March 9, 1965 W. L. TANCRED 3,172,296

PUSH BUTTON SWITCH ACTUATING MECHANISM

Filed Aug. 21, 1961 2 Sheets-Sheet 1

FIG. 1

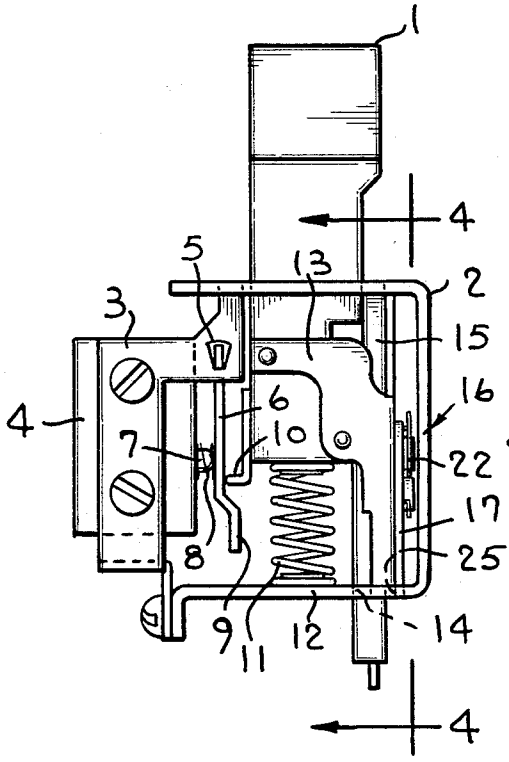


FIG. 3

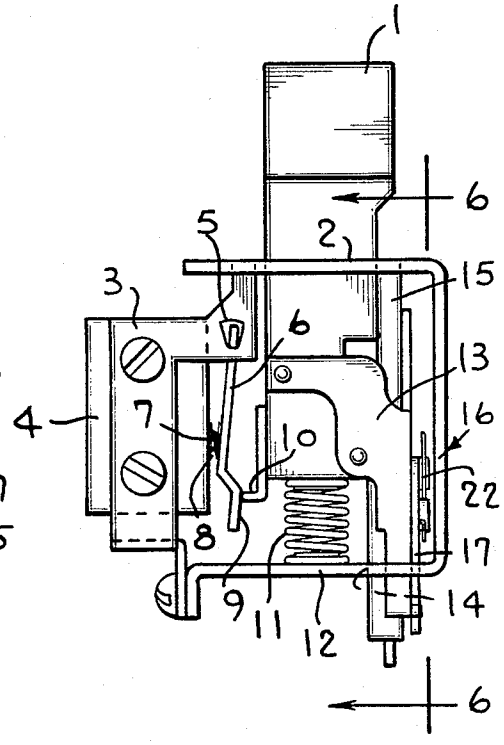
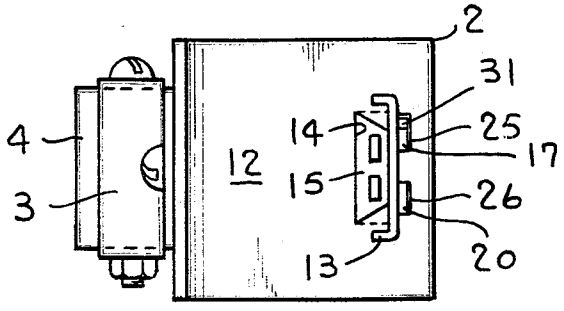


FIG. 2



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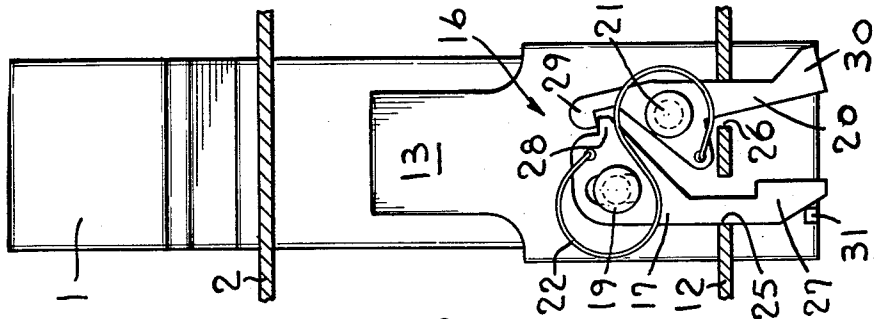


