Dec. 19, 1967 J. I. CLARK 3,359,397

LOCKDOWN KEY MECHANISM

Filed Sept. 12, 1966

FIG. 1.

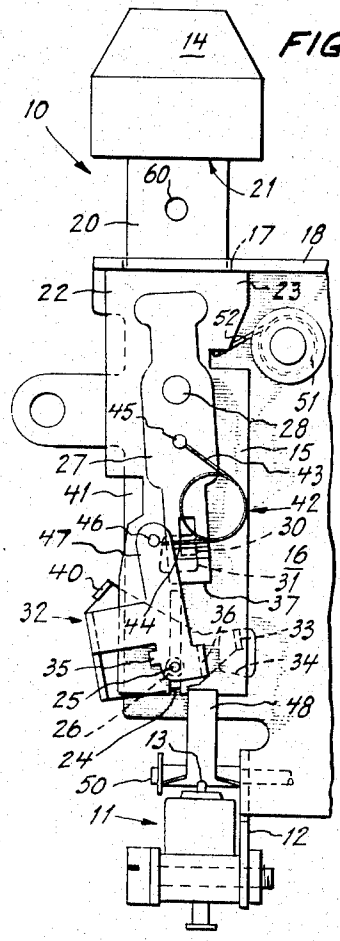


FIG. 2

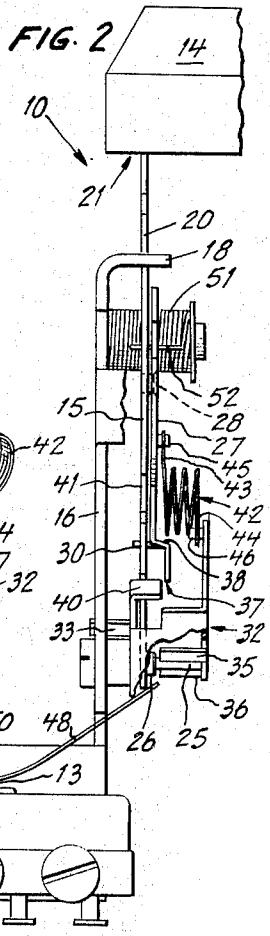


FIG. 3.

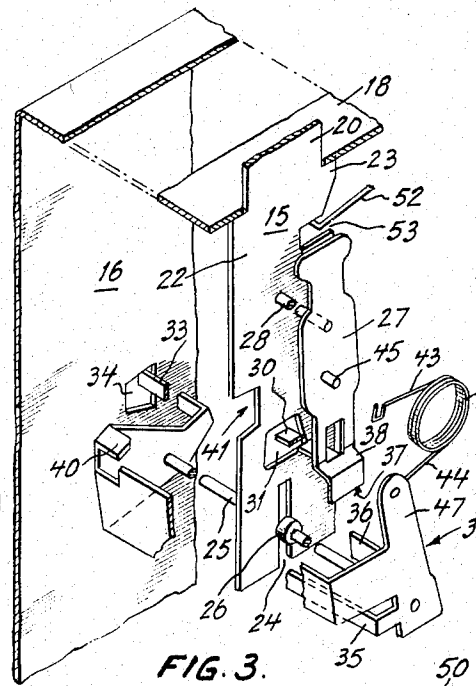


FIG. 4.

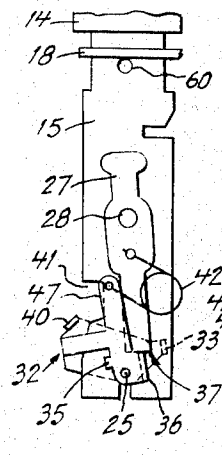


FIG. 5

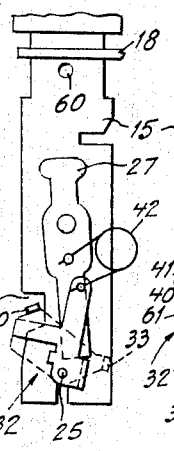


FIG. 6.

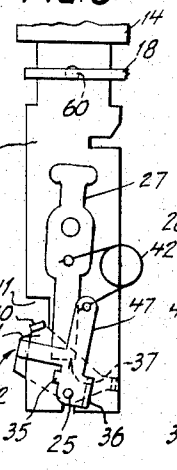


FIG. 7.

