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TIME DELAY SWITCH
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3,133,165

FIG. 1

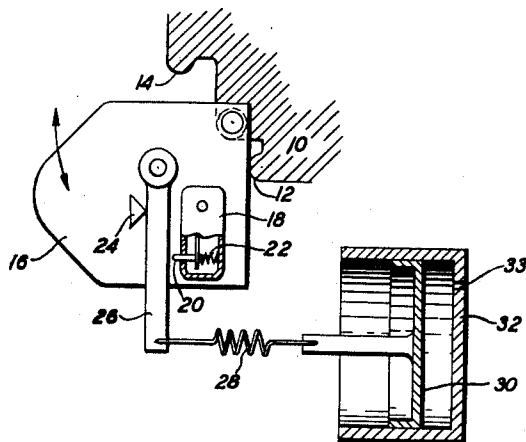
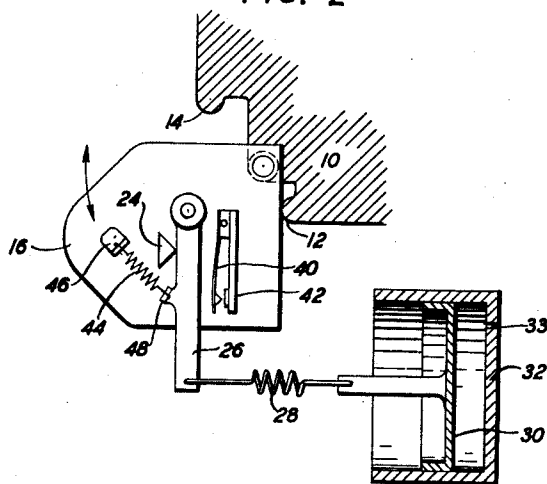


FIG. 2



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1

3,133,165 TIME DELAY SWITCH

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This invention pertains to switches and particularly to time delay switches.

An object of this invention is to provide a switch that is actuated after a delay of a preselected period of time.

Another object of this invention is to provide a switch that when actuated is automatically deactivated after a delay of a preselected period of time.

These and other objects of this invention are achieved in an illustrative embodiment thereof wherein the delay switch comprises a support movable between a first and a second position. Switching means are fixedly secured to the support and an actuator for the switching means is positioned in the path traversed by the switching means as the support moves from its first to its second position. The actuator itself is movable between a first and a second position, the actuator moving along the same general path traversed by the switching means. The actuator is coupled to the piston of a dashpot, and means responsive to the movement of the support from its first to its second position bias the actuator toward its second position.

When the support is in its first position and the actuator is in its first position, the actuator is in a nonactuating relationship with the switching means. As the support moves from its first to its second position, the means responsive to the movement of the support commences to move the actuator toward its second position. However, the movement of the actuator is retarded by the dashpot, and the support moves more rapidly than the actuator is permitted to move by the dashpot. The support thus moves relative to the actuator and after a preselected period of time the switching means is moved into engagement with and actuated by the actuator. After the support reaches its second position and its movement is stopped, the movement responsive means continues to move the actuator toward its second position and following a preselected period of relay the actuator reaches its second position. In this position the actuator is again in a nonactuating relationship with the switching means, and the switching means is thereby deactivated. Moving the support from its second to its first position disables the movement responsive means and means are provided for returning the actuator to its first position.

A complete understanding of the invention and of these and other features and advantages thereof may be gained from consideration of the following detailed description taken in conjunction with the accompanying drawing wherein two embodiments of the invention are illustrated. It is to be expressly understood, however, that the drawing is for the purposes of illustration and description and is not to be construed as defining the limits of the invention.

In the drawing:

FIG. 1 is a schematic representation of one embodiment of the invention; and

FIG. 2 is a schematic representation of a second embodiment of the invention.

Referring to FIG. 1, one embodiment of the invention comprises a stationary base 10 having bosses 12 and 14. A support 16 is pivotally mounted to the base and movable between a first position whereby it engages the boss 12 and a second position whereby it engages the boss 14. Switching means consisting of a force operated switch 18 is attached to the support. The switch is of the type known to the trade as a "Microswitch," and includes an

2

operating plunger 20 biased to a protruding position by a spring member such as the spring 22. A returning detent 24 extends from the support a spaced distance from the plunger side of the switch 18.

5 An actuator 26 is located intermediate the switch 18 and the returning detent 24. One end of the actuator is pivotally secured to the support 16, and the other end of the actuator is coupled through an expandable-compressible coil spring 28 to a piston 30 of a stationary dashpot 32, the dashpot having an orifice 33 through which the fluid moves.

