



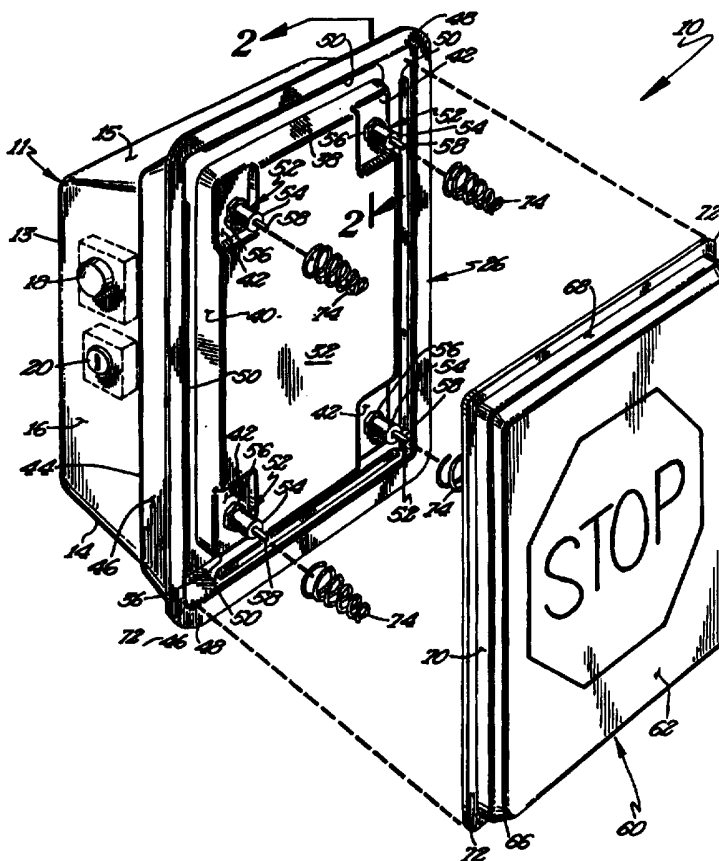
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(54) Title: ELECTRIC CIRCUIT ACTUATING MECHANISM

(57) Abstract

A mechanism (10) for actuating an electric circuit is shown including a switch box (11) fastened to a housing (26) to which a cover (60) is movably mounted. The threaded stems (54) of four de-energizing momentary switches (52) extend through and are held to the front wall (32) of the housing (26). The cover (60) includes a sleeve extending rearwardly of its broad surface front wall (62) and slideably received in a tubular extension (46) of the housing (26). A flange (72) on the sleeve abuts with the ledges (50) formed in the tubular extension (46) to prevent movement therebeyond. The cover (60) can be pushed against the bias of coil springs (74) arranged concentrically around the stems (54) such that any point of the broad surface front wall (62) can be moved in an actuation direction to slide the actuation pins (58) slideable in the stems (54) of one or more of the de-energizing switches (52) to de-energize the electric circuit. The electric circuit is energized by actuating an energizing momentary switch (18) mounted to the switch box (11).



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1 Electric Circuit Actuating Mechanism

BACKGROUND

 This invention relates generally to a safety device
for power tools and more specifically to an electric
5 circuit actuating mechanism which when appropriately
mounted on a power tool stand, allows the operator to turn
on the tool's drive motor by a conscious depression of a
relatively small sized push button switch, but permits the
motor to be turned off by depression of a relatively broad
10 surface by a body part and especially by a body part other
than the hands of the operator whereby there is no need
for the operator to take his eyes or hands off the work
and the cutting or abrading tool.

 U.S. Patent Nos. 3,312,799; 4,166,202; and 4,389,550
15 each describe various forms of switch actuating mechanisms
including a broad surface panel member of one type or
another pivotally mounted in proximity to the operator's
station and this member is mechanically linked to the

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1 on/off lever of the toggle switch. Once the motor of the
tool is turned on, it may be turned off by bumping the
broad surface panel member with one or more parts of the
operator's anatomy other than his hands and this operation
5 may be accomplished without having to glance away from the
working surface of the tool being used. This, of course,
leads to greater safety by preventing accidental or
inadvertent movement of the workpiece or hands into a
position where they may be injured by the tool.