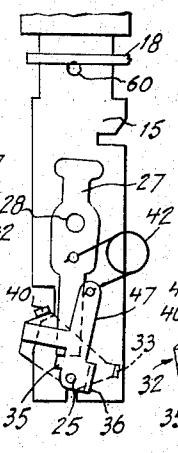


FIG. 8.

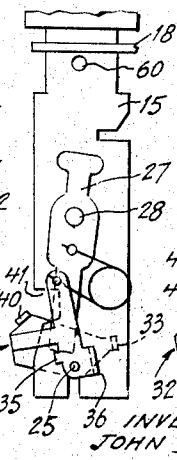
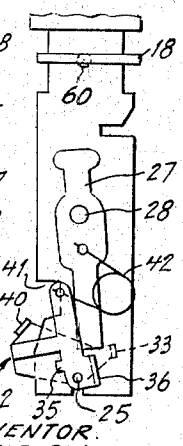


FIG. 9.



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LOCKDOWN KEY MECHANISM

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ABSTRACT OF THE DISCLOSURE

A mechanical latching device having first and second rest conditions effected by successive depressions of an input member, such as a typewriter key or the like. A lockdown mechanism is provided wherein a control element is alternately locked down and released in response to successive similar excursions of the input member. Bilevel signaling is readily obtained by coupling the control element to an output switching member having corresponding dual signaling positions.

The present invention relates to a control mechanism and more particularly to a lockdown device operative in response to the position of an element adapted to actuate a movable member.

It is well known to provide lockdown type control mechanisms for the keyboard portion of office machines such as typewriters, calculators, or the like. For example, in many present day typewriters when it is desirous to employ upper case symbols and lettering, a particular key on the keyboard is depressed by the operator and simultaneously the key is locked down in the depressed position by a latching device actuated by the associated keystem. In the locked down position, related shifting mechanisms are actuated whereby subsequent depression of printing keys arranged on the keyboard will result in upper case printing during normal operation until the locked down key is released. The release function is carried out in many instances by depression of an independent key which actuates an appropriate mechanism to effectively release the latching device. It is also not uncommon to effect the release of such locked down key by toggling the holding portion of the latching device by means of a mechanism actuated by urging the associated keystem in a lateral direction with respect to the keytop.

In addition to the use of lockdown type mechanisms in office machines, the general bilevel nature of such mechanisms leads to widespread adaptation throughout industry in many diverse applications where double action signaling is required. For example, in any control systems where binary type logic is employed a two level input device responsive to predetermined linear displacement, such as that of a keystem, may be advantageously utilized, i.e., the up position of the key may represent one binary character while the depressed position of the key may represent the other binary character.

In any mechanism of this nature, whether use is contemplated in a comparatively simple office machine or a complex office system, reliability is a highly desirable, if not indispensable requisite. In the case of a complete office system where the overall operation is dependent upon selected input data entered by means of an array of mechanical keyboard mechanisms, failure or malfunction of that keyboard will have a crippling effect on the entire system and various associated operations. In the past, where speed of operation in addition to reliability has been a required characteristic, many problems have been encountered in attempts to provide a reliable lockdown mechanism without sacrificing speed in the operation thereof. These problems have been especially prevalent in those mechanisms where intermittent motion is imparted to a drive member disposed for interaction with adjacent parts moving relatively thereto.

It is an object of this invention to provide a novel control mechanism.

Another object is to provide a novel control mechanism wherein a control element is locked down after a first depression thereof and released by a second similar depression.

A further object is to provide a reliable mechanism wherein alternate positions of an output member are obtained in response to successive similar operations of an input member.

Still a further object is to provide a novel control mechanism wherein a control element is alternately locked down and released in response to successive equal force depressions by the operator.

Yet another object is to provide a novel lockdown key mechanism which is alternately locked down and released in response to successive similar depressions of the key and wherein alternatively the release may be effected by an external mechanism notwithstanding key depression.

Still another object is to provide a highly reliable lockdown key mechanism which will not malfunction regardless of the force and rapidity of key depression.