FIG. 7

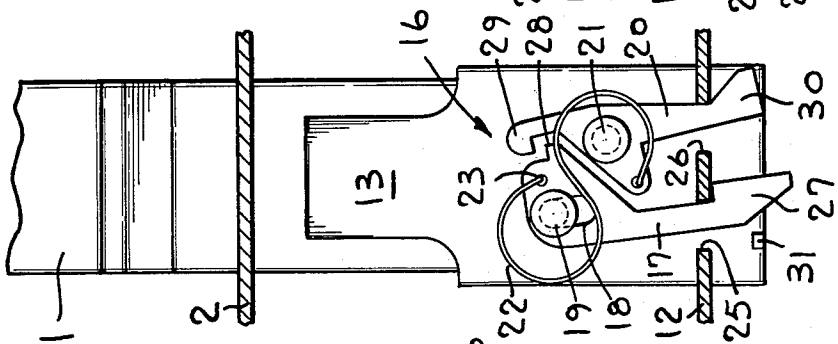


FIG. 6

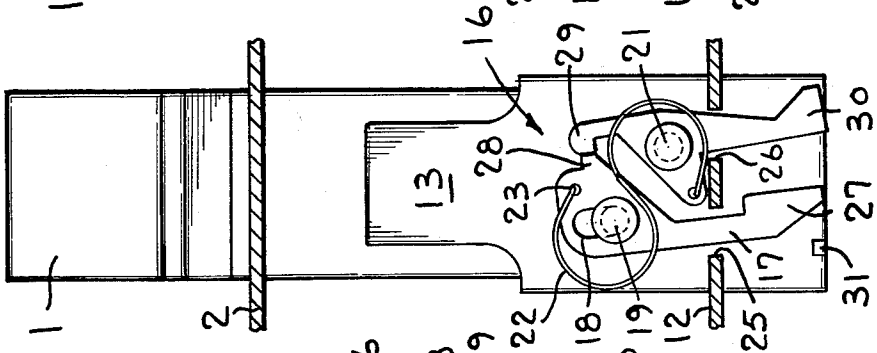


FIG. 5

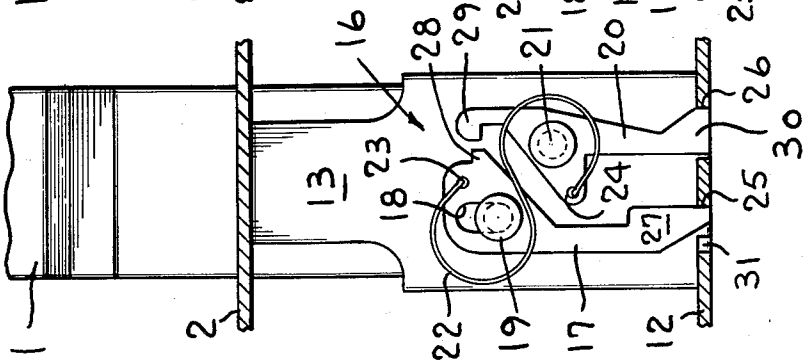


FIG. 4

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PUSH BUTTON SWITCH ACTUATING MECHANISM

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13 Claims. (Cl. 74—103)

This invention relates to actuators for electrical switches and, more particularly, to switch actuators of the alternate action type.

An object of this invention is the provision of a compact and simply constructed alternate action switch mechanism and one which utilizes a minimum number of parts.

