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3,072,769

CONTROL MECHANISM

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FIG. 1

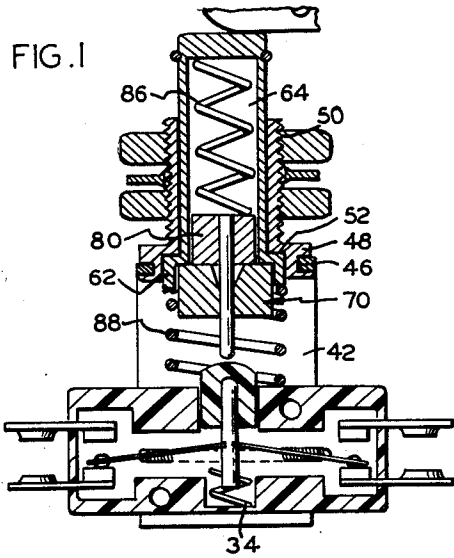


FIG. 2

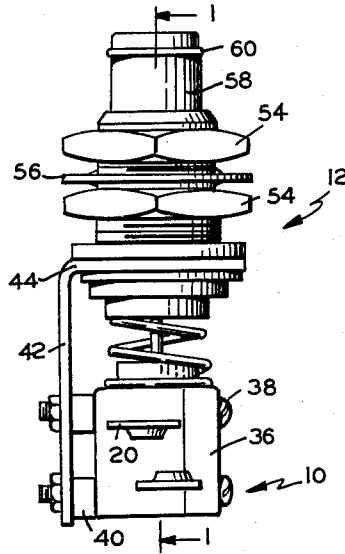


FIG. 3

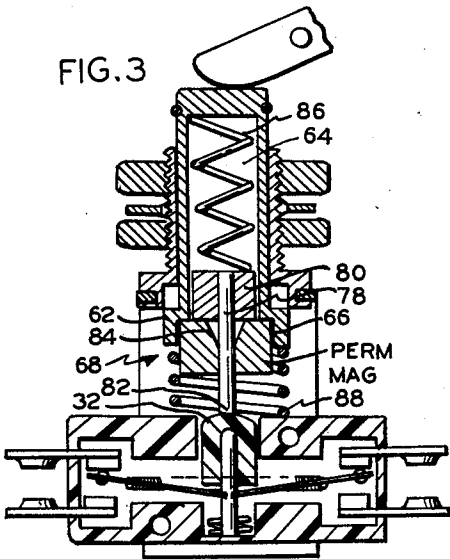


FIG. 4

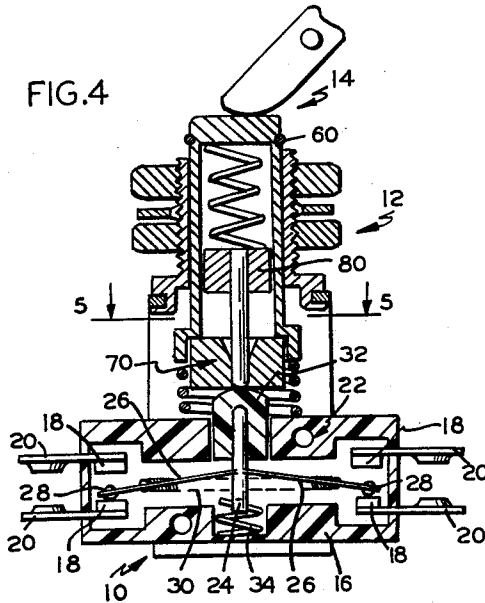
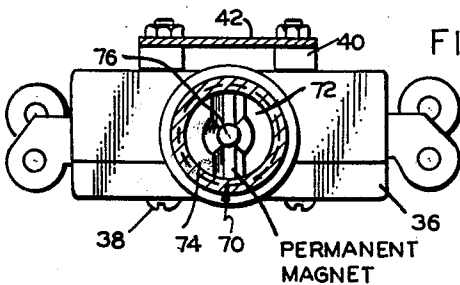


FIG. 5



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1

3,072,769

CONTROL MECHANISM

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This invention relates to switch operating structures for and in combination with a switch, and more particularly, relates to structures for causing both operation and restoration of an electrical switch to occur responsive to each forward operation of a forward and return switch operator.