The present invention contemplates a novel control mechanism for providing alternate positions of an output member in response to successive similar operations of an input member. In one embodiment the output member is associated with the movable contact element of a circuit interrupter and the alternate positions of the output member provide successive open and closed conditions of the circuit interrupter. Thus, by successive depressions of the input member, the associated circuit is alternately disposed in an open and closed condition, i.e., "no signal" and "signal" conditions alternately prevail in response to a substantially identical input signal. It can be seen that the function of such a mechanism is readily adaptable in the input or other portions of present day control systems where bilevel signaling is quite common. The subject mechanism also lends itself for utilization in the keyboard of an office machine, such as a calculator, where it is common to make keyboard entries which are applicable during several subsequent operations, e.g., a constant multiplier or divisor.

More specifically the mentioned embodiment contemplates an electrical switch having contacts associated with the position of a control element such as a keystem mounted for linear movement between a normal nondepressed position and a depressed control position. The normal position corresponding to open contact disposition and the depressed position accordingly corresponds to the closed condition. When the keystem is depressed to a predetermined longitudinal position a trip arm carried thereby engages a pivotally mounted bail member which under control of means coupling the bail and trip arm moves an integral latching lug to a position at which return of the keystem to its normal position is deterred. When the keystem is retained in its depressed control position, return to its normal position may be initiated by depression thereof which causes the coupling means between the bail and trip arm to operatively interact resulting in removal of the restraining means and return of the mechanism to its normal condition. In the event return of the mechanism to its normal condition is required notwithstanding keystem depression, the invention is adapted for release of the restraining means by an independently operating delatching arrangement.

The foregoing and other objects, features and advantages of the invention will appear more fully hereinafter

from a consideration of the detailed description which follows, in conjunction with the accompanying sheet of drawing wherein one principal embodiment of the invention is illustrated by way of example. It is to be expressly understood however, that the drawing is for illustrative purposes only and is not to be construed as defining the limits of the invention.

In the drawing wherein like reference characters refer to like parts throughout the several views:

FIG. 1 is a front view of a keyboard device which incorporates one embodiment of the novel control mechanism;

FIG. 2 is a fragmentary side elevational view of the control mechanism shown in FIG. 1;

FIG. 3 is an exploded perspective view illustrating the parts of the novel control mechanism; and

FIGS. 4–9 schematically show the various interrelated operational disposition of the parts of the control mechanism when the input member is reciprocated between its two operative positions in response to an external activating force.

Now referring to the drawing for a detailed description of the present invention, and more particularly to FIG. 1, a keyboard switching mechanism is generally designated by the reference numeral **10** and indicates by way of example apparatus incorporating an embodiment of the present invention. Mechanism **10** is adapted to operate the contacts of an electrical circuit interrupter or the like, generally designated by reference numeral **11**, and represented for the purposes of this invention, as a two state switching device mounted by a bracket **12** and having an actuator member **13** that is biased normally in the position shown, corresponding to a first state. Actuator member **13**, as in a conventional switch actuator, is illustrated as a button which responds to depression thereof to establish a second state when so depressed, e.g., the closed condition of contacts (not shown) of circuit interrupter **11**. A keytop **14**, preferably arranged in an array comprising a plurality of similar keytops, is attached to the end of a keystem **15** which is reciprocally driven in response to depressions manually initiated at keytop **14** by an operator. When the keystem is in the position shown actuator member **13** is in its extended position and the contacts of circuit interrupter **11** remain open. As will be hereinafter described in further detail, a depression of keystem **15** results in the latching down of the keystem to hold actuator member **13** depressed and the contacts of circuit interrupter **11** are thereby held closed. By a successive depression of the keytop the keystem is delatched (or released) and consequently the circuit interrupter is returned to its normally open condition. Thus, it can be seen that the mechanism, now to be described in the embodiment shown, operatively provides for alternate states of circuit interrupter **11** in response to successive manual depression of keytop **14**.

As mentioned above, a principal feature of the present invention is the means utilized for alternately latching and delatching keystem **15** in response to successive depressions of keytop **14** from which linear displacement of the keystem is derived. To this end, mechanism **10**, shown in detail in FIGS. 1 and 2 and shown for convenience, schematically and in exploded relationship in FIG. 3, includes a mounting frame **16** on which keystem **15** and circuit interrupter **11** are mounted for operative engagement. Keystem **15** is slidable with respect to frame **16** and is guided at the top through a slot **17** (FIG. 1) in a peripheral flange portion **18** of frame **16** extending outwardly therefrom. The cross section of slot **17** corresponds substantially to the extending keytop mounting portion **20** of keystem **15**. The excursions of the keystem are thereby physically limited to the distance between the lower surface **21** of keytop **14** and the upper surface of keystem protrusions **22** and **23** extending outwardly on opposite sides of keystem **15**. A further limitation imposed on the downward excursion of keystem **15** is evident from the description that follows.