10 However, it can be appreciated that due to the hinged
mounting of the broad surface in U.S. Patent Nos. 3,312,799;
4,166,202; and 4,389,550, bumping the broad surface member
along the edge adjacent and parallel to the pivot axis as
well as adjacent to the pivot axis may not cause the broad
15 surface member to pivot and cause actuation of the switch
or result in turning off the motor of the tool. Although
other manners of mounting the broad surface members are
known such as shown in U.S. Patent No. 3,233,071, while
reducing the possibility that pushing the broad surface
20 member would not cause actuation of the switch, such
arrangements did not eliminate the possibility.

Further, the fabrication of prior actuating mechanisms
tended to be overly costly to manufacture because of the
number of parts involved, making it somewhat difficult to
25 market at a price commensurate with the cost of the tool
on which the safety mechanism was adapted to be used.

The present invention according to the preferred
teachings provides an electric circuit actuating mechanism
of the general type described but is designed to be
30 substantially less complicated in terms of the number of
parts and their assembly into a completed article. This
has been done while increasing the element of safety for
which the earlier devices were designed.

Specifically, the present invention solves problems
35 encountered by prior mechanisms in the field of electric
circuit actuation and other needs in the field by
providing, in the most preferred form, a front wall

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1 movably mounted relative to a housing enabling any point
of the front wall to move in an actuating direction and
to slide actuating pins of one or more of a multiplicity
of de-energizing momentary switches to de-energize an
5 electric circuit, with the electric circuit being
energized by an energizing momentary switch which is not
actuated by movement of the front wall.

It is accordingly the principal object of the present
invention to provide a new and improved safety device for
10 use in conjunction with electrical motor-driven power
tools or the like.

Another object of the invention is to provide an
electric circuit actuating mechanism for use with
electrically powered tools and disposed such that the
15 power may be turned on by the depression of a first switch
and turned off through the application of a force against
a broad surface.

Yet another object of the invention is to provide an
improved safety device for the control of power-driven
20 tools, the safety device including a broad surface movably
mounted to a switch box which, in turn, is arranged to be
connected at a desired location on a power tool stand
whereby the operator's knee, thigh, hip or other part of
his anatomy other than his hands may be used to disconnect
25 the power tool from its power supply.

These and further objects and advantages of the
present invention will become clearer in light of the
following detailed description of an illustrative
embodiment of this invention described in connection
30 with the drawings.

DESCRIPTION OF THE DRAWINGS

The illustrative embodiment may best be described by
reference to the accompanying drawings where:

Figure 1 shows an exploded perspective view of an
35 electric circuit actuating mechanism according to the
preferred teachings of the present invention.

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1 Figure 2 shows a partial, cross-sectional view of the electric circuit actuating mechanism of Figure 1 according to section line 2-2 of Figure 1.

All figures are drawn for ease of explanation of
5 the basic teachings of the present invention only; the extensions of the Figures with respect to number, position, relationship, and dimensions of the parts to form the preferred embodiment will be explained or will be within the skill of the art after the following teachings
10 of the present invention have been read and understood. Further, the exact dimensions and dimensional proportions to conform to specific force, weight, strength, and similar requirements will likewise be within the skill of the art after the following teachings of the present
15 invention have been read and understood.

Where used in the various figures of the drawings, the same numerals designate the same or similar parts. Furthermore, when the terms "top", "bottom", "first", "second", "inside", "outside", "front", "back", "outer",
20 "inner", "upper", "lower", "height", "width", "length", "end", "side", "horizontal", "vertical", "rear", and similar terms are used herein, it should be understood that these terms have reference only to the structure shown in the drawings as it would appear to a person
25 viewing the drawings and are utilized only to facilitate describing the invention.

DESCRIPTION

An electric circuit actuating mechanism according to the preferred teachings of the present invention is shown
30 in the drawings and generally designated 10. Mechanism 10 generally includes a first generally rectangular box-like enclosure or switch box 11 having an open front 12, a rear wall 13, a bottom wall 14, an upper or top wall 15 and integrally formed side walls 16. Bottom wall 14 has one
35 or more apertures (not shown) passing through it allowing electrical wiring to be routed from a source of power into switch box 11 and out of switch box 11 to the power tool

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1 or device being controlled. Alternately, mechanism 10
could be in an extension cord-type arrangement where
switch box 11 could include a female outlet mounted
thereto for electrical connection to the male plug of the
5 power tool wished to be actuated and could also include a
cord extending therefrom terminating in a male plug for
electrical connection to a conventional wall outlet or
the like.