The principal object of this invention is to provide a switch operator of the aforementioned characteristics including parts which following the switch operation, are arranged to break away from each other on continuation of the forward movement, thereby permitting restoration (complete cycling) of the switch while the switch operator remains in a forward position. Thereby, the operating time of the switch if limited to the interval elapsing between arrival of the switch operator and its switch operating position and its arrival and its breakaway position, is independent of the dwell of the operator in positions forward of a switch operating position and is also independent of the return time of the operator.

As is well known, a switch generally comprises a spring contact member arranged to be operated by a switch operator, such as a lever or a plunger. A minimum amount of pressure on the plunger causes the spring member of the switch to be thrown into its operated position to close and/or open a set of contacts at the required amount of pressure. The switch remains operated until the operating pressure is relieved, at which time it returns automatically to its at rest position. Such devices are well known in the art and have a wide variety of uses, and, particularly, have been widely adapted for uses in systems wherein a series of objects each requires a control operation to be performed. In such systems arrangements each object, in turn, operates the switch plunger to control the circuit whereby the control operation is performed. As the control operation must often be kept from extending over an undue period of time, it is often necessary that the switch contacts be closed only momentarily.

The present invention eliminates a problem of holding switch contacts operated for an excess period of time by providing a two-part switch operator which are coupled or held together by a predetermined force. The force is created by the field of a magnet mounted between the two parts of the actuator. When the two part actuator is first operated by suitable means, the two parts function as a single unit due to the magnetic coupling means, to close the switch contacts. After a sufficient movement is achieved of the two parts to close the switch contacts, further movement from determined application of pressure on the unit causes an uncoupling of the magnet. If the outside actuating pressure operating on the one part continues and exceeds the predetermined force, that part is left free to travel under the pressure of its actuating force. With the other one or initially held part of the two-part actuator being released from the moving part, the initially held part returns under the influence of a suitable bias means to its at rest position by the pressure of the bias of the switch spring contact member and the switch contacts return to their initial or non-actuated position. Thus, there is only a momentary closing of the switch contacts, which, in turn, insures the momentary control desired in the circuit, independent of the dwell time of the object which actuates the two-part unit.

In a copending application assigned to the same assignee entitled "Breakaway Operator for Self-Restoring Switch"

2

(Serial No. 839,134, filed the tenth day of September, 1959, now U.S. Patent No. 2,997,556), a dual lever arrangement for accomplishing the above functions is described. This invention is an improved form of said operator. More particularly, this invention relates to an operator where the parts are all disposed in coaxial arrangement which prevents fouling of the parts by dirt, grime, and chips that are often associated with manufacturing operations.

It is, therefore, an object of this invention to provide a coaxial switch operating structure which is adapted to enable the switch contacts to be operated for only a determinable time period.

It is also an object of the invention to provide a switch with the above characteristics and operating structure whose travel is controlled independently of the object and/or force moving it after it has reached a predetermined position.

It is a feature of this invention to provide a coaxial switch operating structure comprising two coaxial separably operable portions, one of which is operated by the other to operate a set of contacts, thereafter they separate to permit return of the switch to its unoperated position.

It is another feature of this invention to provide a switch operating structure having one portion mounted on a switch housing in coaxial position to the switch actuating plunger, the other portion being magnetically secured to the first portion and held in a predetermined relationship thereto until a particular force is applied thereto.

It is still another object of this invention to provide a switch actuator as set forth above and having two portions having a magnet and armature for holding one portion in a predetermined relationship to the other until the force applied to the one portion exceeds the particular value of the magnetic attraction between the armature and magnet.