The keystem is also guided by means of a slot **24** extending upwardly from the lower edge of keystem **15**. The slot registers with a mounting rod **25** secured to frame **16**. A collar **26**, or the like, is secured to rod **25** to limit the axial freedom of keystem **15** along rod **25** and thereby effectively provide a slot through which keystem **15** is guided. Thus, keystem **15** is limited in downward and upward excursions by the length of slot **24** and protrusions **22** and **23**, respectively.

A trip arm **27** is pivotally mounted to keystem **15** by a mounting stud **28**. Rotation of arm **27** about stud **28** is limited by an extending finger **30** projecting outwardly from arm **27** and registering with a cutaway portion **31** of keystem **15**. Thus, when trip arm **27** is caused to pivot, its travel is limited by the contact of finger **30** with the opposing side edges of cutaway portion **31**. It should be noted that trip arm **27** is mounted on keystem **15** for independent pivotal action about stud **28** regardless of the relative position of keystem **15** with respect to frame **16**.

Mounted pivotally on rod **25** is a bail member for performing the latching function, generally designated by reference numeral **32**, the pivotal excursion of which is limited by an integral lug **33** extending outwardly therefrom and projecting through a hole **34** in mounting frame **16**. It should be noted that bail **32** is generally U-shaped in configuration and is mounted on rod **25** by virtue of opposing mounting holes in the leg portions of such bail member, as illustrated in the exploded schematic view of FIG. 3. When bail **32** is caused to rotate in a counter-clockwise direction the upper edge of hole **34** limits the travel of lug **33** and, likewise, when clockwise rotation takes place the excursion of bail **32** is limited by contact between the bottom edge of hole **34** and lug **33**. It can be further seen that bail **32**, mounted as described above for rotation about rod **25** which is affixed to frame **16**, includes two integral lug portions **35** and **36** extending inwardly therefrom for selective operative engagement with the lower edge **37** of trip arm **27** in a manner to be described hereinafter. FIGS. 2 and 3 show a ledge portion **38** of trip arm **27**, which ledge portion serves to assure proper depth alignment and facilitates engagement between the lower edge **37** of arm **27** and integral lug portions **35** and **36**.

Bail **32** further includes a latching lug **40**, extending outwardly therefrom with respect to frame **16**. At the limit of the clockwise excursion of bail **32**, latching lug **40** is adapted to register with a notch **41** in keystem **15** when the keystem is in its lowermost position as determined by interaction between limiting slot **24** and mounting rod **25**.

In the normal position of the subject control mechanism the elements are biased to the position shown in FIG. 1 by a toggle spring **42**, which comprises several coil sections and diverging end arm portions **43** and **44**. The spring is mounted between an axially disposed stud **45** on trip arm **27** and a stud **46** on upwardly extending mounting arm **47** on bail **32**. By providing for slight coil compression when mounting the spring, an urging force may be exerted by spring end arm portions **43** and **44** on studs **45** and **46**, respectively, which in turn bias trip arm **27** and bail **32** and accordingly provide moments about stud **28** and rod **25**. Thus, in the normal condition of the mechanism **10** (shown in FIG. 1) trip arm **27** is urged in a counter-clockwise direction about stud **28** by means of the compressive force of spring **42** applied through end arm portion **43** and bail **32** is likewise urged in a counter-clockwise direction about rod **25** through spring end arm portion **44**. The force exerted on trip arm **27** also urges keystem **15** upwardly to the position shown in FIG. 1. Freedom of movement provides for the biasing of keystem **15** with protrusions **22** and **23** resting against flange **18** as a result of force transmitted from spring **42** act-

ing against bail **32** rotated to its most counter-clockwise position and arm **27** also in its most counter-clockwise position. In such normal condition actuator member **13** remains in its extended condition, i.e., circuit interrupter **11** is in its normally open position. To this end a leaf spring **48** is secured to a pin **50** extending from mounting bracket **12** and is resiliently urged against the lower edge of keystem **15**. The disposition of spring **48** permits actuator member **13** to extend in its normally open condition when keystem **15** is in the normal position (FIG. 1). Alternatively, when the keystem **15** is translated downwardly a predetermined linear distance, actuator member **13** retracts under the force of spring **48** and circuit interrupter **11** goes to the closed position. By utilizing a leaf spring for this purpose, a desirable mechanical advantage is realized without exerting an unduly large force on member **13**.

In addition to the force exerted on keystem **15** by toggle spring **42** and leaf spring **48** further means may be provided to accurately control the "feel" characteristics of the keytop **14** and keystem **15** combination as it relates to operation as an integral portion of a keyboard key array. In the embodiment shown, a torsion spring **51** is provided for such purpose. An integral L-shaped arm **52** extends from spring **51** and registers with slot **53** for urging keystem **15** upwardly. Various combinations of spring tension and slot contours enable preselection of any desired feel; however, the presense of spring **51** is not absolutely essential to restore keystem **15** to its normal position, in that toggle spring **42** can readily perform that function, as explained hereinabove.

In accordance with the above described arrangement, operation for alternate actuation and deactuation of circuit interrupter **11** in response to successive depressions of keystem **15** is effected in the following manner. With reference to FIGS. 4–9, which schematically show various interrelated disposition of the elements described above during intermediate states of latching and delatching of the keystem, the specific elements of the control mechanism shown in FIGS. 1 and 2 will be described during various operational steps. Initially, under normal rest conditions, the elements are disposed in the relationship shown in FIG. 1. To facilitate the following operational description a hole **60** is shown in the keytop mounting portion **20** to illustrate the relationship between the slidably mounted keystem **15** and the fixed mounting frame **16**. During rest conditions (FIG. 1) the hole is disposed midway between keytop **14** and flange portion **18**.

In FIG. 4 the keystem **15** has been translated by an operator to an intermediate position at which the lower edge **37** of trip arm **27** is contiguous with lug **36** on bail **32**. By urging the keystem **15** to a predetermined longitudinal position to cause trip arm **27** to forcibly impinge on lug **36**, bail **32** is caused to pivot to the position shown in FIG. 5. Toggle spring **42** shifts in a clockwise direction and latching lug **40** is positioned in notch **41**. Simultaneously the shifted toggle spring pivots trip arm **27** in a clockwise direction to the position shown in FIG. 6 and keystem **15** is retained by interaction between latching lug **40** and a shoulder **61** formed by notch **41** such that hole **60** is aligned with flange **18**. The keystem is thereby locked down and holds the circuit interrupter **11** (FIG. 1) in the closed or actuated position, i.e., the signal condition exists and keystem **15** is retained in the control position.

A subsequent depression of keystem **15** causes bail **27** to impinge on lug **35** of bail **32** as shown in FIG. 7. By further urging the keystem downwardly to the mentioned predetermined position (see hole **60** in FIG. 8) latching lug **40** is rotated out of notch **41** as bail **32** is snapped counter-clockwise due to the resulting opposite moment applied as a consequence of the position change of toggle spring **42** (FIG. 8). By then releasing the force applied to keytop **14**, trip arm **27** is permitted to rotate counter-clockwise to its original position and the keystem is urged upwardly (FIG. 9) until it reaches the position shown in FIG. 1. The circuit interrupter is thereby returned to its original condition associated with the normal rest position of the elements (FIG. 1).

In the event it is desirable to release the keystem without requiring a second depression of the keytop by the operator, it is now readily apparent that the mechanism lends itself to alternative delatching. Referring to the held down disposition of the elements as shown in FIG. 6 the bail **32** can be rotated counter-clockwise against the biasing force of spring **42** by external means (not shown) to the position shown in FIG. 8. This permits return of keystem **15** to its normal rest position without necessitating the impinging of trip arm **27** on lug **35** of bail **32**.

Many advantages of the present invention have been explicitly and implicitly set forth throughout the above description, e.g., a simple, reliable control mechanism which obviates the need for an external release mechanism while still being conveniently adapted for release by external means when desired. The invention is also readily alterable to obtain any required characteristics within a broad range of depressive forces for alternately latching and delatching the novel mechanism.

Although a specific embodiment of the invention has been illustrated and described in detail by way of example, it is to be understood that the invention is not limited thereto. Various changes may be made in the design and arrangement of parts without departing from the spirit and scope of the invention as defined by the appended claims, as will now be understood by those skilled in the art.

What is claimed is:

1. A lockdown key mechanism comprising,

(a) a longitudinally movable keystem,

(b) means for supporting said keystem,

(c) said support means fixed with respect to said keystem and including means for establishing a normal position of said keystem,

(d) means for biasing said keystem in said normal position, and

(e) latch means pivotally mounted on said support means for restraining said keystem at a control position remote from said normal position,

(f) said biasing means including means for operatively coupling said keystem and said latch means,

(g) said coupling means including trip means carried by said keystem for engagingly rotating said latch means to said restraining position when said keystem is moved to a predetermined longitudinal position from said normal position against said biasing means, whereby said keystem is retained in said control position.

2. A mechanism as set forth in claim **1** wherein said trip means comprise an arm pivotally mounted on said keystem and movable relative thereto to first and second predetermined positions, said arm being operable in said first position to engage said latch means when said keystem is moved from said normal position to said predetermined longitudinal position, and said arm being operable in said second position to engage said latch means for rotation thereof to release said keystem from said control position when said keystem is moved from said control position to said predetermined longitudinal position.

3. A mechanism as set forth in claim **2** wherein said latch means includes stop means for limiting rotation of said latch means to extended and retracted positions corresponding respectively to said normal and control positions of said keystem and said coupling means in addition to said trip means comprises a toggle spring connected between said arm and said latch means and is adapted to urge said arm in said first and second positions respectively when said latch means is disposed in said extended and retracted positions, said spring providing sufficient

force to bias said keystem in said normal position under conditions where said latch means is disposed in said extended position.

4. A mechanism as set forth in claim 2 wherein said keystem includes an integral shoulder portion and said latch means comprise a bail member including a latching lug adapted to physically engage said shoulder portion to effect retention of said keystem under conditions where said latch means is rotated by said arm to said restraining position.

5. A mechanism as set forth in claim 3 wherein said toggle spring comprises a coil spring under compression, having diverging end portions extending tangentially outwardly from said coil, said spring end portions being secured to said arm and said latch means respectively whereby the disposition of said spring provides alternately a force and a counter force respectively to rotatively urge said latch means in said extended and retracted positions.

6. A mechanism as set forth in claim 5 wherein said keystem includes an integral shoulder portion, said latch means comprise a bail member including a latching lug extending in the path of said shoulder for effecting physial engagement therewith under conditions where said toggle spring rotates said latch to said retracted position.

7. In a lockdown key mechanism the combination comprising,

(a) switch means including contacts,

(b) a keystem,

(c) means for mounting said keystem for substantially reciprocal linear movement, said keystem being operable to a first position to open said contacts and a second position to close said switch contacts,

(d) means for normally biasing said keystem in said first position,

(e) a manually operable key member connected to said keystem to manually move said keystem from one position to the other to operate said switch contacts,

(f) a trip arm carried by said keystem for movement therewith, said trip arm being movable relative to said keystem to first and second predetermined positions, and

(g) bail means pivotally mounted on said mounting means and adapted for operable engagement with said trip arm, said bail means being selectively driven relative to said keystem by said trip arm to an extended position and to a retracted position,

(h) said biasing means operatively associated with said bail means for selectively urging said trip arm to said first and second predetermined positions for operable engagement with said bail means when said bail means is disposed respectively in said extended and retracted positions,

(i) said bail means including means for restraining said keystem in said second position when said bail means is driven to said retracted position, whereby said contacts are retained closed when said keystem is translated to said second position in response to associated movement of said key member.

8. A mechanism as set forth in claim 7 wherein said keystem includes an integral shoulder portion, said means for restraining comprise an integral latching lug portion of said bail means, said trip arm is pivotally mounted on said keystem and said means operatively associated with said bail means includes a compressed toggle spring having diverging end portions extending outwardly therefrom, said toggle spring end portions being secured to said trip arm and said bail means respectively, whereby said toggle spring provides a rotative force to urge said bail means and dispose said lug portion in the longitudinal path of said shoulder portion of said keystem to effect retentive of said control element in said control position, and said toggle spring provides a counter-rotative force to release the bail means when said keystem is moved from said control position to said predetermined longitudinal position by said key member.

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H. O. JONES, *Assistant Examiner.*