In fabricating mechanism 10 of the present invention,
10 it has been found expedient to use an energizing momentary
switch 18 which operates through a control relay 19 to
selectively energize the electric circuit. The control
relay 19 generally has a coil and a plurality of normally
open contacts. The coil is arranged to be connected in
15 series with the contacts of switch 18 and between the
power terminal such that a momentary closure of switch 18
will cause the coil to be momentarily energized. This
momentary energization, in turn, causes a first set of
normally open contacts to close and latch the relay coil
20 in an energized state such that it will continue to be
energized even when switch 18 is released so as to return
to its original position. Additional control relay
contacts close to connect the terminals across the power
terminals. Control relay 19, itself, may conveniently be
25 mounted within the switch box or enclosure 11. In the
most preferred form, switch 18 is mounted in an aperture
formed in one of the side walls 16. Further in the most
preferred form, a key-operated lock 20 is mounted in an
aperture formed in one of the side walls 16 preferably
30 adjacent to switch 18 and prevents the closure of switch
18 to energize the coil or cause the first set of normally
open contacts to close. In the most preferred form,
switch 18 and lock 20 are commercially available and use
a threaded cylindrical stem which is arranged to pass
35 through the apertures in side walls 16 so as to be held in
place by a locking nut screwed onto the threaded stem.

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1 Switch box 11 has an annular flange 22 extending
outwardly from walls 14-16 parallel to open front 12.
Flange 22 serves as a means whereby switch box 11 may be
fastened to an annular base 24 of a housing 26.
5 Specifically, switch box 11 may conveniently be bolted to
base 24 of housing 26 by means of bolts 28 passing through
base 24 and flange 22. In the most preferred form, a seal
gasket 30 is sandwiched between flange 22 and base 24.

Housing 26 is a rectangular box-like enclosure having
10 a front plate or wall 32, an open rear 34, a bottom wall
36, an upper or top wall 38, and integrally formed side
walls 40. Base 24 extends outwardly from walls 36, 38,
and 40 parallel to open rear 34. A depression 42 is
formed at each corner of housing 26 in walls 32, 36, 38,
15 and 40. An annular, trough-shaped flange 44 is integrally
secured to the outer edge of base 24 opposite walls 36,
38, and 40. In the most preferred form, flange 44 has
semicircular cross sections, with base 24 extending
generally perpendicularly to the upper edge of the first
20 leg of flange 44. A tubular extension 46 extends
generally linearly from the upper edge of the other leg
of flange 44 to a distance beyond front wall 32. The
outer edge of extension 46 terminates in a free edge
having an annular, outwardly extending flange 48. In the
25 most preferred form, extension 46 includes V-shaped ledges
50 extending inwardly from extension 46 spaced inwardly of
the free edge of extension 46 at a constant distance
intermediate base 24 and front wall 32. It can be
appreciated that ledges 50 adjacent wall 36 are in a
30 parallel, spaced relation to ledges 50 adjacent wall 38
and that ledges 50 adjacent to first and second side walls
40 are similarly in a parallel, spaced relation. In the
preferred form shown, ledges 50 are spaced from the
corners of extension 46 but ledges 50 could extend around
35 the entire circumference of extension 46 for better dust
control if desired or necessary.

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1 Mechanism 10 of the present invention further includes
a multiplicity and specifically four de-energizing
momentary switches 52 mounted to housing 26 in a spaced
arrangement, with no three switches being arranged in a
5 linear manner in the preferred form and being arranged at
the corners of a right parallelepiped and in the most
preferred form shown as arranged adjacent the corners of
front wall 32 and specifically in depressions 42 thereof.
Actuation of one or more of switches 52 causes the first
10 set of normally open contacts of control relay 19 to open
and release the relay coil into a de-energized state. The
first contacts will remain open and the relay coil will
remain de-energized until and unless switch 18 is actuated
as previously set forth. Switches 52 are commercially
15 available and use a threaded stem 54 which is arranged to
pass through apertures in depressions 42 so as to be held
in place by a locking nut 56 screwed onto stem 54. In
the most preferred form, the depth of depressions 42 is
generally equal to the height of nuts 56 on stem 54.
20 Actuating pins 58 are slideable inside stems 54, with pins
58 being biased outward of stem 54 from a first position
to a second position and slideable into stem 54 against
the bias to actuate switches 52 when pins 58 are slid from
the second position.