Other objects and features of this invention will become apparent upon further reading of the specification and claims in conjunction with the drawings, wherein;

FIG. 1 is a sectional view along line 1—1 of FIG. 2; FIG. 2 is an end view in full line showing the switch and actuator in assembled relation;

FIG. 3 is a sectional view similar to FIG. 1 showing the parts in a semi-actuated position;

FIG. 4 is a sectional view similar to FIGS. 1 and 3 showing the parts in a third position; and

FIG. 5 is a sectional view along line 5—5 of FIG. 4.

A switch means 10 having an external actuator means 12 mounted thereabove for actuation by a cam means 14 is shown semi-diagrammatically in FIGS. 1, 3 and 4. The switch block per se 16 may be conveniently formed of an insulating molded material such as "Bakelite" or the like, and on opposite sides of a chamber thereof mounts fixed contacts 18 which extend exteriorly of the block 16 to electrical terminals 20 as suitable and desired. An internal switch actuator means 22 is here shown in the form of a movable bar or actuator member 24 which pivotally mounts contact blades 26 on opposite sides thereof in suitable V-shaped grooves formed in the sides thereof. The contact blades 26 mount movable contacts 28 on the free ends thereof for cooperation with the fixed contacts 18. A spring 30 connects two opposing contact blades 26 passing through a suitable slot formed in the bar 24 to retain the contact blades 26 in engagement with bar 24. An external insulating button 32 may extend through a suitable slot in the switch block and projects above the upper surface of the block 16 as shown. The button 32 is biased outwardly (and, hence, the contact blades) to its rest position by a suitable compression spring 34 which has a first predetermined force, for purposes which shall later be apparent. It will be appreciated that the spring 34 biases the switch button toward its position shown in FIG. 1 and normally returns the switch to that position

when the button 32 is not engaged by some means for overcoming the biasing spring 34. Thus, the switch automatically returns itself to the position shown in FIG. 1 whenever there is no force acting on the button 34 greater than the bias or loading of spring 34.

As shown in FIG. 2, the switch block 16 has a cover 36 which is mounted to the switch block 16 by suitable bolts 38 which extend through the cover and block and through suitable spacer means 40 and serve to mount an L-shaped bracket 42, having a portion 44 overlaying the top of the switch block 16. The top portion 44 is formed with a suitable bore 46 which is preferably coaxial with the switch button 32.

A bushing means 48 is mounted in the bore 46 and is threaded along its upper extent 50 to mount suitable washers 54 and a lockwasher 56 to mount the actuator to other pieces of equipment (not shown). It will be observed that the bushing 48 is formed with an internal shoulder 52 adjacent the lower end thereof to slidably receive and seat a plunger in the form of an actuator button 58 which is movable relative thereto in the hollow core of the bushing. The actuator button 58 has a portion extending above the threaded portion 50 of the bushing and has a stop ring 60 mounted near the top thereof to prevent movement of the button beyond the limits defined by the end of the bushing and the location of the stop ring which coacts therewith. The actuator button 58 is formed with an enlarged annular portion 62 and a central bore 64 having a closed end. The counterbore adjacent the enlarged end portion 62 serves to fixedly mount a magnet 70 which forms one part of a magnetic coupling means 68 which will now be described.

The magnet 70 is generally annular in configuration, having spaced pole faces 72 and 74 in a central bore 76. An elongated plunger 78 is slidably received within the bore 76 and mounts an armature member 80 at the upper end thereof for coaction with the pole faces 72 and 74. It is possible to reverse the mounting of the armature and magnet if desired. The plunger 78 is rounded at its entering end and is adapted to be repeatedly inserted within the conical counterbore 84 of the bore 76 to afford ease of entry therewithin. It will be noted that the armature 80 is mounted for movement in the bore 64 of the button 58 and is biased into engagement with the magnet 70 by a suitable compression spring 86 which engages the upper surface of the armature 80 and the closed end surface of the bore 64. The spring rate of the spring 86 is purposefully less than the spring rate of the spring 34 in the switch for purposes hereinafter appearing. The enlarged end portion 62 of the actuator button 58 is engaged by a compression spring 88 which biases the button outwardly towards the position shown in FIG. 1.