Another object of this invention is the provision of an alternate action switch mechanism which is readily adaptable for use in a single switch assembly or in multiple switch assembly.

A further object of this invention is the provision of an alternate action switch mechanism which is vibration and shock resistant.

The novel features of this invention are set forth in the appennded claims. The invention itself, together with additional objects and advantages thereof, will be more clearly understood from a reading of the following description in connection with the accompanying drawings wherein:

FIG. 1 is a side elevation of a preferred embodiment of the invention;

FIG. 2 is a bottom plan view of the mechanism of FIG. 1;

FIG. 3 illustrates the mechanism of FIG. 1 in a subsequent position;

FIG. 4 is an enlarged elevation of the alternate action mechanism in its normal rest position;

FIG. 5 illustrates the alternate action mechanism in a fully depressed position;

FIG. 6 illustrates the alternate action mechanism in its latched position; and

FIG. 7 illustrates the alternate action mechanism as it is moved from the latched position and released for return of the actuator to its rest position.

Referring to FIG. 1, in a preferred embodiment of this invention a switch actuator 1 is mounted on and movable relative to a rigid frame 2. The actuator 1 can be moved manually or, if desired, automatically by connecting it to a suitable electrical solenoid (not shown). Fixedly connected to the frame by means of a bracket 3 is a switch 4. An actuating arm 6 is supported in an aperture 5 for pivotal movement into and out of engagement with a switch actuating button 7. A compression spring 8 is positioned in surrounding relationship with the button 7 and has one end seated against the switch 4 and the opposite end seated on the underside of the actuating arm 6 so that the actuating arm is normally held away from engagement with the button 7.

Included on the actuating arm 6 is a camming portion 9 which is positioned in the path of a follower 10. The follower 10 is rigidly connected to and movable with the actuator 1. Thus, as the actuator 1 is moved downwardly relative to the frame 2 and away from the rest position the follower 10 engages the camming surface 9 and displaces the actuating arm 6 to depress the button 7 and actuate the switch 4.

The frame 2 includes a laterally extending leg which forms a lower shelf 12. A compression spring 11, suitably seated between the underside of the actuator 1 and the shelf 12, urges the actuator upwardly and maintains it in a normal rest position.

A bracket 13 is suitably connected to the actuator 1

and is movable therewith relative to the frame 2. The lower shelf 12 of the frame 2 is provided with an aperture 14 to permit movement of bracket 13. A post 15 is rigidly attached to the frame 2 and provides a guide upon which the actuator 1 and the bracket 13 are movable. The bracket 13 carries a mechanism 16 which provides for alternate action of the switch 4. The mechanism 16, being carried by the bracket 13, is then movable with the actuator 1.

Referring to FIG. 4, the alternate action mechanism 16 includes a latch 17. The latch 17 is provided with an elongated slot 18 in which is positioned a stud 19. The stud 19 is rigid with the bracket 13 so that the latch 17 is movable with the bracket 13, and correspondingly the actuator 1 which is rigid with the bracket 13, and is capable of pivotal movement on the bracket 13. Furthermore, the elongated slot 18 provides for limited travel of the bracket 13 relative to the latch 17 in the direction of movement of the actuator and for a purpose which will appear hereinafter.

Positioned adjacent the latch 17 is a pawl 20 which is pivotally mounted on the bracket 13 by a stud 21. The stud 21 rigidly connects the latch 20 to the bracket 13 for movement therewith and further provides a pivotal connection about which the latch 20 pivots on the bracket 13.

An S-shaped spring 22 is suitably seated in apertures 23 and 24 of the latch 17 and the pawl 20 respectively and biases both the latch 17 and the pawl 20 counterclockwise about their respective pivotal connections. Further, the spring 22 urges the latch 17 upwardly so that the stud 19 is normally positioned at the bottom of the slot 18. The lower ends of the latch 17 and the pawl 20 are disposed in apertures 25 and 26 in the lower shelf 12 of the frame 2. As can be seen in FIG. 2, when the actuator 1 is disposed in its normal position the lower ends of the latch 17 and the pawl 20 and the shelf 12 prevent counterclockwise rotation of the latch and pawl about their pivotal axis so that these members are maintained in relative vertical alignment with the longitudinal axis of the actuator 1.