25 Mechanism 10 of the present invention further includes
a cover 60 movable relative to housing 26. Cover 60 is a
rectangular, box-like structure having a broad surface
front wall or panel 62, an open rear 64, a bottom wall 66,
an upper or top wall 68, and integrally formed side walls
30 70. An annular flange 72 extends parallel to open rear 64
and outwardly from walls 66, 68, and 70 which define a
sleeve extending rearwardly from front wall 62 and having
a size corresponding to and for receipt within tubular
extension 46 of housing 26. The outer edge of flange 72
35 extends outwardly of the inner edges of ledges 50. Housing
26 and/or cover 60 have sufficient flexibility to place
flange 72 behind ledges 50 for assembly but generally

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1 prevent normal removal. Due to spacing of ledges 50 from
the free edge of extension 46, flange 72 is recessed
behind the free edge and inside of extension 46.

Mechanism 10 according to the preferred teachings of
5 the present invention includes suitable members 74 for
biasing cover 60 outwardly from housing 26 such that
flange 72 abuts with ledges 50. In the preferred form,
members 74 are a multiplicity of coil springs corresponding
to the number of switches 52 and in the most preferred
10 form which are positioned concentrically around stems 54
of switches 52 and sandwiched between depressions 42 and
wall 62. Thus, positioning bosses for springs 74 are not
required on housing 26 and/or cover 60. It can then be
appreciated that the sleeve formed by walls 66, 68, and 70,
15 tubular extension 46, ledges 50, flange 72, and springs 74
movably mount front wall 62 relative to housing 26 in a
free floating arrangement enabling any point of the broad
surface of front wall 62 to move in an actuation direction
which is towards front wall 32 in the most preferred form
20 from a normal position to an actuation position, with
front wall 62 being biased by springs 74 from the
actuation position to the normal position. In the normal
position, flange 72 abuts with ledges 50 of tubular
extension 46 and prevent movement of cover 60 therebeyond
25 in a direction opposite to the actuation direction. It
should further be realized that cover 60 is movable inward
of housing 26 against the bias of springs 74 by pushing on
front wall 62 to thereby separate flange 72 or portions
thereof from ledges 50 in the actuation direction. In the
30 most preferred form, pins 58 abut with the rear surface of
front wall 62 and do not actuate switches 52 with cover 60
biased outwardly with flange 72 abutting with all of the
ledges 50. Thus, movement of front wall 62 towards stems
54 will immediately cause pins 58 to slide in stems 54 in
35 a direction opposite to the bias direction of pins 58 in
stems 54 and actuate switch 52.

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1 In the most preferred form of the present invention,
the back surface of front wall 62 includes a network of
ribs 76. It can then be appreciated that ribs 76 increase
the strength of front wall 62 and cover 60 allowing their
5 formation from reduced thickness materials. However,
more importantly in the most preferred form, ribs 76 are
designed to engage front wall 32 before actuating pins 58
are forced to over travel and thus protect switches 52.
In addition, it can be appreciated that depressions 42
10 create further spacing from front wall 62 such that the
length (and diameter) of stems 54 can be increased to
maximize the size of switches 52 which can be utilized.

Switch box 11, housing 26, and cover 60 are
preferably fabricated from sheet metal or plastics, as
15 is conventional for electrical switch boxes.

Now that the details of the construction of mechanism
10 according to the preferred teachings of the present
invention have been set forth, consideration will be given
to its mode of operation and advantages. As has already
20 been mentioned, the present invention comprises a safety
device in the form of electric circuit actuating mechanism
10 for facilitating the control of electrical circuits
such as for drive motors or the like commonly used with
power tools. For example, the present invention may be
25 used with a wide variety of power tools including table
saws, drill presses, lathes, sanders, joiner/planers and
the like. Mechanism 10 is mounted at a convenient
location proximate the operator's usual work station and
power is brought into and out of switch box 11 as set
30 forth previously from motor control relay 19 which is
housed within switch box 11. Thus, due to the solid
construction of switch box 11 and of housing 26 and
specifically front wall 32 thereof, the interior defined
by switch box 11 and housing 26 fastened together with
35 gasket 30 in the most preferred form encloses the
electrical components of switches 18 and 52, lock 20, and

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1 relay 19 and protects them from the environment such as
but not limited to sawdust and the like which may be in
the air.

To start the motor, the operator must first unlock
5 mechanism 10 by rotating the key for lock 20. The
operator may now depress switch 18 to complete the
circuit to control relay 19 causing relay 19 to latch up
and maintain a closed circuit between the power supply
and the motor being controlled. The operator may remove
10 his finger from switch 18 and, in doing so, the internal
spring of momentary switch 18 will force switch 18 back
to its starting position. It can then be appreciated
that actuation of switch 18 does not occur as the result
of movement of front wall 62 or cover 60.

15 All the while, the machine will be running in that the
momentary closure of switch 18 effected an energization
of control relay 19 and its latching contacts. When the
operator desires to again turn off the motor, he may apply
a force either with his hand, but preferably with another
20 part of his anatomy such as his thigh, knee or hip,
against surface 62 to thereby overcome the force of one or
more of coil springs 54 and force surface 62 against one
or more of pins 58 of switches 52. Depression of surface
62 against the force of springs 54 then causes pins 58 to
25 move to the right viewed in Figure 2 such that one or
more of switches 52 are actuated. During its travel,
the electrical connection to the motor control relay coil
is momentarily broken, causing the latching contacts to
release and disconnecting the motor from the power supply.
30 When surface 62 is released, coil springs 54 return it
to its vertical orientation while the internal spring
associated with pins 58 ensure that they will also be
returned to their at-rest position with pins 58 in their
outer orientations.

35 It can then be appreciated that de-energization of the
electric circuit can be accomplished by pushing surface 62
in different manners. Specifically, surface 62 can be

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1 pushed to separate the portion of flange 72 adjacent to
wall 68 from the portion of ledges 50 adjacent wall 38
causing cover 60 to pivot about an axis parallel to the
portion of flange 72 adjacent to wall 66 and the portion
5 of ledges 50 adjacent wall 36 in a similar manner as in
U.S. Patent No. 4,389,550. It can be appreciated that the
portions of flange 72 adjacent to walls 70 will separate
in a non-parallel manner from ledges 50 adjacent to walls
40. Such movement of surface 62 will slide actuating pins
10 58 of the two switches 52 adjacent to wall 38 inward to
thus de-energize the electric circuit. However, unlike
U.S. Patent No. 4,389,550, surface 62 can be pushed to
separate the portion of flange 72 adjacent to wall 66 from
the portion of ledges 50 adjacent wall 36 causing cover 60
15 to pivot about an axis parallel to the portion of flange
72 adjacent to wall 68 and the portion of ledges 50
adjacent wall 38. It can be appreciated that the portions
of flange 72 adjacent to walls 70 will separate in a non-
parallel manner from ledges 50 adjacent to walls 40. Such
20 movement of surface 62 will slide actuating pins 58 of the
two switches 52 adjacent to wall 36 inward to thus de-
energize the electric circuit. Furthermore, unlike U.S.
Patent No. 4,389,550, surface 62 can be pushed to separate
the portion of flange 72 adjacent to one of the first and
25 second side walls 70 from the portion of ledges 50
adjacent to the corresponding side wall 40 of housing 26
causing cover 60 to pivot about an axis parallel to the
portion of flange 72 adjacent the other of the first and
second side walls 70 from the portion of ledges 50
30 adjacent to the corresponding side wall 40 of housing 26.
It can be appreciated that the portions of flanges 72
adjacent to walls 66 and 68 will separate in a non-parallel
manner from ledges 50 adjacent to walls 36 and 38. Such
movement of surface 62 will slide actuating pins 58 of
35 the two switches 52 adjacent to wall 40 adjacent to the
portion of flange 72 separated from ledge 50 inward to
thus de-energize the electric circuit. Further, unlike

