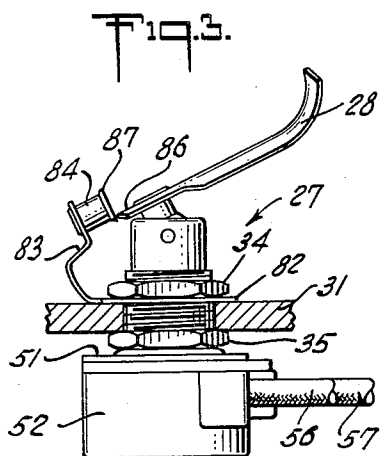


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TRIGGER SWITCH LOCKING MEANS

2 Sheets-Sheet 1



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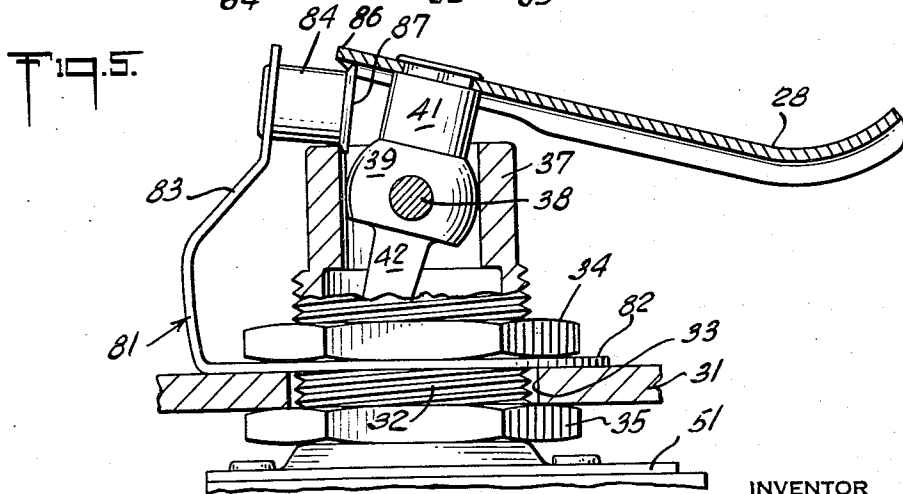
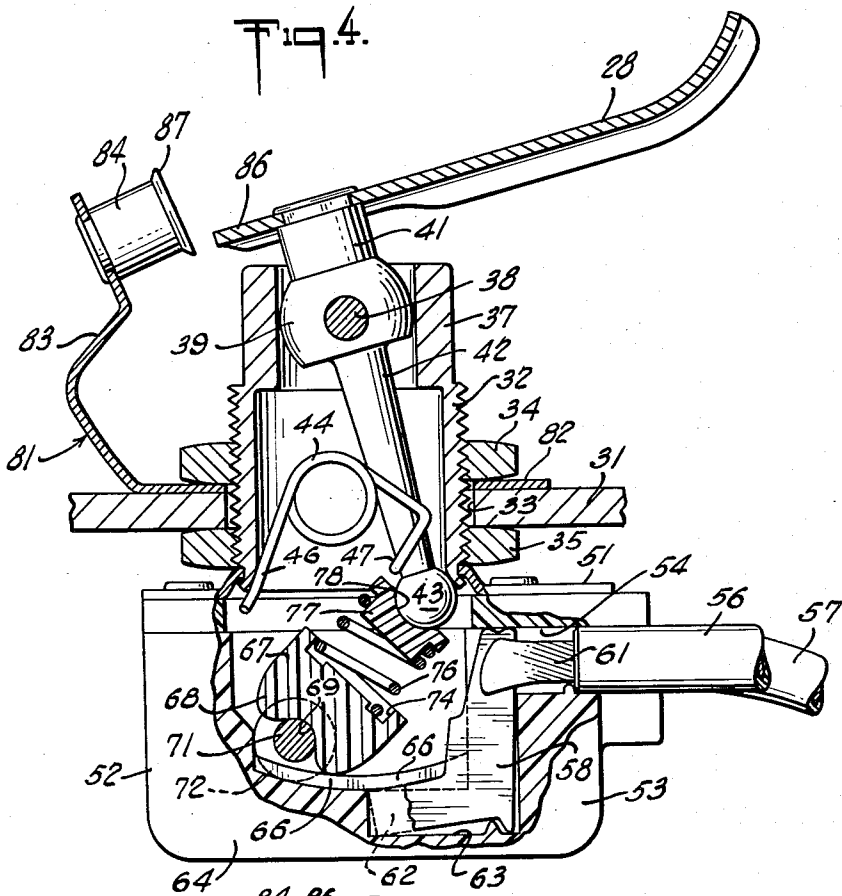
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TRIGGER SWITCH LOCKING MEANS

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2 Sheets-Sheet 2



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TRIGGER SWITCH LOCKING MEANS

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This invention relates to switches, and particularly to a momentary switch having a novel locking device for its actuator or trigger lever.

A salient feature of the invention comprises a novel locking means operable in conjunction with a momentary switch for maintaining said switch in a closed circuit condition for a desired period of time. When it is intended to stop the operation of the apparatus controlled by the switch, the locking means is automatically released by pressure of the actuator or trigger lever of the switch whereby the spring action of the switch elements restores it to the open circuit condition.

The switch, which of particular use for operating such apparatus as vacuum cleaners, hand tools, electric drills and the like, has a thumb actuated trigger lever which is operable intermittently, as desired, to close the electrical circuit to run the apparatus for intermittent periods of time. When, however, it is desired to run the apparatus for a prolonged period of time without the necessity of maintaining thumb or finger pressure upon the switch lever, a spring mounted locking element is movable into a position where it locks the switch lever in a closed circuit position, thereby relieving the operator of the necessity of maintaining pressure upon the switch lever. When it is desired to stop the running of the apparatus, the operator merely depresses the switch lever again to release the locking element whose spring mounting retracts it automatically, so that the lever is urged by the internal spring elements of the momentary switch back into the open circuit position.

By means of the present invention, the prolonged operation of electric hand tools, vacuum cleaners, appliances and machines can be easily and simply effected, not only minimizing fatigue on the part of the operator, but also relieving the operator of the necessity of immobilizing one of his hands for working the switch.

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 an electrically operated hand tool showing the switch of the present invention mounted thereon;

FIG. 2 is a top view, somewhat enlarged, of the switch shown in FIG. 1;

FIG. 3 is a side elevation of the switch shown in FIG. 2;

FIG. 4 is a very greatly enlarged partial section view, similar to that shown in FIG. 3, showing the switch in the open circuit condition;

FIG. 5 is a fragmentary view of a portion of FIG. 4, showing the switch lever in the closed circuit condition and the locking arrangement therefor; and

FIG. 6 is a greatly enlarged perspective view of the lock pin and the spring element upon which said pin is mounted.

Referring now to the drawings in detail, FIGURE 1 shows a side elevation of an electrically operated hand tool 21 such as a drill or the like, which contains an electric motor, not shown. Said motor is operable to rotate a chuck 22 in which is mounted a drill bit 23, or

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the like. Tool 21 has a pistol grip 29 to which is connected an electric cable 25 for connecting the motor inside the tool to a source of electric power.

Mounted on the rear of tool 21, and above the pistol grip portion thereof, is a switch, generally designated 27, having a pivotable trigger lever 28 which is manipulated by the thumb of the operator for momentarily closing the circuit to the electric motor to operate the drill. The circuit remains closed as long as the trigger is depressed by the thumb of the operator. When pressure is released from said trigger, the switch operated by said trigger opens the electrical circuit to the motor whereby the operation of the drill is stopped.

The detailed structure of the switch and its locking arrangement is shown in the remaining figures of the drawings. The switch may be applied not only to pistol grip hand tools, such as drills and the like, but also may be utilized to control such devices as household vacuum cleaners and the like.

The switch assembly herein may be mounted upon the housing 31 of the tool and comprises a bushing 32 extending through an aperture 33 in said housing (see also FIGS. 4 and 5). Bushing 32 may be secured to housing 31 by means of a pair of threaded nuts 34 and 35 engaging the threaded periphery of said bushing. Bushing 32 has an upper tubular extension 37 having a diametrically arrayed pin 38 positioned across the interior thereof. Mounted pivotally on pin 38 is a control element or toggle 39 having an integral upwardly extending stub 41, having trigger lever 28 connected to the externally extending end thereof. Toggle 39 has a downwardly extending integral leg 42 terminating in a spherical ball 43.

Positioned within the lower portion of bushing 32 is a coil spring 44, one end portion 46 of which bears against an interior wall of said bushing, while the other end terminates in a hook 47 which partially encircles the lower end of leg 42. Coil spring 44 is arranged to exert outward forces between elements 46 and 47 whereby leg 42 is normally urged toward one side of bushing 32, as shown in FIG. 4.

Connected to the lower end of bushing 32 is a plate 51 made of sheet metal or the like, to which is connected the box-like switch envelope 52 made of a suitable insulating material that is molded or otherwise formed of Bakelite, nylon or the like.

One end wall 53 of envelope 52 has an aperture 54 through which a pair of electrical lead lines 56 and 57 extend (FIGS. 3 and 4). Positioned side by side on the hollow interior of envelope 52 is a pair of spaced apart L-shaped electrically conductive contact elements 58. In FIG. 4 only one of said contact elements is seen, but it is understood that the other one is positioned directly behind it.

The electrically conductive cores 61 of lead lines 56 and 57 are connected at one end by means of welding or the like to the top portions of respective spaced apart contact elements 58. The other portions of lines 56 and 57 pass by way of cable 25 for connection to a suitable source of electric power.

Each contact element 58 has an integral inwardly extending toe 62 which lies within a respective recess 63 in floor 64 of envelope 52, the upper edge of each toe extending slightly above the surface of said floor. The interior of envelope 52 may be provided with an integrally molded partition 66 which extends somewhat above the interior surface of floor 64 and between toes 62 and elements 58, the top of said partition being concave in profile.

Positioned within the interior of envelope 52 is a movable contact guide 67 made of a suitable insulating material, such as Bakelite, nylon or the like. Guide 67 has

a downwardly extending leg 68 provided with a laterally extending recess 69 which rotatably accommodates an electrically conductive pin 71. Fastened to each end of pin 71 on both sides of leg 68 is an electrically conductive roller contact 72 adapted to roll back and forth along the interior surface of floor 64.

The top surface of guide 67 has a circular recess 74 which accommodates one end of a coil spring 76, the other end of which engages a guide cap 77 made of a suitable insulating material such as Bakelite, nylon or the like. The top of cap 77 has a semi-spherical concave recess 78 which slidably accommodates ball 43.

Normally, as shown in FIG. 4, hook 47 of spring 44 causes ball 43 to be urged to the right while spring 76 causes guide 67, and accordingly, roller contacts 72 to be urged to the left where the latter are spaced apart from toes 62 of contact elements 58. In that condition, trigger lever 28 is in a raised position and indicates that the electrical apparatus which it controls is in the "off" or open circuit condition.

When it is intended to operate the apparatus, lever 28 is momentarily depressed to the position shown in FIG. 5, causing the pivoting action of toggle 39 whereby ball 43 is urged to the left against the action of spring 44. At the same time, cap 77 is also urged by ball 43 to the left, and while the latter is shifting its position, spring 76 is compressed and shifted to cause guide 67 to move to the right. During this action, contacts 72, rotating on pin 71, roll on floor 64 to the right, where said contacts make electrical contact with respective toes 62 of contact elements 58, thereby closing the electrical circuit between elements 58. Thus, the depression of lever 28 places the circuit in the "on" condition for operating the apparatus controlled by the switch. Concomitantly, by releasing pressure from lever 28, spring 44 acting on stub 42, reverses the pivotal motion of toggle 39 to raise said lever and to cause the switch actuating elements to return to their original open circuit positions, as shown in FIG. 4.

In many situations it is either inconvenient or fatiguing for the operator to maintain pressure on lever 28 when the apparatus is in operation for an extended period of time. Accordingly, when it is desired to keep lever 28 in the closed circuit position without continued manual, digital or thumb pressure, there is provided a sheet metal spring, generally designated 81, having a ring-shaped base 82, which encircles bushing 32 and which is secured by means of nut 34 to housing 31.

Integrally formed with base 82 of spring 81 is an upwardly extending arm 83 to the upper end of which is attached one end of a solid metal lock pin 84 positioned near the upper end of extension 37 of bushing 32 and normally slightly spaced apart from the end of an integral projection or finger 86 of trigger lever 28. In some embodiments finger 86 may be formed integrally with stub 41.

The other free end of lock pin 84 has an integral outwardly extending annular flange 87. When it is desired to lock trigger lever 28 in the closed circuit position, said lever is first depressed, after which pin 84 is pushed manually inwardly to a position where it is located between finger 86 and the top edge of extension 37 of bushing 34 (FIG. 5). Since the action of torsion spring 44 normally causes finger 86 to be urged downwardly when pressure is released from trigger lever 28 (FIG. 4), it is evident that said action will cause said finger to be urged downwardly upon pin 84 to retain the latter frictionally in position against extension 37 whereby toggle lever 28 is maintained in the depressed closed circuit position. In some embodiments, the protrusion of flange 87 over the inner edge of extension 37 enhances the locking action of pin 84.

There is sufficient lost motion in the action of toggle 39 and the other actuating parts of the switch to provide for slight downward overtravel of trigger lever 28 and to permit the insertion of the outer end of lock pin 84

between finger 86 and extension 37, after which lever 28 is released to produce the locking action as shown in FIG. 5. When it is desired to open the electrical circuit to stop the operation of the apparatus, the same overtravel or lost motion action permits sufficient slight further depression of trigger lever 28 from its locking position, whereupon finger 86 lifts slightly, pressure is released from lock pin 84, and spring 81 automatically operates to retract said pin out of engagement with said finger. Thereafter pressure is released from trigger lever 28 which then automatically assumes the open circuit position as shown in FIG. 4.

It is evident that the switch lock comprising sheet metal spring 81 and pin 84 may be incorporated into switch assemblies having other types of trigger elements than components 82 and 86 described hereinabove, provided that such elements move pivotally as a lever to operate a pivotable momentary switch. In such event pin 84 would cooperate with a portion of the control lever of the switch to lock it in position when it is moved into the closed circuit position. The form and shape of such other operating levers would be a matter of design and choice provided there is a projection thereon that performs the same function as finger 86 described hereinabove. Accordingly, such alternative embodiments would come within the purview of the present invention.

It is claimed:

1. A switch comprising a case, a control element pivotally mounted on said case and positionable into first and second switch positions, a projection on said control element, a spring normally urging said control element into said first position, a spring-mounted lock element near said case, a pin on said lock element, and a tubular extension on said case surrounding a portion of said control element, said pin being engageable between said projection and an edge of said extension when said control element is in the second position to cause said control element to remain in said second position, the mounting of said lock element being normally biased whereby said pin is released from engagement with said projection when said control element is depressed.

2. A switch according to claim 1, and further comprising a flange on said pin, said flange extending over the internal edge of said tubular extension when said pin is engaged by said projection.

3. A switch comprising a case, a pivotable control element mounted in said case and movable into first and second switch positions, a spring normally urging said control element into said first position, a spring-mounted lock element engageable by said control element when the latter is moved into the second position against the action of said spring to lock said control element in said second position, said control element being capable of a degree of lost motion beyond said second position, the actuation of said control element in said lost motion permitting said spring-mounting automatically to retract said lock element from engagement with said control element and permitting said control element to be returned by said spring to said first position.

4. A switch according to claim 3, and further comprising an arm on said control element, said arm being manually operable to cause the pivoting action of said control element from said first position to said second position and for providing said lost motion action for said control element.

5. A switch according to claim 3 wherein said spring mounting comprises a piece of sheet metal, one end of said metal being mounted near said case, said lock element being mounted on the other free end of said metal, the resilience of said metal being predetermined normally to maintain said lock element spaced apart from said control element and from said case.

6. A switch comprising a case, a control element pivotally mounted in said case, a spring in said case normally urging said control element into a first switch position,

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said control element being movable against the action of said spring into a second switch position, said second switch position being maintainable with some overtravel action of said control element, a spring-mounted lock element near said case and normally retracted in an inactive condition, said lock element being interposable between said case and a portion of said control element when the latter is first moved into an overtravel condition in respect of said second switch position, said lock element being grasped in an active condition between said case and said control element when the latter is returned by said spring from its overtravel condition and is maintained locked by said lock element in said second switch position, the moving of said control element again into an overtravel condition permitting said lock element automatically to retract from between said case and said lock element and permitting said control element to return under the action of said spring to the first switch position.

7. A switch comprising a case, a toggle control element pivotally mounted on said case, said element being movable into an open circuit position and into a closed circuit position, spring means normally urging said control element into an open circuit position, a trigger lever on said control element, a pair of arms on said lever extending in opposite directions, the first of said arms being depressible to move said control element into the closed circuit position, a spring element mounted near said case, a lock element on said spring, said lock element being insertable and frictionally engageable between the second of said arms and a portion of said case when said first arm is first depressed against the action of said spring means and then released to cause said control element to remain in the closed circuit position by the action of said spring means, said spring element being normally biased to withdraw said lock element from between said second arm and said case when said first arm is again depressed against the action of said spring means.

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8. In a momentary switch having a pivotable actuating control element and a mounting therefor, the improvement comprising a spring, one portion of which is connected to said mounting, a lock element mounted on a free portion of said spring, said locking element being normally retracted by the normal bias of said spring away from said control element, said locking element being movable into a position where it is engageable between said control element and said mounting for maintaining said control element in a static position.

9. A switch according to claim 8, and further comprising a second spring normally biasing said actuating control element into one of two switching positions in said switch, said locking element when engaged by said control element causing the latter to be maintained against the action of said second spring in the other of said positions.

10. A switch according to claim 9 wherein said control element is movable into a first overtravel position against the action of said second spring to permit the insertion and engagement of said locking element between said control element and said mounting, the subsequent movement of said control element into an overtravel position automatically permitting the locking element to be retracted by said first mentioned spring.

11. A switch according to claim 10 wherein said first mentioned spring comprises a piece of sheet metal, one end of said metal being connectible at said mounting, said locking element being mounted at the other free end of said sheet of metal, said locking element being in the form of a pin insertable between a portion of said control element and said mounting.

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