When the actuator 1 is moved from its normal position to actuate the switch 4 the latch 17 and the pawl 20 move downwardly through the apertures 25 and 26 respectively. This frees the latch and pawl for pivotal movement about their respective axes. When the actuator 1 is fully depressed to an abnormal position the latch and pawl are pivoted to the position shown in FIG. 5 by the spring 22. The latch 17, at its lower end, is provided with a hook portion 27. Pivotal movement of the latch 17, when the actuator 1 is fully depressed positions the hook portion 27 below a portion of the shelf 12 adjacent the aperture 25. Since the actuator 1 is biased towards its normal position by the spring 11, when the force applied to depress the actuator is removed the actuator will attempt to return to its rest position; however, the hook 27 will engage the shelf 12 to hold the actuator against return and in a latched position. It should be noted that when the actuator 1 is held in the latched position by the hook 27 the follower 10 is held in engagement with the camming surface 9 and maintains the actuation of switch 4.

The upper end of the latch 17 is provided with a laterally extending jaw 28 and the pawl 20 is provided at its upper end with a hook 29. When the actuator 1 is moved to the depressed position of FIG. 5, the pawl 20 is also pivoted by the spring 22. The hook 29 abuts the jaw 28 and limits the pivotal movement of the pawl 20. The elongated slot 18 permits limited travel of the bracket 13 relative to the latch 17 after the hook portion 27 has engaged the shelf 12. The pawl 20, being movable with the bracket 13, also travels relative to the latch 17 so that

the hook **29** is displaced from abutting relationship with the jaw **28**. This frees the pawl and allows the spring **22** to pivot it further about the stud **21** and position the hook **29** above the jaw **28** for engagement of the paw **28** by the hook **29** when the actuator is again moved against the bias of spring **11** and away from its latched position.

The alternate action mechanism **16** is illustrated in its latched position in FIG. 6. When the actuator is moved away from its latched position, the slot **18** will again permit limited movement of the bracket **13** and the pawl **20** relative to the latch **17** io that the hook **29** will be brought into engagement with the jaw **28** to pivot the latch **17** out of engagement with shelf **12**. Referring to FIG. 7 when the actuator is moved to a fully depressed position from the latched position, the hook **29** is in engagement with the jaw **28** and the hook **27** on the latch has been displaced out of alignment with the shelf with both the latch **17** and the pawl **20** being positioned with their longitudinal axes in general alignment with the longitudinal axis of the actuator **1** so that the actuator is freed for return to its normal position.

The pawl **20** includes a camming surface **30**, which, when the alternate action mechanism is in the position of FIG. 7 with the hook **29** engaging the jaw **28**, is positioned to engage the portion of the shelf **12** adjacent the aperture **26** as the actuator moves toward its normal position. More specifically, after the latch **17** has been released from the shelf **12** and the downward pressure on the actuator **1** is removed to permit the actuator **1** to return to its normal position, the camming surface **30** engages the shelf **12** and pivots the pawl **20** about its axis and disengages the hook **29** and jaw **28** so that upon return of the actuator to its normal position the alternate action mechanism is returned to the condition of FIG. 2 and is ready for another sequence of operations.

It should be noted that the latch **17** and the pawl **20** are formed, substantially planar members which fit flush with the bracket **13** and that the alternate action of the actuator **1** is accomplished without the use of space consuming lateral projections. The working portions and surfaces of the latch and pawl are contained in the planes of these members and the members themselves are generally co-planar. Hence, a simple, compact alternate action structure is provided which can be readily fitted within the width limits of the actuator **1** and which has a minimum lateral extension from the actuator. Such an alternate action mechanism can be incorporated in a switch assembly without sacrificing space which in many switch installations, such as electronic computers, adding machines, aircraft controls, etc., is at a premium. Furthermore the alternate action mechanism of this invention is readily adaptable for use with a single switch assembly or for use in a switch assembly incorporating a plurality of switch stations, commonly referred to as a gang-mounted switch assembly.

The alternate action mechanism of this invention is also particularly well suited for use in installations where considerable vibration may be encountered or where the switch assembly may be subjected to severe impact or shock. An interlock is provided which locks the mechanism in its latched position and prevents the latch from being shaken loose. More specifically, the bracket **13** is provided with a lock pin **31** which is rigid with the bracket **13** and is normally positioned relative to the latch **17** so as not to interfere with the pivotal movement of the latch about the stud **19**. When the alternate action mechanism is in is latched position, see FIG. 6, and the bracket **13** has moved relative to the latch **17**, the lock pin **31** is also moved relative to the latch. The lock pin, in the latched position, thus assumes a position relative to the latch **17**, so as to limit the travel therefor such that any travel will be insufficient to disengage the hook **27** from the shelf **12** and free the actuator **1** for return to its normal position.

The discussion of this invention with respect to a particular preferred embodiment thereof is intended for illustrative purposes only and not by way of limitation. Accordingly, it is intended in the appended claims to cover all modifications and/or embodiments of this invention as fall within the true spirit and scope thereof.

What I claim is:

1. A switch actuating mechanism comprising, in combination, an actuator mounted on and movable relative to a frame, means for biasing said actuator toward a normal position relative to said frame, a planar latch, means for connecting said latch to said actuator for pivotal movement relative thereto into and out of engagement with said frame and for limited travel of said actuator relative to said latch in the direction of movement of said actuator relaive to said frame, a hook on said latch disposed to engage said frame when said actuator is moved against said bias to an abnormal position and operative to hold said actuator in a latched position intermediate said normal and abnormal position and against return to said normal position, a planar pawl, means for connecting said pawl to said actuator for movement therewith and pivotal movement thereon into and out of engagement with said latch, said pawl including a hook portion which when said actuator is in said normal position is disposed in spaced relation from said latch, means interconnecting said latch and said pawl for pivotally displacing said latch and said pawl when said actuator is moved against said bias from said normal position to engage said hook on said latch with said frame and position said hook on said pawl for engagement with said latch when said actuator is moved against said bias away from said latched position to thereby pivot said hook on said latch away from said frame and free said actuator for return to said normal position, and means on said pawl disposed to engage said frame as said actuator is returned to said normal position for disengaging said hook on said pawl from said latch.

2. A switch actuating mechanism comprising, in combination, an actuator mounted on and movable relative to a frame, means for biasing said actuator toward a normal position relative to said frame, a planar latch, means for connecting said latch to said actuator for pivotal movement relative thereto into and out of engagement with said frame and for limited travel of said actuator relative to said latch in the direction of movement of said actuator relative to said frame, a hook on said latch disposed to engage said frame when said actuator is moved from said normal position and hold said actuator in a latched position and against return to said normal position, a planar pawl, means for connecting said pawl to said actuator for movement therewith and pivotal movement thereon into and out of engagement with said latch, said pawl including a hook portion which when said actuator is in said normal position is disposed in spaced relation from said latch, means interconnecting said latch and said pawl for pivotally displacing said latch and said pawl when said actuator is moved from said normal position to engage said hook on said latch with said frame and to position said hook on said pawl for engagement with said latch when said actuator is moved away from said latched position to thereby pivot said hook on said latch away from said frame and free said actuator for return to said normal position, and means on said pawl disposed to engage said frame as said actuator is returned to said normal position for disengaging said hook on said pawl from said latch.

