July 4, 1967 E. V. SAHRBACKER 3,329,789

MULTI-POSITION LOCK FOR TRIGGER SWITCH

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Fig. 1.

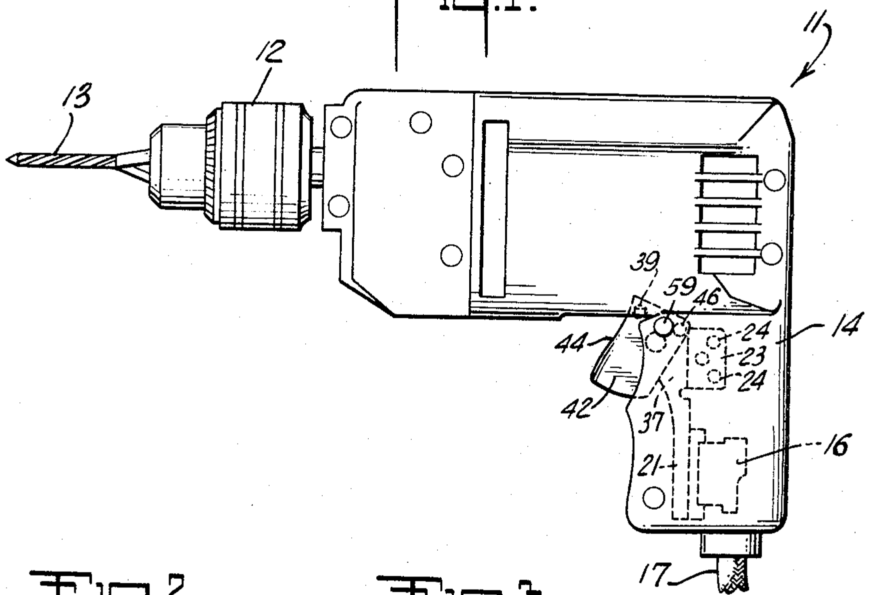


Fig. 2.

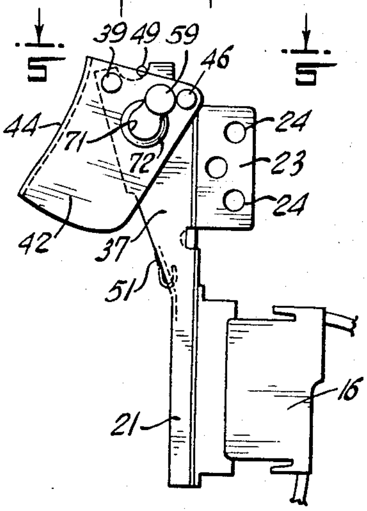


Fig. 3.

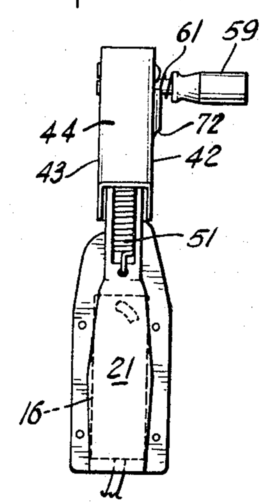


Fig. 4.

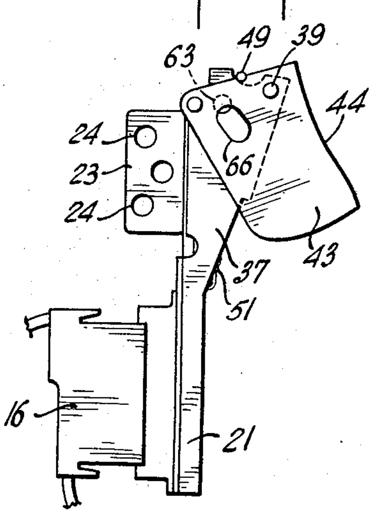
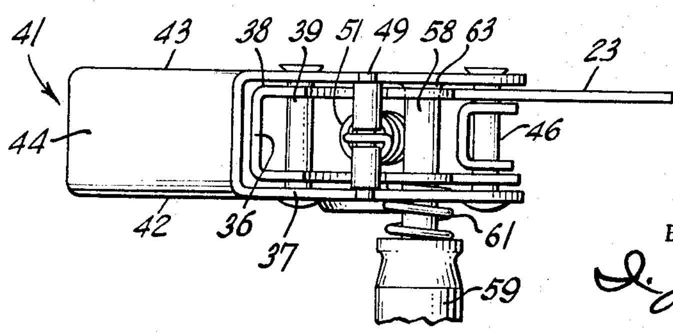


Fig. 5.