Operation

The cam means 14 engages the top of the button 58 when the parts are in the position shown in FIG. 1 and as the cam means actuates the button downwardly (as shown in FIG. 3) the plunger 78 and the button 58 move as a unit due to the magnetic coupling of the magnet 70 and the armature 80. The end 82 of the plunger 78 engages the top of switch button 32 and the switch is actuated to its second position, as shown in FIG. 3, against the bias of spring 34 and spring 88. Upon the parts attaining the position shown in FIG. 3 (the arm 24 having bottomed so that it can travel no farther) further movement of the cam means 14 causes the button 58 to continue downward movement, but the force transmitting connection between the bar 24 and the plunger 78 is such that the magnetic coupling force is overcome and the armature 80 under the influence of the biasing spring 34 moves to the position shown in FIG. 4. This occurs since spring 86 has a lesser spring rate than does spring 34 as aforesaid.

Further rotation of the cam means 14 so as to be out of engagement with the top of the button 58, allows the

spring 88 to return the button to the position shown in FIG. 1 and also allows the spring member 86 to return the armature to the position shown in FIG. 1 for a recoupling of the magnetic actuator. Thus, independent of the amount of dwell time of the cam means 14 the switch will have a momentary actuation thereof until sufficient force is encountered to cause uncoupling of the magnetic coupling means.

From the foregoing description, it will be apparent that the relationship of the parts provides a simple coaxial relationship of parts to afford the desired function and the magnet and armature faces being encased within the button 58 maintain a long and trouble-free life due to the freedom from contamination. It will be further appreciated that the parts are well adapted to mass manufacture techniques and may be readily supplied either as an actuator per se for existing switches in the field or may be supplied as the combination unit as shown. In either event, however, the spring rate of the spring 86 must be designed with specific relationship relative to the return bias of the switch actuator button 32.

Although a specific embodiment of the invention has been shown and described, it is with full awareness that many modifications thereof are possible. The invention, therefore, is not to be restricted except insofar as is necessitated by the prior art, by the spirit of the appending claims.

What is claimed as the invention is:

1. In a switch operator for use with a switch having a spring member for controlling the position of its contacts, the improvement comprising a plunger arranged to operate said spring member to control said contacts, a second plunger in coaxial relationship to said first plunger, and releasable control means characterized as being for retaining said second plunger in predetermined relationship to said first plunger such that an object moving said second plunger moves said first plunger to operate said spring member and contacts whereafter said second plunger is released from said first plunger to permit said spring member and contacts to be returned to their unoperated condition while said second plunger is still operated by said object.

2. In an operator device of the type claimed in claim 1, wherein said releasable control means comprises a magnet and armature.

3. In an operator device of the type claimed in claim 1, wherein the releasable control means further comprises a second spring member for returning said second plunger to said predetermined relation, when said object is not operating said second plunger.

4. Switch operating apparatus comprising a spring contact member to control an electrical circuit, a second member coaxial with said first member and held in operative engagement with said first member by a predetermined force whereby said first member is operated in said one direction thereby to control said electrical circuit, and last means for thereafter preventing further operation of said first member and for returning said first member to its at rest position.

5. A device of the type described in claim 4 wherein a magnet is used for providing said predetermined force.

6. A device of the type set forth in claim 4, the inclusion of means for restraining operation of said second member responsive to a predetermined degree of operation thereof.

7. The device set forth in claim 4 in which said last means includes means for disengaging said first member from said second member to enable return of said first member to its at rest position.

8. In combination, a switch, first switch actuating means, first biasing means biasing, with a predetermined force, said first switch actuating means to thereby bias said switch to a first from a second position, and second actuator means for said switch, said second actuator means comprising an actuator plunger aligned with said

5

first actuator means for operation thereof against said first biasing means, second biasing means, a movable operator means coaxial with said actuator plunger and biased by said second biasing means with a second predetermined force to a first position and movable to a second position, third biasing means biasing said actuator plunger into coupled engagement with said movable operator means with a third predetermined force, said third predetermined force being less than said first predetermined force, and magnetic coupling means having a coupled and uncoupled relation comprising an armature and magnet coaxial with said first and second actuator means and respectively mounted on said actuator plunger and movable operator means whereby actuation of said movable operator means from its first towards its second position when said magnetic coupling means is in coupled relation affords simultaneous movement of said actuator plunger and first actuator means to actuate said switch from its first to its second position against said first and second biasing means until an uncoupling force is encountered thereupon said first biasing means separates said magnetic coupling means and said switch moves from its second position to its first position under the influence of said first biasing means against the bias of said third biasing means independent of the position of said movable operator means.