10 When the support 16 is rotated in a clockwise direction, the initial rotation of the support causes the plunger 20 of the switch 18 to strike the actuator 26. With continued movement of the support 16, the spring 22 acting through the plunger 20 tends to rotate the actuator 26 in a clockwise direction. However, the actuator is coupled to the piston of the dashpot, and the dashpot, depending upon the piston area and orifice area thereof and the fluid utilized therein, offers a particular resistance to a particular rate of movement of the piston. If the actuator and thereby the piston is forced to move faster than a certain critical speed, the dashpot retards the movement of the actuator sufficiently so that the actuator then acts to compress the spring 22 and expand the spring 28. After a period of time dependent upon the characteristics of the particular springs used, the lever arm advantage of spring 28 over spring 22, and the resistance of the dashpot to the motion of the actuator, the spring 22 is compressed and the switch 18 is actuated. Thus it is seen that there is an initial period of delay before the switch 18 is actuated.

Any further movement of support 16 in a clockwise direction results in the actuator being forcibly moved in the same direction by the switch 18, and relative motion between the actuator 26 and the piston 30 of the dashpot 32 is taken up by the expansion of the spring 28.

When the clockwise motion of the support 16 is discontinued, as by being arrested by the boss 14 of the base 10, the plunger-spring 20—22 configuration tends to rotate the actuator clockwise and deactivate the switch, but this is prevented by the greater counterclockwise turning moment applied to the actuator by the spring-dashpot 28—32 configuration, the spring of which is in an extended position. The switch 18 prevents the actuator 26 from moving in a counterclockwise direction, and hence, in trying to contract, the spring 28 gradually moves piston 30 to the left. After a period of time dependent upon the spring and dashpot characteristics, and the lever arm advantage of spring 28 over spring 22, the leftward movement of the piston results in the turning moment applied to the actuator arm by the spring-dashpot 28—32 configuration falling below that of the plunger-spring 20—22 configuration. The plunger-spring configuration 55 then moves the actuator in a clockwise direction and the switch is deactivated. Thus it is seen that there is a second period of delay before the switch is deactivated.

It is seen that if the motion of the support had been discontinued prior to its being arrested by the boss 14, the support could again be moved in a clockwise direction and the switch could be again actuated for a preselected period of time.

When the support 16 is moved in a counterclockwise direction, the returning detent 24 forces the actuator 26 to also move in this direction. The dashpot 32 may be provided with a relief valve to allow rapid motion of the piston 30 to the right or the spring 28 may be used to take up the relative motion between the actuator and the piston. In the latter case, the spring 28 would be compressed and over a period of time the energy stored therein would return the piston 30 to the right.

Referring to FIG. 2, a second embodiment of the in-

3

vention is shown. This embodiment is similar to the first embodiment except that the switching means comprises a pair of normally open contact members 40 and 42 instead of the switch 18. The contact member 40 is a moving member while the contact member 42 is a rigid stationary member. In addition, a spring 44, one end of which is secured to a tab 46 extending from the support 16 and the other end of which is secured to a tab 48 extending from the actuator 26, acts to bias the actuator in a clockwise direction. However, the motion of the actuator is limited by its engagement with the detent 24.

The operation of the second embodiment of the delay switch is quite similar to that of the first embodiment. When the support 16 is rotated in a clockwise direction, the initial rotation of the support moves the contact members 40 and 42 toward the actuator 26 and moves the detent 24 and the tab 46 from the actuator. The movement of the detent 24 and the expansion of the spring 44 caused by the movement of the support result in a biasing of the actuator in a clockwise direction. Movement of the actuator, however, is restrained by the dashpot 32, resulting in an expansion of both spring 44 and spring 28. After a period of delay dependent upon the characteristics of the springs used, the lever arm advantage of spring 28 over spring 44, and the resistance of the dashpot to the motion of the actuator, the relative motion between the support and the actuator results in the moving contact member 40 being moved by the actuator into engagement with the stationary contact member 42.

Any further movement of the support 16 in a clockwise direction, causes the stationary contact member 42 to forcibly move the actuator 26 in the same direction, and relative motion between the actuator and the piston 30 of the dashpot 32 is taken up by the expansion of the spring 28.

When the clockwise motion of the support 16 is discontinued, the spring 44 tends to rotate the actuator clockwise, but this is prevented by the greater counterclockwise turning moment applied to the actuator by the spring-dashpot 28—32 configuration. The stationary contact member 42 prevents the actuator from moving in a counterclockwise direction, and in trying to contract, the spring 28 gradually moves the piston 30 to the left. After a period of time dependent upon the spring and dashpot characteristics, and the lever arm advantage of spring 28 over spring 44, the leftward movement of the piston results in the turning moment applied to the actuator by the spring-dashpot 28—32 configuration being reduced below that of the spring 44. The spring 44 then moves the actuator in a clockwise direction, permitting the moving contact member 40 to separate from the stationary contact member 42.

Although the structure shown involves rotational movement, it would be a simple matter to remount the elements for rectilinear movement. In addition, although not shown, it would be possible to attach switching means to the support on both sides of the actuator and have one switching means operated by clockwise motion of the support and have the other switching means operated by a counterclockwise motion of the support.

What is claimed is:

1. A time delay switch comprising:
 - a movable support;
 - switching means attached to the movable support;
 - means for actuating the switching means, the actuating means lying in the path traversed by the switching means and being movable relative thereto;
 - means responsive to the movement of the support for biasing the actuating means in the same direction, the movement responsive means tending to maintain the actuator in a nonoperating relationship with the switching means;
 - and means for retarding the movement of the actuating means.