3. A switch actuating mechanism comprising, in combination, an actuator mounted on and movable relative to a frame, means for biasing said actuator toward a normal position relative to said frame, a planar latch, means for connecting said latch to said actuator for pivotal movement relative thereto into and out of engagement with said frame and for limited travel of said actuator relative to said latch in the direction of movement of said actuator relative to said frame, holding means on said latch disposed to engage said frame when said actua-

tor is moved from said normal position for holding said actuator in a latched position and against return to said normal position, a planar pawl, means for connecting said pawl to said actuator for movement therewith and pivotal movement thereon into and out of engagement with said latch, and means interconnecting said latch and said pawl for pivotally displacing said latch and said pawl when said actuator is moved from said normal position to engage said holding means with said frame and to position said pawl for engagement with said latch when said actuator is moved away from said latched position to thereby pivot said latch away from said frame to free said actuator for return to said normal position, and means for disengaging said pawl from said latch as said actuator is returned to said normal position.

4. A switch actuating mechanism comprising, in combination, an actuator mounted on and movable relative to a frame member, means for biasing said actuator toward a normal position relative to said frame member, a latch member pivotally connected to said actuator for movement therewith and for pivotal movement thereon into and out of engagement with said frame, holding means on said latch member disposed to engage said frame member when said actuator is moved from said normal position for holding said actuator in a latched position and against return to said normal position, a pawl pivotally connected to said actuator for movement therewith and for pivotal movement thereon into and out of engagement with said latch member, and means for displacing said latch member and said pawl when said actuator is moved from said normal position to engage said holding means on said latch member with said frame member and to move said pawl for engagement with said latch member when said actuator is moved from said latched position to thereby disengage said holding means from said frame member to free said actuator for return to said normal position.

5. A switch actuating mechanism comprising, in combination, an actuator mounted on and movable relative to a frame, means for biasing said actuator toward a normal position relative to said frame, a latch pivotally connected to said actuator for movement therewith and for pivotal movement thereon into and out of engagement with said frame, a pawl pivotally connected to said actuator for movement therewith and for pivotal movement thereon into and out of engagement with said latch, and means for displacing said latch and said pawl when said actuator is moved against said bias and away from said normal position to engage said latch with said frame to hold said actuator against return to said normal position and to position said pawl for engagement with said latch when said actuator is again moved against said bias to thereby disengage said latch from said frame and free said actuator for return to said normal position.

6. A switch actuating mechanism, comprising, in combination, an actuator mounted on and movable relative to a frame, means for biasing said actuator toward a normal position relative to said frame, first and second relatively movable members connected to said actuator for movement therewith, one of said movable members positioned on said actuator to engage said frame when said actuator is moved against said bias and away from said normal position to hold said actuator against return to said normal position, means for baising said one member toward engagement with said frame, and means for displacing the other of said movable members, said other movable member moving with said actuator into engagement with said one movable member for engagement with said one member when said actuator is again moved against said bias and said other movable member operative, in accordance with movement thereof with said actuator, to move said one member out of engagement with said frame to free said actuator for return to said normal position.

7. The combination of claim 6 including means for disengaging said one member from said other member as said actuator is returned to said normal position.

8. A switch actuating mechanism comprising, in combination, an actuator mounted on and movable relative to a frame, means for biasing said actuator toward a normal position relative to said frame, a latch, means for connecting said latch to said actuator for pivotal movement relative thereto into and out of engagement with said frame and for limited travel of said actuator relative to said latch in the direction of movement of said actuator relative to said frame, said latch disposed to engage said frame when said actuator is moved from said normal position and hold said actautor in a latched position and against return to said normal position, a projection on said actuator so positioned relative to said latch when said actuator is held in said latched position as to limit the movement of said latch to an amount insufficient to disengage said latch from said frame, a pawl, means for connecting said pawl to said actuator for movement therewith and pivotal movement thereon into and out of engagement with said latch, and means for pivotally displacing said latch and said pawl when said actuator is moved from said normal position to engage said latch with said frame and to move said pawl for engagement with said latch latch when said actuator is moved away from said latched position to pivot said latch away from said frame and free said actuator for return to said normal position.