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1 U.S. Patent No. 4,389,550, surface 62 can be pushed to
separate the portion of flange 72 adjacent to the corner
between wall 66 and the first side wall 70 from the
portions of ledges 50 adjacent to the corner between wall
5 36 and the first side wall 40 causing cover 60 to pivot
about an axis parallel to the portion of flange 72
adjacent to wall 68 and second side wall 70 and the
portions of ledges 50 adjacent wall 38 and the second
side wall 40. It can be appreciated that the remaining
10 portions of flange 72 will separate in a non-parallel
manner from the remaining portions of ledges 50. Such
movement of surface 62 will slide actuating pin 58 of
switch 52 adjacent to the corner of wall 36 and first side
wall 40 inward to thus de-energize the electric circuit.
15 Similarly, cover 62 can be pushed to slide actuating pin
58 of switches 52 adjacent the other corners of front
wall 32.

It can then be appreciated that the positioning of
the body part other than the hand such as thigh, knee,
20 or hip on surface 62 is not as accurate as a hand would
be, especially when surface 62 is not being viewed and
even further under emergency situations where fast
actuation is desired. Mechanism 10 then provides a
substantial improvement over mechanisms including
25 actuation surfaces which are pivotally mounted through
the use of a hinged mounting such as in U.S. Patent Nos.
3,312,799; 4,166,202; and 4,389,550 in the ability to
quickly and consistently de-energize the electric circuit.
Furthermore, the present invention provides a substantial
30 improvement over mechanisms including actuating surfaces
which are not mounted through the use of hinge mountings
such as in U.S. Patent No. 3,233,071. Specifically, such
mechanisms were not consistent in causing actuation of
the switch. For example, in some circumstances, the
35 surface would bottom out by hitting other portions of
the mechanism before actuating the switch. Further,
considerable travel of the surface would be required

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1 especially when pushed at the corner before the switch
was actuated, and similarly considerable force would be
required in these circumstances especially if a typical
start/stop type switch was utilized. Mechanism 10
5 according to the teachings of the present invention then
takes a novel and unique design direction from prior
mechanisms such as shown in U.S. Patent No. 3,233,071.
Specifically, momentary switches 18 and 52 are utilized
such that the amount of travel of surface 62 and the amount
10 of force to push surface 62 required to actuate switches
52 are minimized. But more importantly, the use of
momentary switches 52 allows the use of a multiplicity of
switches 52. Use of more than one start/stop type switch
as in U.S. Patent No. 3,233,071 is not possible and/or is
15 impractical. It can then be appreciated that multiple
momentary switches 52 according to the teachings of the
present invention allows them to be spaced from each other
such that different movements of surface 62 will actuate
one or more of such switches 52 especially if switches 52
20 are arranged in a nonlinear manner in the preferred form
and at the corners of a right parallelepiped in the most
preferred form. Thus, mechanism 10 according to the
teachings of the present invention effectively eliminates
the possibility that pushing front wall 62 will not
25 cause actuation of one or more switches 52 causing
de-energization of the electric circuit and over comes
the disadvantages and limitations of prior mechanisms
including but not limited to the types as shown in U.S.
Patent Nos. 3,233,071; 3,312,799; 4,166,202; and 4,389,550.
30 To lock actuating mechanism 10 and to thereby prevent
unauthorized use of the power tool, the operator turns the
key for lock 20 which prevents switch 18 from energizing
control relay 19 and removes the key. In the most
preferred form, lock 20 is a key-operated electrical
35 switch which, when a proper key is inserted in the tumbler
and rotated, the switch is operative to apply electrical
current to the utilization device via switch 18. However,

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1 when the key-operated electrical switch is off, the
circuit is broken to switch 18 and actuation thereof is
incapable of initiating operation of the motor or other
device utilizing actuating mechanism 10 of the present
5 invention.

By making switch 18 relatively small and by placing
switch 18 in switch box 11 behind housing 26 and cover
60 and specifically behind front wall 62 of cover 60,
accidental operation of switch 18 is practically
10 eliminated. It of course can be appreciated that switch
18 can be located at other positions in switch box 11 or
at positions other than in switch box 11 according to the
teachings of the present invention as long as actuation of
switch 18 does not occur as the result of the movement of
15 front wall 62 or cover 60. Once switch 18 is operated to
turn the machine on, the operator need not search around
for an OFF switch in that application of a force anywhere
on surface 62 functions to turn off the machine.

It can then be appreciated that telescoping walls
20 66, 68, and 70 defining the sleeve of cover 60 inside
extension 46 and spacing ledges 50 from the free edge
and inside extension 46 are believed to be advantageous
in making disassembly more difficult. Specifically, if
cover 60 were telescoped on the outside of housing 26 such
25 as disclosed in U.S. Patent 3,233,071, the back edges of
the cover could be easily flexed outwardly to release the
cover from the housing, with such flexing being the result
of an object accidentally catching on the back edges or
by simply being gripped by the fingers of a vandal which
30 can be a significant problem in a school or similar
environment. Due to the construction of mechanism 10
according to the preferred teachings of the present
invention, disassembly requires extension 46 and flange
48 to be flexed outwardly and/or walls 66, 68, and 70 and
35 flange 72 to be flexed inwardly which is very difficult
to perform especially when mechanism 10 is mounted on the
work station.

CLAIMS

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1. Mechanism for actuating an electric circuit comprising, in combination: a housing; a front wall having a broad surface; means for movably mounting the front wall relative to the housing enabling any point of the broad surface to move in an actuation direction from a normal position to an actuation position, with the front wall being biased from the actuation position to the normal position; and a multiplicity of de-energizing momentary switches mounted to the housing in a spaced arrangement, with the de-energizing momentary switches each including a slideable actuating pin biased in a direction opposite to the actuation direction from a first position to a second position, with movement of any point of the broad surface of the front wall in the actuation direction from the normal position sliding the actuating pin of at least one of the de-energizing momentary switches in the actuation direction, with the de-energizing momentary switches de-energizing the electric circuit when the actuating pin of at least one of the de-energizing momentary switches is slid in the actuation direction from the second position, with the energizing of the electric circuit not occurring as the result of the movement of the front wall.
2. The electric circuit actuating mechanism of claim 1 wherein at least three de-energizing momentary switches are arranged in a non linear manner.
3. The electric circuit actuating mechanism of claim 2 wherein four de-energizing momentary switches are arranged at the corners of a right parallelepiped.
4. The electric circuit actuating mechanism of claim 2 wherein the movably mounting means comprises, in combination: a multiplicity of coil springs corresponding to the number of de-energizing momentary switches, with the coil springs being sandwiched between the housing and the front wall and located concentric to the actuating pin.
5. The electric circuit actuating mechanism of claim 4 wherein the movably mounting means comprises, in combination:

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ledge portions located in a spaced relation on one of the housing and the front wall; and flange portions on the other of the housing and the front wall for abutting with the ledge portions in the normal position, with the flange portions being movable from the ledge portions when the front surface moves from the normal position.

6. The electric circuit actuating mechanism of claim 5 wherein the housing includes a tubular extension; and wherein the front wall includes a sleeve of a size corresponding to and for receipt within the tubular extension, with the ledge portions located on one of the tubular extension and the sleeve and the flange portions located on the other of the tubular extension and the sleeve.

7. The electric circuit actuating mechanism of claim 6 wherein the tubular extension includes a free edge, with the tubular extension including the ledge portions spaced from the free edge in the actuating direction to recess the flange portions inside of the tubular extension.

8. The electric circuit actuating mechanism of claim 7 further comprising, in combination: at least one energizing momentary switch which can be actuated to energize the electric circuit, with the actuation of the energizing momentary switch not occurring as the result of the movement of the front wall.

9. The electric circuit actuating mechanism of claim 8 wherein the housing comprises, in combination: a front plate of a solid construction; and a switch box in the form of an enclosure of a solid construction having an open front, with the front plate closing the open front and defining an interior, with the de-energizing momentary switches mounted to the front plate and located within the interior with the actuating pins sliding through the front plate, with the energizing momentary switch mounted to the switch box, with the interior enabling the electrical components of the switches and the electric circuit to be enclosed therein and environmentally protected.

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10. The electric circuit actuating mechanism of claim 9 wherein the front plate includes a multiplicity of depressions corresponding to the number of de-energizing momentary switches and each having a depth; and wherein each of the de-energizing momentary switches include a threaded stem passing through the front plate and for receipt of a nut having a thickness, with the actuating pin of the momentary switch being slideable in the threaded stem.

11. The electric circuit actuating mechanism of claim 10 wherein the depth of the depressions is generally equal to the thickness of the nut.

12. The electric circuit actuating mechanism of claim 1 wherein the movably mounting means comprises, in combination: ledge portions located in a spaced relation on one of the housing and the front wall; and flange portions on the other of the housing and the front wall for abutting with the ledge portions in the normal position, with the flange portions being movable from the ledge portions when the front surface moves from the normal position.

13. The electric circuit actuating mechanism of claim 12 wherein the housing includes a tubular extension; and wherein the front wall includes a sleeve of a size corresponding to and for receipt within the tubular extension, with the ledge portions located on one of the tubular extension and the sleeve and the flange portions located on the other of the tubular extension and the sleeve.

14. The electric circuit actuating mechanism of claim 13 wherein the tubular extension includes a free edge, with the tubular extension including the ledge portions spaced from the free edge in the actuating direction to recess the flange portions inside of the tubular extension.

15. The electric circuit actuating mechanism of claim 1 further comprising, in combination: at least one energizing momentary switch which can be actuated to energize the electric circuit, with the actuation of the energizing momentary switch not occurring as the result of the movement

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of the front wall.

16. The electric circuit actuating mechanism of claim 15 wherein the housing comprises, in combination: a front plate of a solid construction; and a switch box in the form of an enclosure of a solid construction having an open front, with the front plate closing the open front and defining an interior, with the de-energizing momentary switches mounted to the front plate and located within the interior with the actuating pins sliding through the front plate, with the energizing momentary switch mounted to the switch box, with the interior enabling the electrical components of the switches and the electric circuit to be enclosed therein and environmentally protected.

17. The electric circuit actuating mechanism of claim 16 wherein the front plate includes a multiplicity of depressions corresponding to the number of de-energizing momentary switches and each having a depth; and wherein each of the de-energizing momentary switches include a threaded stem passing through the front plate and for threadable receipt of a nut having a thickness, with the actuating pin of the momentary switch being slideable in the threaded stem.

18. The electric circuit actuating mechanism of claim 17 wherein the depth of the depressions is generally equal to the thickness of the nut.

19. The electric circuit actuating mechanism of claim 1 wherein the housing includes a front plate having a multiplicity of depressions corresponding to the number of de-energizing momentary switches and each having a depth; and wherein each of the de-energizing momentary switches include a threaded stem passing through the front plate and for threadable receipt of a nut having a thickness, with the actuating pin of the momentary switch being slideable in the threaded stem.

20. The electric circuit actuating mechanism of claim 19 wherein the depth of the depressions is generally equal to the thickness of the nut.

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21. The electric circuit actuating mechanism of claim 1 further comprising, in combination: a network of ribs formed on the front wall, with the housing including a front plate, with the actuating pins of the momentary switches being slideable relative to the front plate; with the network of ribs extending from the front wall to engage the front plate before the actuating pins are forced to over travel in the de-energizing momentary switches.

22. The electric circuit actuating mechanism of claim 1 wherein the movably mounting means comprises, in combination: a multiplicity of coil springs corresponding to the number of de-energizing momentary switches, with the coil springs being sandwiched between the housing and the front wall and located concentric to the actuating pin.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 95/13417

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H01H3/02 H01H3/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,4 785 144 (FOSNAUGH HARLAND R ET AL) 15 November 1988 see abstract; figures 1,5,6 ---	1
A	FR,A,2 456 378 (REITER JOHN) 5 December 1980 cited in the application see figures ---	1
A	GB,A,2 162 372 (PEACHEY CYRIL JOHN;PEACHEY SALLY WINIFRED JOAN) 29 January 1986 see abstract; figure 1 ---	1
A	US,A,4 389 550 (REITER JOHN J) 21 June 1983 cited in the application see figures -----	1

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Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No PCT/US 95/13417
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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GB-A-2162372	29-01-86	NONE	

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