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SWITCH OPERATING MECHANISM WITH HANDLE POSITIONING MEANS

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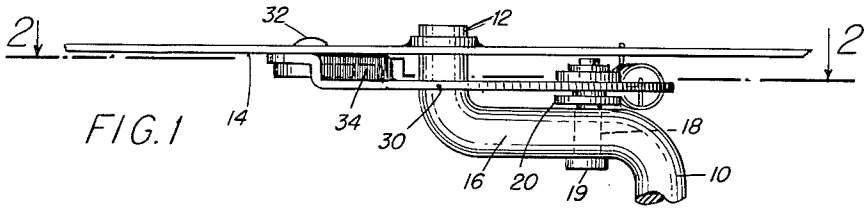


FIG. 1

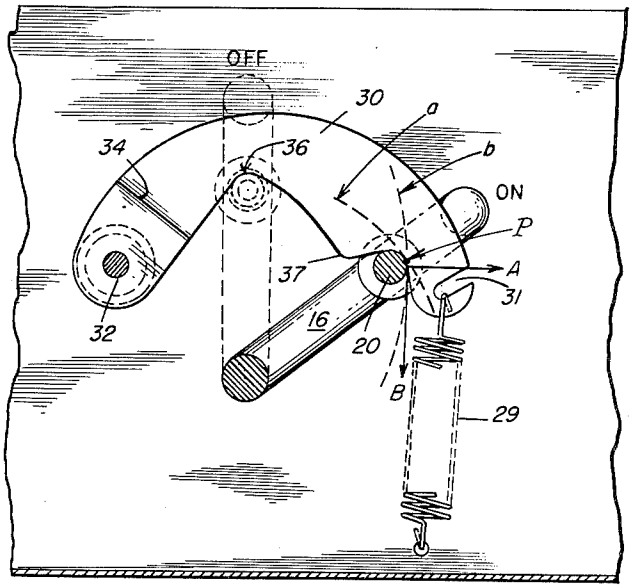


FIG. 2

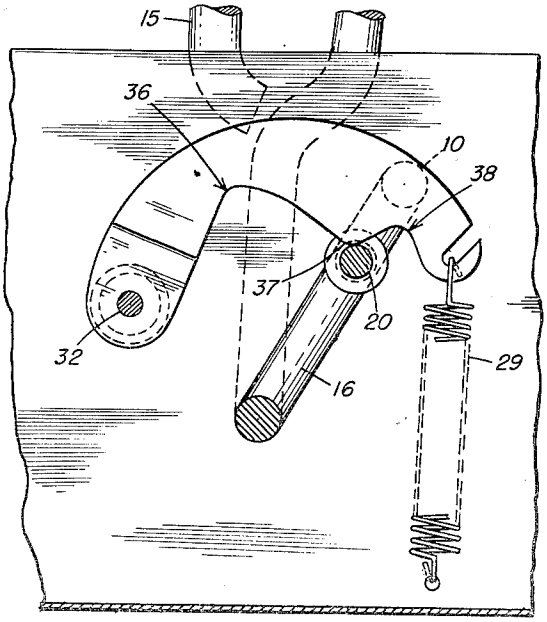


FIG. 3

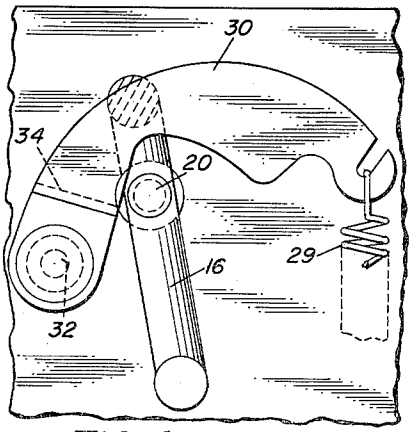


FIG. 4

INVENTOR.
Daniel F. Daly
BY his attorneys
Howson and Howson.

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SWITCH OPERATING MECHANISM WITH HANDLE POSITIONING MEANS

Daniel F. Daly, Hartford, Conn., assignor to The Arrow-Hart & Hegeman Electric Company, Hartford, Conn., a corporation of Connecticut

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This invention relates to manual operating mechanism for electric switches and, more particularly, to a quick make and break mechanism in which the action is substantially involuntary on passing over-center between one switch position and another, but is prevented from continuing movement past the two at-rest or "On" and "Off" positions of the switch and mechanism.