9. In combination, a switch, a switch button, first biasing means biasing, with a predetermined force, said switch button to thereby bias said switch to a first from a second position, a mounting bracket attached to said switch and having a portion overlying said switch button and formed with a bore therewithin; and second actuator means for said switch mounted in said bore of said bracket, said second actuator means comprising an actuator plunger aligned with said switch button for operation thereof against said first biasing means, second biasing means, a movable operator means having a closed end and a hollow bore coaxial with said bore in said bracket and biased by said second biasing means with a predetermined force to a first position and movable to a second position, third biasing means located in said bore of said movable operator means and in engagement with said closed end and biasing said actuator plunger into coupled engagement with said movable operator means with a third predetermined force, said third predetermined force being less than said first predetermined force, and magnetic coupling means having a coupled and uncoupled relation comprising an armature and magnet coaxial with said switch button and second actuator means and respectively mounted on said actuator plunger and movable operator means whereby actuation of said movable operator means from its first to its second position when said magnetic coupling means is in coupled relation affords simultaneous movement of said actuator plunger and switch button to actuate said switch from its first to its second position against said first and second biasing means until an uncoupling force is encountered thereupon said first biasing means separates said magnetic coupling means and said switch moves from its second position to its first position under the influence of said first biasing means against the bias of said third biasing means independent of the position of said movable operator means.

10. In combination, a switch including first switch actuating means, first biasing means biasing said switch actuating means to thereby bias said switch to a first from a second position, and second actuator means for said

6

switch, said second actuator means comprising an actuator plunger associated with said first actuator means for operation thereof against said first biasing means, second biasing means, a movable operator means associated with said actuator plunger and biased by said second biasing means to a first position and movable to a second position, third biasing means for biasing said actuator plunger into coupled engagement with said movable operator means, said third biasing means having a force less than the force of said first biasing means, and magnetic coupling means having a coupled and uncoupled relation comprising first and second magnetic members associated with said first and second actuator means and respectively mounted on said actuator plunger and movable operator means whereby actuation of said movable operator means from its first towards its second position when said magnetic coupling means is in coupled relation affords simultaneous movement of said actuator plunger and first actuator means to actuate said switch from its first to its second position against said first and second biasing means until an uncoupling force is encountered thereupon said first biasing means separates said magnetic coupling means and said switch moves from its second position to its first position under the influence of said first biasing means against the bias of said third biasing means independent of the position of said movable operator means.

11. In combination, a switch, first switch actuating means, first biasing means within said switch biasing, with a predetermined force, said first switch actuating means to thereby bias said switch to a first from a second position, and second actuator means for said switch, said second actuator means comprising a plunger aligned with said first actuator means for operation thereof against said first biasing means, second biasing means, a movable operator means coaxial with and surrounding said plunger and biased by said second biasing means with a second predetermined force to a first position and movable to a second position, third biasing means biasing said plunger into coupled engagement with said movable operator means with a third predetermined force, said third predetermined force being less than said first predetermined force, and magnetic coupling means having a coupled and uncoupled relation comprising first and second magnetic members associated with said first and second actuator means and respectively mounted for movement with plunger and movable operator means whereby actuation of said movable operator means from its first towards its second position when said magnetic coupling means is in coupled relation affords simultaneous movement of said plunger and first actuator means to actuate said switch from its first to its second position against said first and second biasing means until an uncoupling force is encountered thereupon said first biasing means separates said magnetic coupling means and said switch moves from its second position to its first position under the influence of said first biasing means against the bias of said third biasing means independent of the position of said movable operator means.

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