illustrated in FIG. 4 and when the trigger is then depressed to bring such abutment surface into engagement with fixed abutment surface 19, the catch surface 38 will have passed the annular lip 35 such that depression of the button 32 will allow 107 annular lip 35 to be located just forwardly of the catch surface 38. Release of the trigger will 93 the spring 18 101 urge the same outwardly forcing the catch surface 38 against the lip 35 for locking the trigger in its intermediate position. When the knob 24 is rotated to position the movable abutment surface 28 in the position shown in FIGS. 1—3 and when the trigger is then fully depressed, the lip 35 will be engaged by the catch surface 39 thereby to lock the trigger 16 in its fully depressed or maximum positon.

The other embodiments of the invention will now be described. The parts of such other embodiments which correspond to the parts of the embodiment just described will be indicated by the same numerals along with a hyphenated numeral to distinguish the various embodiments.

The casing 10–1 of the embodiment shown in FIGS. 5 and 6 includes fixed abutments surfaces 40, 41 and 42 respectively contained in separate parallel planes which are generally perpendicular to the direction of trigger movement. The trigger 16–1 includes in one side thereof a vertically elongated cavity 44 in which is mounted a button 45, such button having a rearwardly extending formation 46. The formation 46 has an end wall 47 defining a movable abutment surface.

The button 45 includes a pair of lugs 48 which are received in a vertical slot 49 formed in the trigger sidewall thereby to mount the button 45 for vertical reciprocal sliding movement relative to the trigger. A spring strip 50 is suitably mounted within the trigger for detenting engagement with one of the lugs 48 thereby to detent the button 45 in each of three positions wherein the movable abutment surface 47 will be in alignment with the fixed abutment surfaces 40, 41 or 42. When the trigger 16–1 is depressed, its movement will be limited by abutting engagement of the surface 47 with one of such fixed abutment surfaces.

It will be appreciated that the arrangement just described will establish two intermediate trigger positions was well as a maximum trigger position wherein the trigger is fully depressed. The trigger is preferably provided with indicia such as H, I, and L for high, intermediate and low speeds, respectively, such indicia being selectively obscured by the button 45 as the same is slid to its various positions. The casing 10–1 will of course be provided with suitable contact means to make advantageous use of the three trigger positions.

Turning now to the embodiment shown in FIGS. 7 and 8, the trigger 16–2 includes a cross bore 52 rotatably receiving a pin 53 one end of which carries a disc 54, the latter being received in a cutout 55 formed in the trigger. The disc 54 has flat, peripherally disposed surfaces 57, 58 and 59. It will be understood the disc 54 is rotated for selectively placing one of such flat surfaces in spaced, parallel, confronting relationship with the fixed abutment surface 19–2. The surfaces 57—59 are spaced at different distances from the axis of rotation of the disc 54. Accordingly, the disc 54 can be rotated for establishing three predetermined trigger positions, that is, a so-called maximum position established by the surface 59 and two intermediate positions established by the surfaces 57 and 58.

Referring to the embodiment shown in FIGS. 9 and 10, an arm 60 is pivotally mounted at one end thereof to the casing 10–3 by means of a pin 61. The distal end of the arm 60 includes a formation 62 on the underside thereof which is adjacent the trigger 16–3 to facilitate engagement and operation of the arm 60 by the operator's trigger finger. The arm 60 is received under a strap 63 which strap guides the arm and also acts as a stop means to limit movement of the arm back and forth between the position shown in FIG. 9 and its other position on the other side of the longitudinal centerline of the switch device.

The trigger 16–3 includes a cavity 65 extending generally longitudinally of the direction of trigger movement. A wall 66 extends into this cavity from one side thereof, such wall defining a fixed abutment surface. When the arm 60 is in the position illustrated in FIG. 9, depressing or squeezing of the trigger will bring the fixed abutment surface 66 into engagement with the movable abutment element or surface 64 thereby limiting movement of the trigger to an intermediate distance or position When the arm 60 is swung to its other position, the element 64 will be out of the path of movement of the abutment surface 66 thereby allowing the trigger 16–3 to be squeezed or moved to its maximum position.