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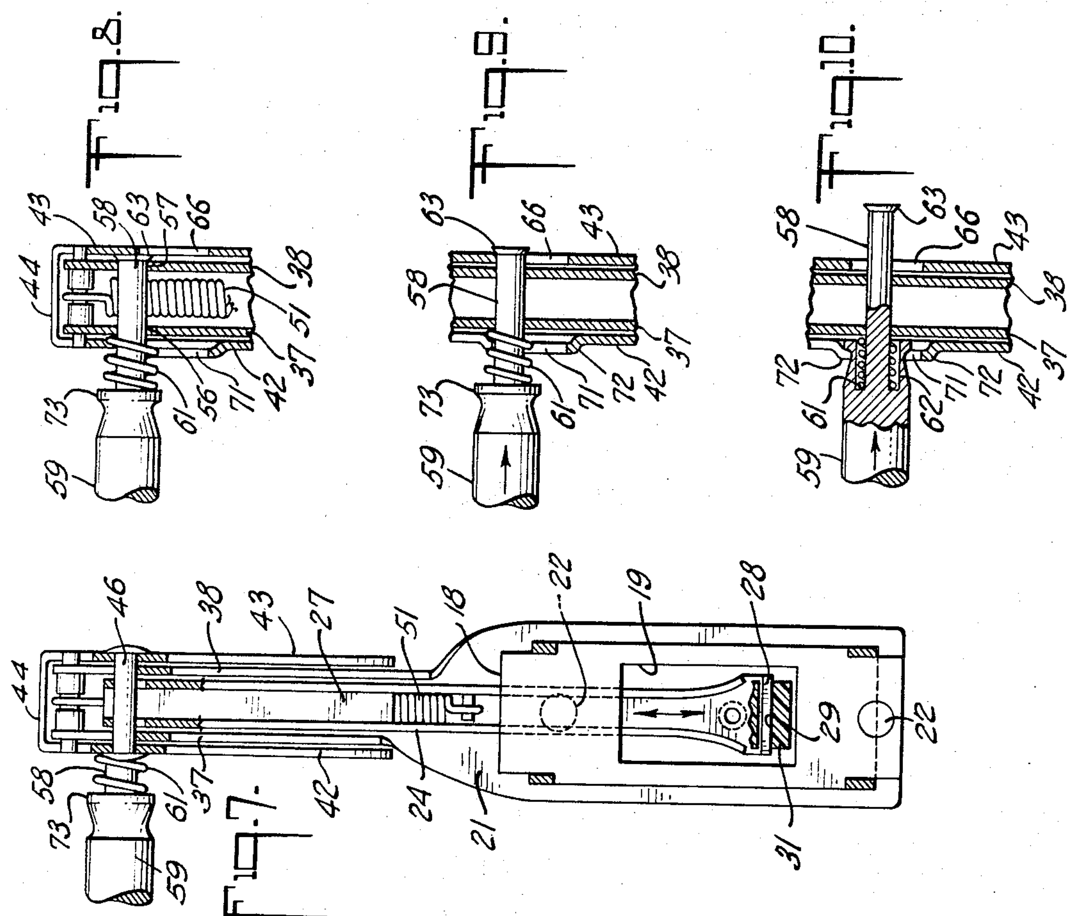

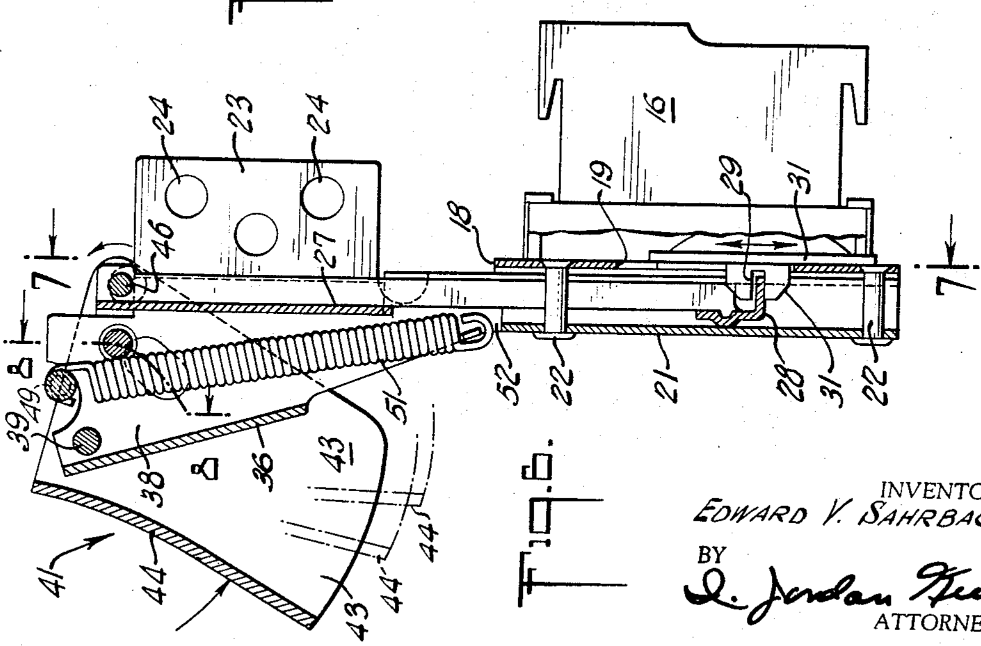

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MULTI-POSITION LOCK FOR TRIGGER SWITCH

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Filed Nov. 5, 1965, Ser. No. 506,499
12 Claims. (Cl. 200—157)

This invention relates to electric switches and, more particularly, to a multi-speed switch having a trigger element that is positionable into separate locked locations for operation at different fixed speeds.

In providing variable speed electrical tools such as piston-grip hand drills and the like, the speed of the motor driven tool is controlled by a finger operated trigger element which is movable at will in finitely located steps between low and high speed operation. Since human finger control may not be sufficiently stable and can be subject to fatigue, it is desirable, in some operations, to set the trigger switch at a selected speed at which the tool may continue to operate without continuing finger control.

According to the present invention, a variable speed switch having finger operated trigger control is provided with novel indexing means for establishing at least two different predetermined operational speeds for the tool drive motor.

A salient feature of the invention is the provision of a simple mechanism for locking the trigger of the switch in either of two separate positions intermediate the low and maximum speeds, the improved mechanism being operable by self-indexing means in the trigger itself acting in conjunction with a thumb depressible yieldable element whereby the locking and unlocking of the trigger may be accomplished by the same hand which holds the tool in its working position. Although the device of the present invention may be utilized in conjunction with infinitely variable switches, it may also be used for the operation of progressive step switches having a limited number of operating positions.

Still other objects and advantages of the invention will be apparent from the specification.

The features of novelty which are believed to be characteristic of the invention are set forth herein and will best be understood, both as to their fundamental principles and as to their particular embodiments, by reference to the specification and accompanying drawings, in which:

FIGURE 1 is a side elevation of a piston-grip electrically operated hand tool such as a drill, incorporating the switch and trigger control of the present invention in the piston-grip portion thereof, some parts being shown in phantom outline;

FIGURE 2 is an enlarged fragmentary side view of the switch and trigger mechanism shown in outline in FIGURE 1;

FIGURE 3 is a front view of the device shown in FIGURE 2;

FIGURE 4 is a reverse side view of the device shown in FIGURE 2;

FIGURE 5 is a greatly enlarged top view taken on line 5—5 of FIGURE 2;

FIGURE 6 is a still further enlarged side view similar to FIGURE 2, showing some parts in section, some parts in phantom outline, and some parts broken away;

FIGURE 7 is a view taken on line 7—7 of FIGURE 6;

FIGURE 8 is a fragmentary view taken on line 8—8 of FIGURE 6, showing the trigger in the "off" position;

FIGURE 9 is similar to FIGURE 8, but showing the trigger locked in a first operating position; and

FIGURE 10 is similar to FIGURES 8 and 9, but showing the trigger locked in a second operating position.

Referring now to the drawings in detail, a typical hand tool such as a piston-grip drill, generally designated **11**, is shown in FIGURE 1, said drill being operated by an electric motor, not shown, which rotates a clutch **12** within which is mounted a drill bit **13** or the like.

Drill **11** has a hollow piston-grip handle **14** within which is mounted a switch case **16** containing a variable switch, not shown, connected to a suitable power source, not shown, by means of cable **17**, said switch, in turn, being connected to the electric drill motor by suitable electrical circuitry well known in the art. The switch in case **16** controls the speed of the electric motor from an "off" condition to an "on" condition and thence from low speed to high speed in infinite gradients. The switch has a suitable infinitely variable current or voltage control such as variable resistor, potentiometer, or the like having a movable control element for varying the power supplied to the tool motor. Variable switches of this type are well known in the art.

The open side portion of switch case **16**, which is made of suitable insulating material, is connected to a sheet metal rectangular bracket **18** by suitable means, said bracket having a central, rectangular aperture **19** which is positioned over the open side of said switch case. Bracket **18** is fastened to the lower end portion of a vertical channel track element **21** by means of spaced apart rivets **22**. The upper portion of track element **21** has an integrally formed lug **23** having a plurality of apertures **24** for attachment by way of rivets or studs to the interior of handle **14**.

Track element **21** is made of sheet metal and is bent to form an elongated channel **26** within which an elongated actuator **27** is reciprocably movable. The lower end of actuator **27** has an integrally formed laterally extending lug **28** which engages a slot **29** of slider element **31** movable slidably and reciprocably across the opening of case **16**. Slider **31**, made of suitable insulating material, has an integrally formed boss **32** which extends into the interior of case **16** to engage and operate the variable or stepping control of the motor switch.

The upper portion of track element **21** has an enlarged V-shaped channel formed of sloping forward wall **36** and integrally formed spaced apart side walls **37** and **38** between which a plurality of trigger components operate.

Mounted between the forward portions of walls **37** and **38** near the upper ends thereof is a pin **39** upon which is pivotally mounted a trigger element, generally designated **41**, formed of a unitary piece of sheet metal having two spaced apart side walls **42** and **43** and an integrally formed forward end wall **44** upon which the operator's finger bears.

Mounted between trigger walls **42** and **43**, at their upper and rearward portions, and spaced apart from pin **39** is a second pin **46** upon which the upper end of actuator **27** is pivotally mounted. The upper edges of trigger walls **42** and **43** each have small notches **47** and **48**, respectively, formed therein intermediate pins **39** and **46**, said notches supporting between them a third pin **49**. Connected to pin **49** is one end of a spring **51**, the other end of which is hooked through aperture **52** in track element **21** intermediate the ends thereof. Spring **51**, under tension, normally urges pin **49** downwardly to cause trigger **41** to pivot into a forward "off" position, as shown in FIGURES 1, 2 and 3, while at the same time actuator **27** is urged into its extreme downward position where normally the switch elements in case **16** are in the open circuit condition. The downward motion of actuator **27** is limited by pin **46** abutting the top edges of walls **37** and **38**.

Upon retraction of trigger **41** against the action of spring **51**, the resulting pivoting motion raises pin **46** thereby causing actuator **27** and slider **31** to move upwardly whereby the switch assumes a closed circuit condition and its electric power or current transmitting capacity may be varied to the extent that trigger **41** is retracted.

Near the upper ends of walls **37** and **38** there are formed axially oriented apertures **56** and **57**, respectively, which slidably accommodate a shaft **58**, said shaft having an integrally formed outwardly extending head **59** whose diameter is somewhat larger than that of said shaft.

Mounted around shaft **58** is spring **61**, one end of which bears against the outer surface of wall **37**, the other end of which bears against the interior wall of a circular recess **62** formed at the inner portion of head **59**. The action of spring **61** normally urges shaft **58** and head **59** to move outwardly, said movement being limited by an integral flange **63** on the free end of shaft **58** which bears against the outer surface of wall **38**.

Wall **43** of trigger **41** has an elongated slanting aperture **66** which is somewhat wider than the outside diameter of flange **63** on shaft **58** whereby the latter can be caused to protrude through said aperture when head **59** is pressed against the action of spring **61**.

Normally, when trigger **41** is in the released and "off" circuit position as shown in FIGURES 2, 6 and 8, for example, wall **43** overlaps aperture **57** in wall **38**, thereby preventing any depression of shaft **58** against the action of spring **61**. When trigger **41** is retracted to an intermediate position "1" as shown in FIGURES 6 and 9, a portion of aperture **61** becomes aligned with aperture **57** thereby permitting head **59** to be depressed against the action of spring **61** to cause the free end of shaft **58** to extend through aperture **66**.

When trigger **41** is released at this time, flange **63** of shaft **58** engages the upper edge of aperture **66** to lock said trigger in the first position whereby the tool motor operates at a selected predetermined fixed speed without the necessity for maintaining the trigger position by finger operation. When it is desired to turn off the tool motor, slight retraction of trigger **41** causes flange **63** to be released from the edge of aperture **66** whereby shaft **58** is automatically withdrawn therefrom under the action of spring **61** to its non-operating position as shown in FIGURE 8. Upon release of trigger **41**, spring **51** operates to return said trigger to its "off" position and to depress actuator **27** and slider **31** into an "off" circuit condition for the switch elements in case **16**.

Formed in wall **42** of trigger **41** is an elongated aperture **71** having a small upper portion and a somewhat larger lower portion. The smaller portion of aperture **71** freely bypasses shaft **58** during the pivoting action of trigger **41**. That part of wall **42** surrounding the lower larger portion of aperture **71** has an outwardly extending flange **72** which engages an outwardly extending rib **73** on the inner end of head **59** when the latter is depressed against the action of spring **61** and when trigger **41** is retracted to a second operating position as shown in FIGURES 6 and 10. In position "2" of trigger **41**, the latter is now locked in a location where the tool motor operates at a second selected predetermined fixed speed without the necessity for maintaining said trigger position by finger operation.

When it is desired to turn off the tool motor from its second fixed position, slight retraction of trigger **41** causes rib **73** to be released from flange **72** whereby head **59** is automatically withdrawn and moved outwardly under the action of spring **61** to the non-operating position as shown in FIGURE 8. Upon release of trigger **41**, spring **51** operates to return said trigger to its "off" position and to depress actuator **27** and slider **31** into an "off" circuit condition for the switch elements in case **16**.

In both position "1" and position "2" of trigger **41**, actuator **27** and slider **31** are located in positions where the circuit elements in switch case **16** are operated to cause the tool motor to run at different respective predetermined speeds.

In operation, when the operator's hand grasps the pistol grip **14** of tool **11**, the forefinger is in a natural position to operate trigger **44** while the operator's thumb is in a natural position to manipulate head **59** to depress the latter into the selected positions for locking trigger **41** as shown in FIGURES 9 and 10. In the embodiment illustrated herein, the thumb operated head **59** and shaft **58** move in a direction laterally in respect of or substantially perpendicular to the direction of movement of trigger **41**.

By utilizing the locking device as described hereinbefore, the operator is relieved of the fatiguing task of attempting to maintain the trigger in a desired constant speed location. At any desired time, the operator may slightly retract trigger **41** to permit flange **63** of shaft **58** or rib **72** of head **59** to be automatically released in order to turn off the tool motor. Optionally, the operator may dispense with the manipulation of head **59** and utilize finger control on trigger **41** for establishing and maintaining different motor speeds, at will.

By arranging for a thumb control element such as embodied in the unitary combination of shaft **58** and head **59** where these component parts are of different diameter and where each of said components is engaged selectively by the trigger element at different pivoted locations thereof, it is now possible to provide a multiplex operation of the tool motor by a device made of simple, stamped parts and which is easily and conveniently manipulated by the tool operator.

In some embodiments, flange **63** and rib **73** may be omitted from pin **58** and head **59**, respectively, since trigger spring **51** may be provided with sufficient power to cause the frictional engagement of the edges of apertures **66** and **71** with said pin and said head to maintain the respective parts in locked condition.

What is claimed is:

1. A trigger switch apparatus comprising a support, a trigger pivotally mounted on said support, a switch actuator element mounted pivotally on said trigger and movable thereby, means normally urging said trigger and said actuator yieldably into an "off" position, means on said support movable into either of first and second positions, said movable means in its first position engaging and locking said trigger into a first switch operating position and in its second position engaging and locking said trigger into a second switch operating position.

2. Apparatus according to claim **1** wherein said movable means comprises a pin slidably mounted on said support, and further comprising a spring normally disengaging said pin from said trigger, a first portion of said pin engaging a first portion of said trigger when the latter is retracted into said first position, a second portion of said pin engaging a second portion of said trigger when the latter is retracted into said second position.

3. Apparatus according to claim **1** and further comprising a switch case mounted on said support, said actuator being movable relative to the interior of said case for operating the switch elements contained therein.

4. A trigger switch apparatus comprising a support, a trigger pivotally mounted on said support, said trigger normally being yieldably spring biased to an "off" position and retractable to an infinite gradient of switching positions, a pin mounted on said support and movable laterally in respect of said trigger, a first portion of said pin engaging a first portion of said trigger to lock the latter in a first switching position, a second portion of said pin engaging a second portion of said trigger to lock the latter in a second switching position.

5. Apparatus according to claim **4** and further comprising a spring between said support and said pin normally urging said pin into disengagement from said trigger.

6. Apparatus according to claim **5** wherein said trigger comprises first and second spaced apart walls movable past respective sides of said support and wherein said pin engages one of said walls for locking said trigger in said first position and engages the second of said walls for locking said trigger in said second position.

7. Apparatus according to claim **6** and further comprising an aperture in said support, said pin being slidably movable through said aperture, an aperture in the first trigger wall, an aperture in the second trigger wall, one portion of said pin having a predetermined diameter and engaging the edge of said aperture in said first wall to lock said trigger in said first position, another portion of said pin having a somewhat larger diameter and engaging the edge of said aperture in said second wall to lock said trigger in said second position.

8. Apparatus according to claim **7** wherein said trigger and said pin are located in relation to each other for manipulation of said trigger by the forefinger and of said pin by the thumb of the hand by the operator.

9. Apparatus according to claim **6** wherein slight retraction of said trigger when the latter is in either of said first or second positions permits the pin spring to disengage said pin from said trigger.

10. A trigger switch apparatus comprising a support, said support being shaped to form an elongated channel, a trigger pivotally mounted on said support, said trigger normally being yieldably spring biased to an "off" position and retractable to an infinite gradient of switching positions, a pin mounted on said support and movable laterally in respect of said trigger, said pin being movable into either of two positions for releasably locking said trigger in either of a first and second retracted switching position relative to said support, a switch actuator mounted pivotally on said trigger and movable reciprocably within said channel upon the pivoting action of said trigger, and a switch case mounted on said support, said actuator communicating with the interior of said case.

11. Apparatus according to claim **10** and further comprising a first spring connected between said trigger and said support, and a second spring connected between said pin and said support.

12. Apparatus according to claim **10**, wherein said pin comprises first and second portions, said first portion upon partial movement of said pin engaging said trigger in said first position, said second portion of said pin upon further movement of said pin engaging said trigger in said second position.

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