An object of the invention is to provide a simplified mechanism for manually operating electric switches which is economical to form and assemble, yet will be strong and reliable during continued hard use where relatively strong forces are involved.

Another object is to provide a mechanism satisfying the above objectives which can be made from easily stamped and machined parts.

Other objects and advantages of the invention will occur as it is described in connection with the accompanying drawing.

In the drawing:

FIG. 1 is a fragmentary top plan view of the invention as applied to the wall and operating member of a conventional electric switch and box.

FIG. 2 is a broken side elevation view, partly in section, on line 2—2 of the invention as illustrated in FIG. 1.

FIG. 3 is a side elevation view similar to FIG. 2 with the parts in midposition.

FIG. 4 is a view similar to FIGS. 2 and 3, but with the operating member stopped from movement beyond the dotted position of FIG. 2.

Referring to the drawing, the invention is illustrated in connection with the pertinent parts of a conventional electric switch box. Since the switch contacts and the connections between them and the operating mechanism are conventional, the switch is not illustrated, nor is the box as a whole. The box is commonly rectilinear. In its opposite side walls, the ends of a U-shaped bent wire-rod operating member 10 of conventional form and construction are pivotally mounted.

Only one end portion of the operating member and its outer extremity 12 is illustrated in connection with its mounting in one side 14 of the box, since the other end is formed to cooperate in an identical way with the opposite wall of the box except that the opposite end has a handle 15 formed thereon (shown in phantom in FIGURE 3) outside the box for manual operation of the switch mechanism.

In the arm 16 of the operating member is a diametrical bore in which is received an axle or pivot pin 18 with an enlarged head 19 on its inner end and a flanged roller 20 on its other or outer end. The roller may be held revolvably on the pin in any common suitable way, as by a split collar.

Engaged with the roller 20 is a generally C-shaped lever member 30 pivotally mounted at one end against the side wall of the box on a pivot pin 32 fixedly mounted in the side wall. The lever has an S bend near its pivot forming a shoulder 34 offsetting the remainder of the lever from its pivot parallel to and spaced from the box wall 14. The offset portion of the lever lies in the plane of the roller 20 with its edge between the flanges of the roller, thus preventing the lever from slipping sideways off the roller.

To hold the lever in engagement with the roller, a coiled tension spring 29 has one end hooked into a notch 31 in the "free" end of the lever while the other end of the spring is anchored to the box wall 14 by looping through a hole or otherwise.

The inside surface of the lever with which the roller 20 engages is formed as a cam surface with two valleys or positioning recesses 36 and 38 (see FIGURE 3) between which is a hill 37, all of which have different camming actions on the roller and operating member.

When seated in recess 36 which may conveniently be referred to as the "Off" recess, the switch contacts (not shown) commonly are in open or disengaged position. Any attempt to move the switch further counterclockwise from the "Off" or dotted-position of FIGURE 2 will be halted by the outer flange of the roller 20 abutting the shoulder 34 of the lever, as shown in FIG. 4.

As the handle 15 is moved to turn the operating member clockwise from the dotted-position of FIGURE 2, the roller rolls up one side of the hill 37 during which the spring 29 is stressed as shown in FIGURE 3. After the peak of the hump is reached, the roller starts rolling down the opposite side of the hump into the full-line position of FIGURE 2. This occurs with an involuntary action due to the shape of the hill and because the spring force acting through the lever on the roller and thence on the operating member is mainly or substantially in a direction tangential with respect to the arc about the axis of the operating member.

On reaching the "On" position, the operating member and roller stop. Any attempt to move beyond the "On" position is halted for the following reasons.

When force is applied to the handle to move the operating member 10 and roller 20 clockwise beyond the "On" position, the force is applied against the lever 30 at a point substantially where an imaginary line through the axes of the pivots 32 and 20 would intersect the inner surface of the lever. At this point, such force may be broken into its components A and B, B being parallel to the cam surface of the lever at the point of engagement P of the roller and lever in the "On" position (and tangential to the arc *b* whose center is the axis of pivot pin 32 of the lever). Force component A is perpendicular to B and is in alignment with the imaginary line through the axes of the pivot 32 and roller 20 in the "On" position.