4

2. A time delay switch comprising:
 - a support movable between a first and a second position;
 - switching means attached to the support;
 - an actuator for the switching means lying in the path traversed by the switching means as the support moves from its first to its second position, the actuator being movable along the general path of the switching means;
 - first means responsive to the movement of the support toward its second position for biasing the actuator in the same direction, the first movement responsive means tending to maintain the actuator in a nonactuating relationship with the switching means;
 - second means responsive to the movement of the support toward its first position for moving the actuator in the same direction;
 - and means for retarding the movement of the actuator.
3. A time delay switch comprising:
 - a support movable between a first and a second position, the support having a detent;
 - switching means attached to the support a spaced distance from the detent;
 - a movable actuator for operating the switching means located intermediate the switching means and the detent, the actuator lying in the path traversed by the switching means as the support moves from its first to its second position and lying in the path traversed by the detent as the support moves from its second to its first position;
 - means responsive to the movement of the support toward its second position for biasing the actuator in the same direction, the movement responsive means tending to maintain the actuator in a nonoperating relationship with the switching means;
 - and means for retarding the movement of the actuator.
4. A time delay switch comprising:
 - a support movable between a first and a second position, the support having a detent;
 - switching means attached to the support a spaced distance from the detent;
 - a movable actuator for operating the switching means located intermediate the switching means and the detent, the actuator lying in the path traversed by the switching means as the support moves from its first to its second position and lying in the path traversed by the detent as the support moves from its second to its first position;
 - means responsive to the movement of the support toward its second position for biasing the actuator in the same direction, the movement responsive means tending to maintain the actuator in a nonoperating relationship with the switching means;
 - and a stationary dashpot having a piston coupled to the actuator, the dashpot retarding the movement of the actuator.
5. A delay switch comprising:
 - a support movable between a first and a second position;
 - a force operated switch secured to the support, the switch including
 - a plunger, the depression of which results in the actuation of the switch,
 - and a spring member for biasing the plunger to a protruding position whereby the switch is deactuated;
 - a movable actuator lying in and being movable along the general path traversed by the plunger as the support moves from its first to its second position;
 - a stationary dashpot having a piston;
 - and an expandable-collapsible coil spring having one end connected to the piston and the other end connected to the actuator;
 - the movement of the support from its first to its second position moving the plunger into engagement with the actuator, whereupon the spring member acting

5

upon the plunger biases the actuator in the direction of movement of the support while the dashpot retards the movement of the actuator, the retarding force of the dashpot being greater than the biasing force of the spring member so that the plunger is depressed by the actuator;

and subsequent cessation of the movement of the support permitting the spring member acting upon the plunger to continue the movement of the actuator whereby after a period of time the spring member moves the plunger to a protruding position.

6. A delay switch as in claim 5 wherein the support includes a detent for engaging the actuator upon movement of the support from its second to its first position, the detent moving the actuator in the direction of movement of the support.

7. A delay switch comprising:

a support movable between a first and a second position, the support having a detent;

a moving contact member and a stationary contact member attached to the support a spaced distance from the detent, the contact members being in juxtaposition with one another and the moving contact member being normally separated from the stationary contact member;

a movable actuator for moving the moving contact member into engagement with the stationary contact member, the actuator being located intermediate the contact members and the detent, the actuator lying in and being movable along the path traversed by the contact members as the support moves from its first to its second position, and the actuator lying in and being movable along the path traversed by the detent as the support moves from its second to its first position;

a spring member secured to the support for biasing the actuator against the detent;

a stationary dashpot having a piston;

and an expandable-collapsible coil spring having one end connected to the piston and the other end connected to the actuator, the retarding force of the dashpot being greater than the biasing force of the spring member.

8. A time delay switch comprising:

a movable support;

switching means attached to the movable support;

6

means for actuating the switching means, the actuating means lying in the path traversed by the switching means and being movable relative thereto;

means responsive to the movement of the support for biasing the actuating means in the same direction, the movement responsive means tending to maintain the actuator in a nonoperating relationship with the switching means;

a dashpot for retarding the movement of the actuating means;

and means for coupling the dashpot to the actuating means, the coupling means responsive to the movement of the support exerting a biasing force on the actuating means counter to the movement of the support.

9. A time delay switch comprising:

a movable support;

switching means attached to the movable support;

means for actuating the switching means, the actuating means lying in the path traversed by the switching means and being movable relative thereto;

means responsive to the movement of the support for biasing the actuating means in the same direction, the movement responsive means tending to maintain the actuator in a nonoperating relationship with the switching means;

a dashpot for retarding the movement of the actuating means, the dashpot including a piston;

and means for coupling the piston of the dashpot to the actuating means, the coupling means permitting relative motion between the piston and the actuating means and the coupling means responsive to the movement of the support exerting a biasing force on the actuating means counter to the movement of the support.

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