In the embodiment shown in FIGS. 11 and 12, the trigger 16–4 includes a rearwardly facing, 72 abutment surface 70. A sleeve 71 is rotatably mounted on the cylindrical formation (not shown) which receives the locking button 31–4. This sleeve carries a radially extending lug 72 which has a portion adapted to extend between the casing 10–4 and the trigger 16–4 for being engaged by the abutment surface 70 when the sleeve is in the position illustrated in the FIGS. Engagement of the fixed abutment surface 70 and the abutment surface defined by the lug 72 limits movement of the trigger to its intermediate distance or position. The sleeve 71 may be manually swung in a clockwise direction for moving the lugs 72 out of the space between the trigger 16–4 and the casing 10–4 thereby allowing the trigger to be squeezed or depressed to its maximum position.

Although trigger-locking means have not been shown in the embodiments according to FIGS. 5—12, it will be appreciated by those skilled in the art that locking means can be readily devised following the teachings of the present invention as shown in FIGS. 1 and 2. It will also be understood that all of the embodiments include suitable contact means and circuit means for making advantageous use of the various trigger positions.

I claim:

1. For use with a portable apparatus having a housing with a trigger-receiving aperture, wherein such apparatus is of the type having a motor for use with a control system capable of operating such motor at a plurality of predetermined speeds in response to the amount of trigger movement, a trigger-actuated switch device for mounting in such housing with the trigger extending through said aperture for manual depression, said switch device comprising, a casing member, a trigger member mounted by the casing member for oscillating movement relative thereto, resilient means interposed between said members and urging the trigger member in one direction of movement thereof to an extended position, said trigger member having a formation thereon defining a first abutment surface, a finger-manipulatable element carried by said casing member for movement relative thereto, said element including a formation defining a movable abutment surface, movement of said element to one position thereof serving to locate said movable abutment surface in the path of movement of said first abutment surface such that the former is engaged by the latter during movement of the trigger member in its other direction of movement thereby to limit movement of the latter to a first distance less than its maximum distance in such direction for establishing one of said predetermined speeds, movement of said element to another position serving to move said movable abutment surface out of the path of movement of the first abutment surface thereby permitting said trigger member to be moved in its other direction a distance greater than said first distance for establishing another of said predetermined speeds.

2. The switch device according to claim 1 further defined by, said element being rotatably carried by said casing, said movable abutment surface being eccentric to the axis of rotation of said element.

3. The switch device according to claim 1 further defined by, said element including an arm pivotally mounted at one end thereof to said casing member, the other end of said arm being disposed adjacent said trigger member for being engaged by the operator's trigger finger.

4. For use with a portable apparatus having a housing with a trigger-receiving aperture, wherein such apparatus is of the type having a motor for use with a control system capable of operating such motor at a plurality of predetermined speeds in response to the amount of trigger movement, a trigger-actuated switch device for mounting in such housing with the trigger extending through said aperture for manual depression, said switch device comprising, a casing member, a trigger member mounted by the casing member for oscillating movement relative thereto, resilient means interposed between said members and urging the trigger member in one direction of movement thereof to an extended position, said trigger having a formation defining a first abutment surface, a trigger lock

button assembly carried by said casing member and including a cylindrical formation coaxial with the axis of movement of the lock button, a sleeve rotatably mounted on said cylindrical formation and carrying a lug defining a movable abutment surface, rotation of said sleeve to one position serving to locate said lug in the path of movement of said first abutment surface such that the former is engaged by the latter during movement of the trigger member in its other direction of movement thereby to limit movement of the latter to a first distance less than its maximum distance in such direction for establishing one of said predetermined speeds, movement of said sleeve to another position serving to move said lug out of the path of movement of the first abutment surface thereby permitting said trigger member to be moved in its other direction a distance greater than said first distance for establishing another of said predetermined speeds.

5. The switch device according to claim 4 further defined by, said lug being arranged for extending into the space between the front of the casing member and the rear of the trigger member when said sleeve is in said one position thereof, said trigger formation being on said rear thereof.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,590,193 Dated June 29, 1971

Carl J. Frenzel

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

Abstract, last sentence, last word, "surface" should be --surfaces--.

Column 1, line 39, "surface" should be --surfaces--.

Column 3, line 16, delete "107". Line 17, delete "93" and insert --allow--. Line 18, delete "101" and insert --to--. Line 51, delete "was" and insert --as--.

Column 4, line 23, delete "72" and insert --fixed--. Line 25, delete "31-4" and insert --32-4--.

Signed and sealed this 18th day of July 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents