

[54] **ALTERNATE ACTION MECHANISM
WITH MAGNETIC LATCH CAM
FOLLOWER BIASING MEANS**

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[22] Filed: **Sept. 16, 1970**

[21] Appl. No.: **72,736**

[52] U.S. Cl. 200/153 J, 200/159 R

[51] Int. Cl. H01h 13/56

[58] Field of Search..200/153 J, 153 W, 16 A, 159 R

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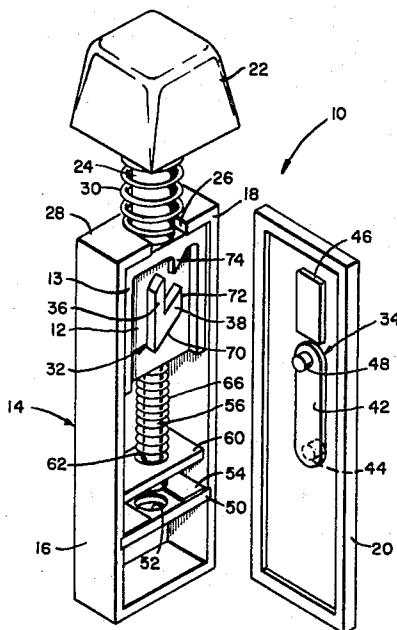
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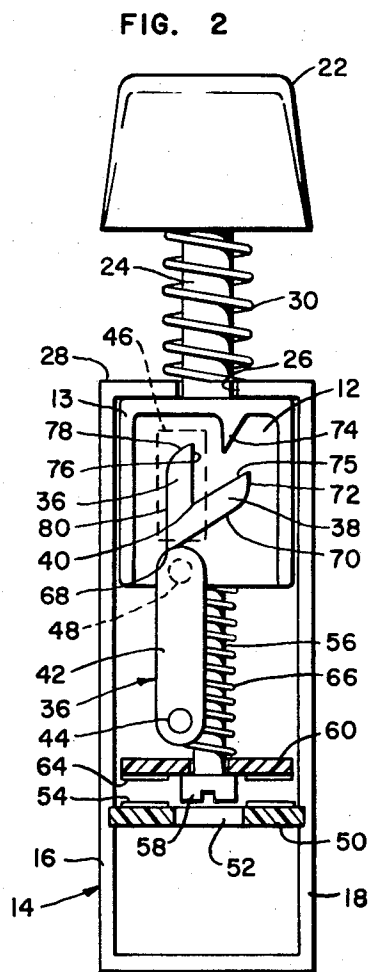
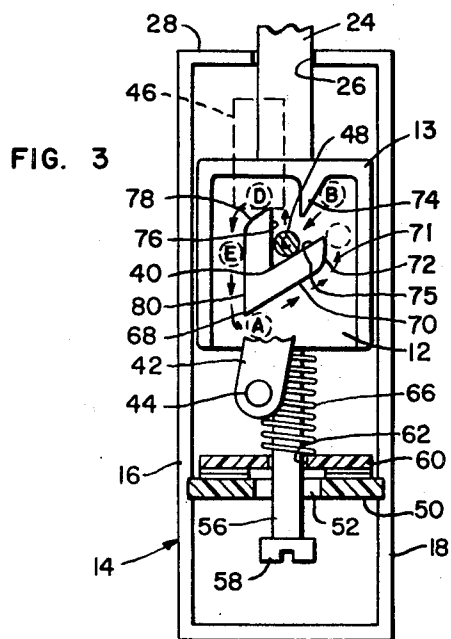
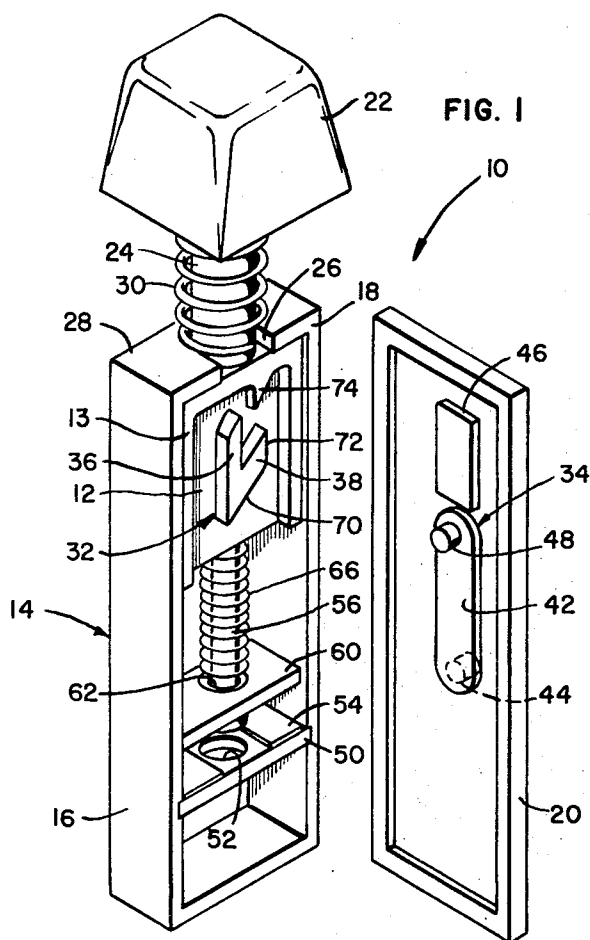
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ABSTRACT

A bistable mechanical device, such as a push-to-make/push-to-break switch has a cam which is arranged for manual reciprocation within a housing. A spring urges return of the cam to the latter position. A rockable follower is carried from the housing and is urged toward a beginning aspect by a permanent magnet which is secured from the housing. The follower is rocked by the cam during a first push and moves: (1) toward cam latching condition under influence of the permanent magnet, as the cam moves from its end stroke position toward its start stroke position following the first push to fix the cam parts in a first or latched relative position; and (2) out of said latching condition under influence of the permanent magnet during a subsequent push, as the cam moves from latched position to end stroke position.

1 Claim, 3 Drawing Figures





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ALTERNATE ACTION MECHANISM WITH MAGNETIC LATCH CAM FOLLOWER BIASING MEANS

FIELD AND BACKGROUND OF THE INVENTION

The present invention relates to bistable mechanical devices. Particularly it relates to a bistable latch which is operated by successive movements of manual control means, and to a switch incorporating such a latch.

A bistable mechanical device involves two relatively movable members whereupon successive relative movement therebetween the members assume and are held first in one relative fixed position and thereafter in a second relative fixed position. A referenced device generally is operated by successively depressing a single plunger which may be a push button. It is commonly embodied in a push-to-make/push-to-break switch and has a plunger which, when depressed once, produces a first fixed relative condition of the movable members and, when pushed again, produces a second fixed relative condition of the movable members.

Of course, these switches may be of the type which control electrical circuits. Or, they may be purely mechanical in nature; for example, of the type used for shifting between registers in a typewriter, to enable printing in either upper or lower case letters.

A known device of the indicated class comprises cam means including a follower which latches relatively movable parts together in a first fixed condition, in a first phase of operation. Thereafter, the follower is released, in a second phase of operation, for restoration to a normal condition under bias of a spring, and the movable parts assume a second fixed condition.

It is an object of the present invention to provide a novel bistable device.

It is another object of the invention to obviate a spring for controlling a follower in bistable devices.

It is a further object of the invention to provide a novel switch.

SUMMARY OF THE INVENTION

To effect the foregoing, and other objects of the invention which will become apparent from ensuing description, a first of alternate fixed positions of first and second relatively movable members in an alternate action device results from travel of a follower relative to a cam and into latched association. The second fixed position of the relatively movable members results from release of the cam and follower from their latched association and relative translocation thereof to places of beginning. Means for generating a magnetic bias maintain the cam and follower in engagement and urge the follower toward its place of beginning.

From another aspect, the aforesaid objects are realized by a relatively fixed member. A second member is reciprocative between a first position and a second position relative said fixed member. Means are adapted for urging the second member to the first position. A component which is connected to the fixed member is adapted for movement into and out of a beginning aspect in response to movement of the second member. Means connected from said component are adapted for releasably latching the fixed and second members upon movement of said second member toward its first position from its second position. Means are adapted to bias the component to said beginning aspect upon

movement of the second member toward its second position following latching. An element secured from said second member is adapted for reciprocation through an aperture in fixed contact means. Movable contact means associated with said element is proportioned for engaging said fixed contact means when said second member is in one of its positions and is disengaged therefrom when the second member is in its other position.

BRIEF DESCRIPTION OF THE DRAWINGS

In the ensuing detailed description of the invention reference is had to the accompanying drawings in which:

FIG. 1 is a partially exploded perspective view of a push-to-make/push-to-break switch embodying the present invention;

FIG. 2 is a sectional view of said switch, a permanent magnet shown in phantom; and

FIG. 3 is a view similar to FIG. 2, however, showing the switch alternately conditioned in solid line; and in dotted line, schematically illustrating the path of a follower comprising said switch.

DETAILED DESCRIPTION OF THE INVENTION

Referring now more particularly to the drawings, an alternate action device herein is shown as a push-to-make/push-to-break switch generally designated 10. It comprises a first or manually movable member which herein is a block 12 secured with a raised frame 13. The block is relatively movable with respect to and arranged for reciprocation in a housing or casing 14, the latter being a relatively fixed member. In the exemplary embodiment, the housing is vertically oriented and has a pair of parallel vertical side walls 16 and 18 in which frame 13 is slideable, and an end wall 20 which covers the opening between the side walls.

A manual control means such as knob or handle 22 is disposed externally of housing 14 and is carried from one end portion of an upper vertical stem 24. The opposite end portion of the stem projects through an aperture 26 in the upper wall 28 of said housing and is rigidly secured from the upper end portion of frame 13. A compression spring 30 which is disposed about stem 24, at its upper end bears against knob 22 and at its lower end bears against upper wall 28 about aperture 26. The normal bias of said spring holds block 12 in an upper, start stroke or normal position, shown herein as in engagement with the inner surface of wall 28 (FIGS. 1 and 2). Upon depression of knob 22 against the bias of said spring, block 12 will be driven downwardly or inwardly, to the limit of its range of motion in that direction, herein defined as its end stroke position.

Means for latching the relatively movable members, namely, block 12 and housing 14 comprises a cam 32 and a follower assembly 34. The cam is rigidly secured to block 12, whereby it is relatively movable. It is V-shaped, having a pair of legs 36 and 38 which are angularly disposed and generate a notch or interior angle 40 therebetween. The follower assembly comprises an arm 42 and a follower 48 which projects and is carried from the free end portion of said arm. At its other end portion the arm is fastened about a pivot 44 for rocking adjacent the inside surface of wall 20.

Arm 42 is a magnetic fabrication; and it and follower 48 are held in their normal positions or places of beginning, that is, vertically oriented, follower 48 then being superposed relative pivot 44 (FIGS. 1 and 3). A permanent magnet 46, which is rigidly secured to wall 20 in superposed vertical alignment with pivot 44, comprises means for generating a magnetic bias for urging the arm and, accordingly, the follower to their places of the beginning. The arm is disposed in a plane parallel to a plane in which the arm proximate face of cam 32 is disposed and parallel to the inside surface of wall 20.

The follower is proportioned for engaging the peripheral surface of cam 32 and, together with arm 42, will rock about pivot 44 in response to movement of block 12 (and said cam) between its start stroke and end stroke positions. The arrangement is such that when the block is in said start stroke position the follower is disengaged from the cam. However, once the cam is depressed, it is disposed through the normal position of the follower and thereby causes said follower to rock, the bias of the permanent magnet urging the follower into cam engagement.

Fixed contact means comprises a plate 50 which is rigidly secured in the lower end portion of housing 14. It has a central aperture 52 and an upper surface on which an electrical contact 54 is rigidly secured.

A lower stem or element 56 having a vertical aspect depends from block 12 to which its upper end is rigidly secured. On its lower end portion the stem carries a retainer or boss 58 which, when in normal position, (FIG. 1) is disposed above plate 50. The stem and the retainer are proportioned for passing through aperture 52 as block 12 moves between its start stroke and end stroke positions.

Movable contact means comprises a plate 60 which is disposed about stem 56 and retained by the construction in a plane substantially parallel to and above plate 50. Said movable plate has an aperture 62 through which stem 56 slidably extends, said last aperture being smaller than and coaxial with aperture 52. However, the dimensions of the retainer 58 are such that it will not pass aperture 62, said retainer being an agent for preventing removal of plate 60 from the stem.

An electrical contact 64 is rigidly secured from the lower face of plate 60 and is vertically aligned with electrical contact 54. A compression spring 66 is disposed about stem 56 and has an upper end which bears against the lower end portion of block 12 and a lower end which bears against the upper surface of plate 60. Spring 66 together with spring 30 comprise means for urging block 12 toward its start stroke position. Spring 66 also comprises means for urging contact 64 into engagement with contact 54.

METHOD OF OPERATION

The place of beginning of follower 48 is slightly offset to the right (relative to FIG. 2) of the apex of the external angle 68 of cam 32 when block 12 is in its start stroke position, this condition being prior to a pair of successive push/push operations. From said place of beginning, (A in FIG. 3), the follower will move in the direction of arrows 71 (only one of which is numbered) about the cam through exemplary positions B-E and back to the place of beginning A in response to a pair of successive push/push operations.

As block 12 moves from its start stroke to its end stroke position responsively to a first inward push or depression of knob 22, follower 48 will move along external surfaces 70 and 72 of cam leg 38 reaching position B as the first stroke is completed. A boss, abutment or projection 74 from frame 13 prevents the follower from passing over cam 32, particularly over cam leg 36 in response to the flux field of magnet 46.

Thereafter, upon release of knob 22, as cam 32 begins its return toward the start stroke position, follower 48 will first disengage boss 74, then the follower will be engaged by sloping upper surface 75 of the rising cam which will urge said follower into latched position C in notch 40. Thus, the block 12 and housing 14 will be restrained from relative movement in an alternate of a pair of fixed positions, the cam then being disposed medially of its start stroke and end stroke positions. It is observed that when the parts are thusly latched, the follower has not yet been restored to its place of beginning and is under magnetic tension.

When the knob 22 is depressed a second time in the push/push succession, to drive cam 32 to its end stroke position, the extent of the motion is sufficient to enable follower 48 to clear over side 76 of leg 36 and magnetically be drawn to position D which is coincident with position A. Thereafter, when the knob is released, the cam will move upwardly toward its start stroke position responsively to springs 30 and 66. In consequence, follower 48 will be cammed over downwardly sloping surface 78 and magnetically will be urged into engagement with side 80 of leg 36 passing through position E. Upon clearing external angle 68, subsequently, the follower will be urged magnetically to its place of beginning A, block 12 and housing 14 then being disposed in the other of alternate fixed conditions.

The length of stem 56 is such that, when cam 32 is in its start stroke position, retainer 58 supports plate 60 above plate 50 with contacts 54 and 64 disengaged. As the cam moves to its end stroke position, stem 56 will pass through apertures 52 and 62. However, before the end stroke position of the cam has been attained, contacts 54 and 64 will have been brought into engagement, the association being maintained by spring 66 and while the parts are latched.

Following release of the parts from latched condition, and as the cam moves toward start stroke position, retainer 58 will raise plate 60 from plate 50, in its role as agent for disengaging contacts 54 and 64.

As many modifications in the described construction could be conceived, and as many changes could be made therein without departing from the spirit and scope of the claims, it is intended that all matter contained in the accompanying specification shall be considered as illustrative only and not in a limiting sense.

I claim:

1. An alternate action device comprising:
 - a fixed member;
 - an arm with an upper end portion and having a lower end portion pivotally connected to said fixed member, said arm having a first aspect in an untensioned condition and a skewed aspect tensioned for movement toward said first aspect;
 - a follower of magnetic material mounted in said upper end portion;

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a permanent magnet secured to said fixed member, said upper and lower end portions aligned each with the other and both with said magnet only when said arm is in said first aspect;

a cam having a raised portion mounted on said fixed member and defining a cam track about said raised portion, said follower engaged in said cam track in the flux field of said magnet;

a straight section on said raised portion and disposed parallel to said arm in said first aspect, said straight portion having an upper edge canted at an angle other than perpendicular to said arm in said first aspect;

means for depressing said cam relative to said fixed member in response to a first push force and from a first position in which said arm is at said first aspect to a second position in which said follower is rocked by said cam to tension said arm; and

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means for urging said cam toward said first position following release of said first push force, a part of said cam latching said follower and preventing arm restoration to said first aspect and said cam from returning from its second position to said first position, said follower being disposed in the path of movement of said upper edge and said arm being disposed in said first aspect responsive to said flux field and following depression of said cam in response to a second push force, said follower guided by said upper edge into a tensioned aspect of said arm responsive to movement of said cam under action of said urging means after release of said second push force to unlatch said follower, and said arm disposed in said first aspect responsive to said flux field upon return of said cam to said first position from said second position.

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