Hence, the component B acting parallel to the surface of the lever at the point of contact exerts no turning force on the lever; and component B, being aligned with the centers of the pivot 32 and the roller 20, exerts no turning action.

More importantly, since the spring 29 is constantly urging the lever clockwise, its point of engagement with the roller tends to move in an arc *b* whose center is the pivot 32, while the roller tends to move in an arc *a* whose center is the pivotal axis of the operating member. Since the arc *a* crosses the arc *b* in the "On" position of the switch the lever and roller tend to bind each other in the "On" position when an attempt is made to move clockwise from the "On" position.

A valuable function is served by the proximity of the flanges on the roller 20 to the faces of the lever member 30. Because the roller is constantly held in engagement with the lever, and because the lever is mounted for pivotal movement in a fixed plane parallel to the box wall, axial movement of the operating member or bail 16 is prevented by the flanges of the roller abutting one face or the other of the lever 30. Thus, the end of the bail, shown in FIGURE 1 as passing through a hole with an extruded periphery, is prevented from coming out of its bearing in the side wall of the box.

The mechanism as described is adapted for use with knife-blade switches, but may also be used with butt-con-

tact switches and in many other conditions. The invention is not limited to any particular type of switch or contacts.

Ordinarily, switches which are adapted for handling heavy currents of 50 or 100 amperes or more have very heavy parts and, hence, strong spring forces are involved. Particularly when large spring forces are involved, the movement of the operating member and switch contacts from one position to another becomes involuntary or almost uncontrollable after the peak of the hump has been passed in the movement from one switch position to the other.

Modifications within the scope of the invention will occur to those skilled in the art. Therefore, the invention is not limited to the form and arrangement of parts as illustrated and described.

What is claimed is:

1. The combination comprising a contact operating member pivotally mounted in the side wall of the box, a flanged roller pivotally mounted on said operating member in fixed relation thereto, a lever member pivotally mounted on a box wall for movement in a plane parallel to said wall, spring means holding said lever member engaged with said roller with a flange between said lever and the box wall, whereby said operating member is maintained axially in a predetermined position.

2. The combination comprising a contact operating member pivotally mounted in a side wall of the box, a lever member pivotally mounted on a box wall for movement in a plane parallel to said wall, means on said operating member in fixed relation thereto and having surfaces adjacent to the sides of said lever, spring means holding said lever member engaged with said first means, whereby said operating member is maintained axially in a predetermined position by said surfaces.

3. The combination of a box with electric switch operating mechanism comprising a contact operating member mounted in the box for movement between two at-rest positions, anti-friction means on said operating member, a pivotally mounted positioning lever supported from said box, spring means holding said lever engaged with said anti-friction means, means formed on said positioning lever to locate said anti-friction means and operating member in either of said two positions, and means to halt movement of the operating member past one of said positions, said lever being laterally offset from the plane of movement of the lever adjacent one end providing a shoulder engageable by said anti-friction means to stop movement of said operating member beyond the other of said positions.

4. The combination of a box with electric switch operating mechanism comprising a contact operating member pivotally mounted in the box for movement between two at-rest positions about a first pivotal axis, an arcuate pivotally mounted positioning lever supported from said box for movement about a second pivotal axis, said first pivotal axis being on the concave side of said arcuate lever, anti-friction means on said operating member engaging with the concave side of said arcuate lever, said concave side having a hill portion between said two at-rest positions for engagement with said anti-friction means causing over-center movement of said operating member into said at-rest positions, said anti-friction means engaging said arcuate lever at a certain point in one at-rest position, the arc of said point about said first axis intersecting the arc of said point about said second axis in said one at-rest position, spring means holding said arcuate lever in engagement with said anti-friction means, the intersection of said arcs and said spring bias preventing movement past said one at-rest position by said operating member.

5. The combination as claimed in claim 4 wherein a portion of said arcuate lever is laterally offset from the plane of movement of said lever adjacent its pivot end providing a shoulder engageable by said anti-friction means to stop movement of said operating member beyond the other at-rest position.

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