9. A switch actuating mechanism comprising, in combination, an actuator mounted on and movable relative to a frame, means for biasing said actuator toward a normal position relative to said frame, a latch member pivotally connected to said actuator for movement therewith and for pivotal movement thereon, said latch member disposed to engage said frame when said actuator is moved from said normal position and hold said actuator in a latched position against return to said normal position, means movable with said actuator and so positioned relative to said latch member when said actuator is in said latched position as to limit movement of said latch to an amount insufficient to disengage said latch member from said frame, a pawl member pivotally connected to said actuator for movement therewith and for pivotal movement thereon into and out of engagement with said latch member, and means for displacing said latch member and said pawl member when said actuator is moved from said normal position to engage said latch member with said frame and to move said pawl member for engagement with said latch member when said actuator is moved away from said latched position to disengage said latch member and said frame and free said actuator for return to said normal position.

10. A switch actuating mechanism comprising, in combination, an actuator mounted on and movable relative to a frame member, means for biasing said actuator toward a normal position relative to said frame member, first and second relatively movable members connected to said actuator for movement therewith, one of said movable members positioned on said actuator to engage said frame member when said actuator is moved against said bias to hold said actuator against return to said normal position, means disposed adjacent said one movable member when said actuator is held away from said normal position to limit movement of said one movable member relative to said frame member and maintain engagement of said one movable member with said frame, means for biasing said one member toward engagement with said frame member, and mean operative when said actuator is held away from said normal position for displacing the other of said movable members for engagement with said one member to disengage said one member from said frame member when said actuator is again moved against said bias to thereby free said actuator for return to said normal position.

11. A switch actuating mechanism comprising, in combination, frame means, an actuator movable into and out of a normal position relative to said frame means, means biasing said actuator toward said normal position, latch means supported on one of said actuator and said frame means and arranged for selective engagement with the

other of said actuator and frame means and operable when said actuator is moved from said normal position to hold said actuator in a latched position to prevent return of said actuator to said normal position, means mounted on and movable with said actuator for releasing said latch means to free said actuator for return to said normal position, and means carried by said actuator disposed adjacent said latch means when said actuator is in said latched position to limit movement of said latch means to prevent release of said latch means while it is holding said actuator against return to said normal position.

12. A switch actuating mechanism comprising, in combination, an actuator mounted on and movable relative to a frame member into and out of a normal position, first and second relatively movable members connected to said actuator for movement therewith, one of said movable members positioned on said actuator to engage said frame member when said actuator is moved away from said normal position to hold said actuator in a latched position and against return to said normal position, means for biasing said one member toward engagement with said frame member, means operative when said actuator is held away from said normal position for displacing the other of said movable members for engagement with said one member so that said other movable member is operative to move said one member out of engagement with the frame member when said actuator is moved away from said latched position to free said actuator for return to said normal position, and means disposed adjacent said one movable member when said actuator is held away from said normal position to limit movement of said one movable member and maintain engagement of said one member with said frame member.

13. A switch actuating mechanism comprising, in combination, frame means, an actuator movable into and out of a normal position relative to said frame means, latch means supported on one of said actuator and said frame means arranged for selective engagement with the other of said actuator and frame means and operable when said actuator is moved from said normal position to hold said actuator in a latched position to prevent return to said normal position, means connected with one of said actuator and said frame means and operable in response to movement of said actuator for releasing said latch means to free said actuator for return to said normal position, and means carried by said actuator and operative when said actuator is in said latched position to limit movement of said latch means so as to prevent release of said latch means while it is holding said actuator against return to said normal position.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,172,296 March 9, 1965

William L. Tancred

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 14, for "relaive" read -- relative --; column 5, lines 68 and 69, strike out "for engagement with said one member", and insert the same after "members" in line same column 5; column 6, line 11, for "actautor" read -- actuator --; line 22, strike out "latch", first occurrence; line 65, for "mean" read -- means --; column 7, line 7, before "disposed" insert -- and --; column 8, line 8, before "arrange insert -- and --.

Signed and sealed this 27th day of July 1965.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents