United States Patent

Moodie

[15] **3,674,965**

[45] **July 4, 1972**

[54] SWITCH PROGRAMMING DEVICE WITH SEQUENTIALLY ACTUATED SWITCHES

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[73] Assignee: **Polaroid Corporation,** Cambridge, Mass.

[22] Filed: **Oct. 5, 1970**

[21] Appl. No.: **78,103**

[52] **U.S. Cl.** .....**200/153 R,** 200/153 LA, 200/5 C, 200/50 C

[51] **Int. Cl.** **H01h 9/26**

[58] **Field of Search** .....200/50 C, 153 LA, 5 C, 160, 200/153 T, 153 J, 156, 153 R

[56] **References Cited**

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Assistant Examiner—Robert A. Vanderhye
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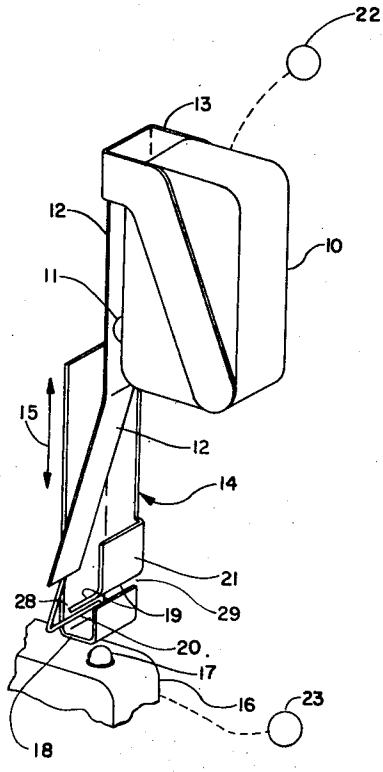
[57] **ABSTRACT**

A mechanical system for operating functions for example, electrical switches on a programmed basis. An actuator movable past a follower in reciprocatory movement with the follower on one path in one direction and on another path in the reverse direction. One way mechanical gate to require change in travel path on reverse of reciprocation to preclude reversal of sequence regardless of reversal of movement. Ramp and platform to actuate and hold switch on programmed basis. Application example, sequential operation of electronic flash units in a photographic system.

20 Claims, 11 Drawing Figures



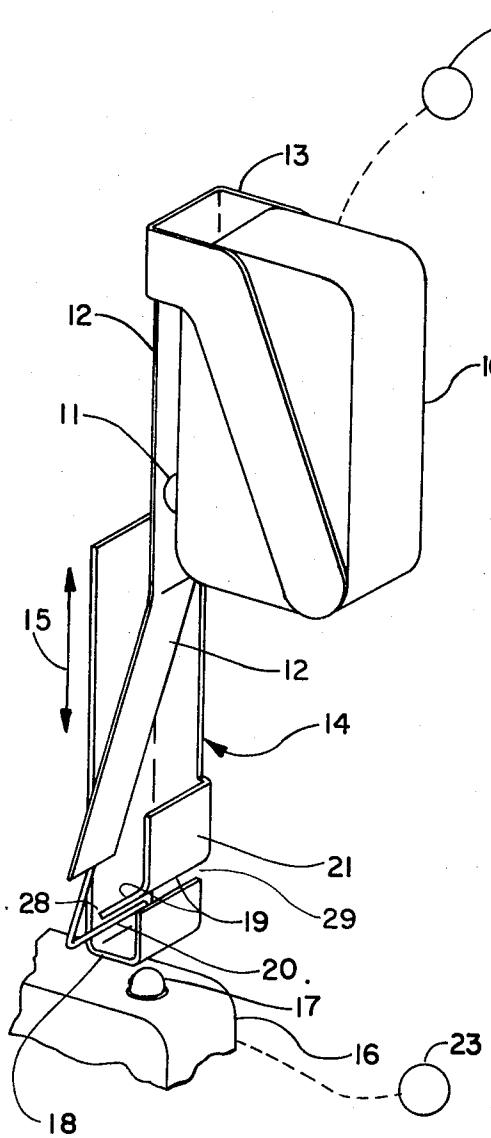


FIG. 1

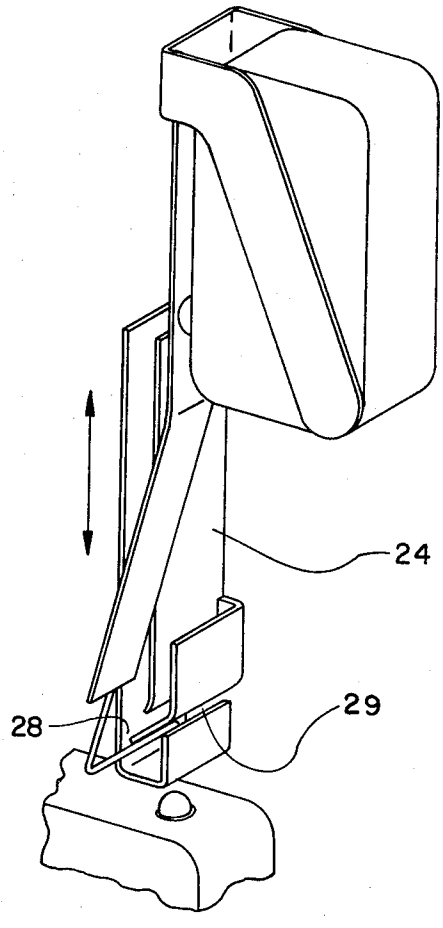


FIG. 2

FIG. 11

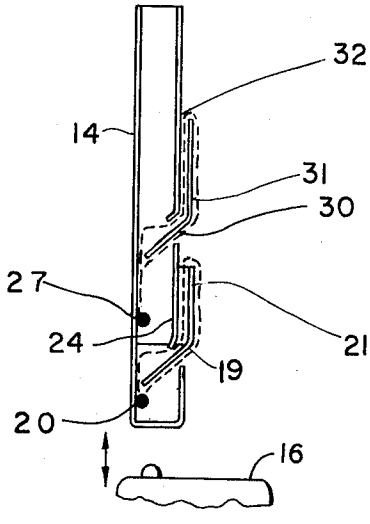


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FIG. 6

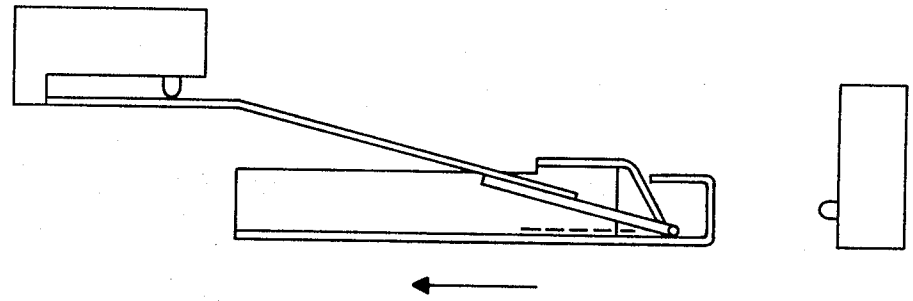

FIG. 5

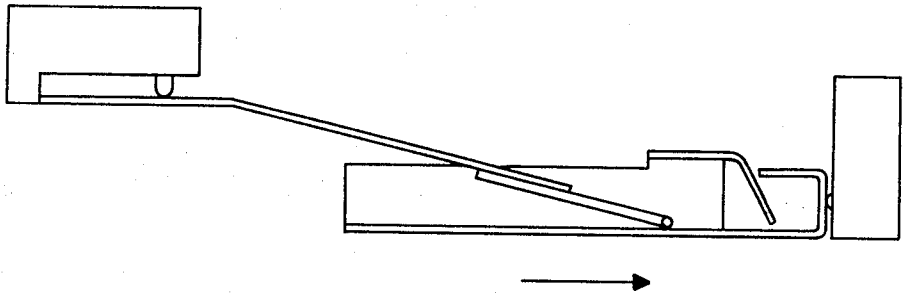

FIG. 4

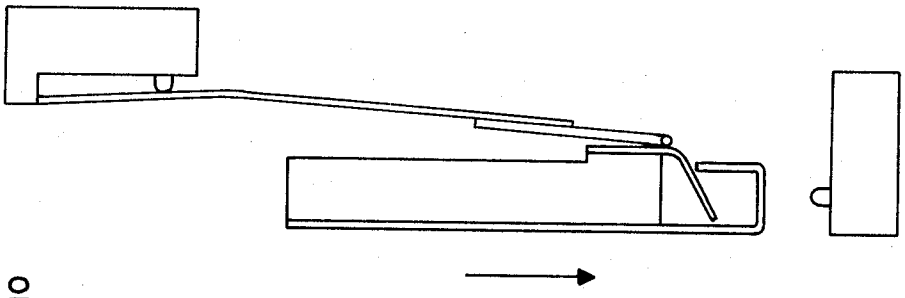

FIG. 3

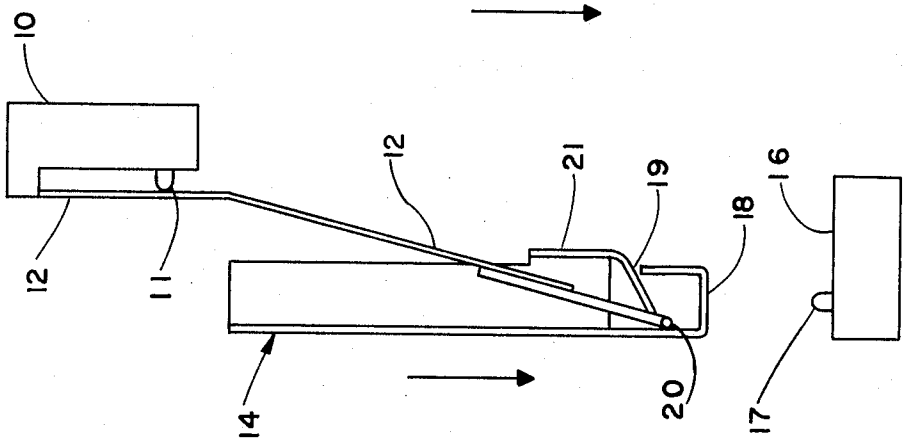

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FIG. 10

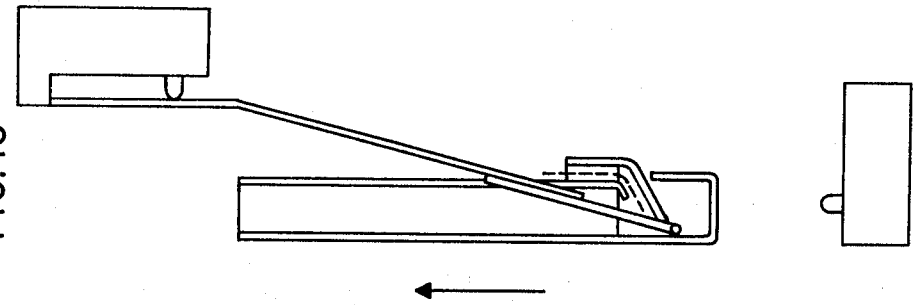


FIG. 9

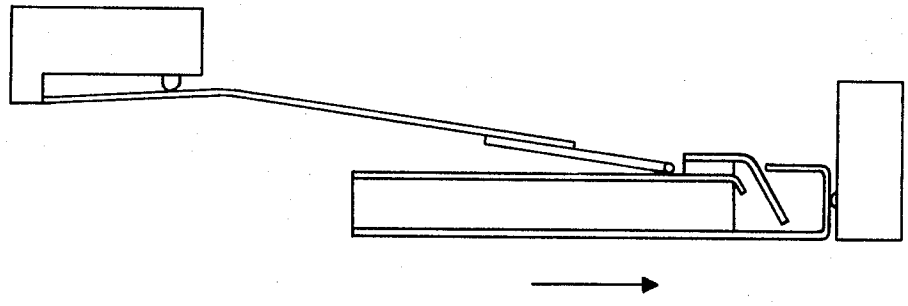


FIG. 8

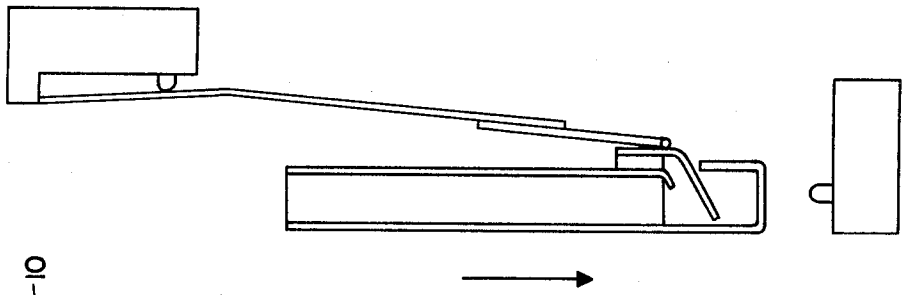
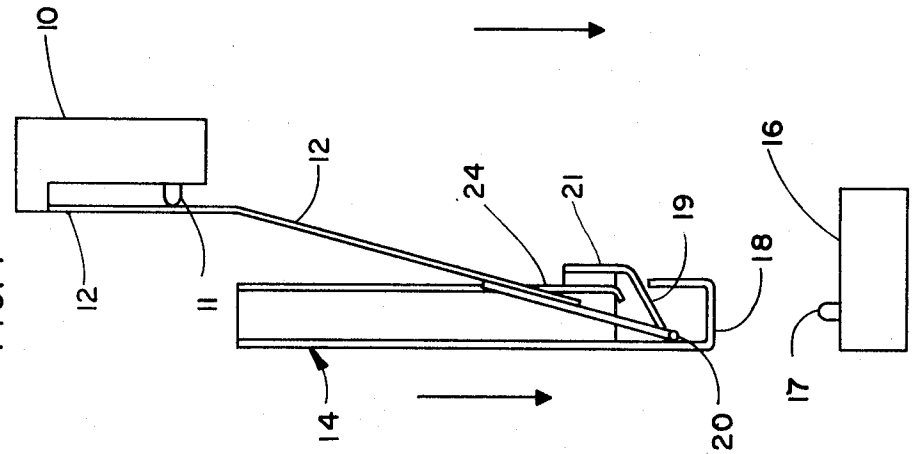


FIG. 7



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SWITCH PROGRAMMING DEVICE WITH SEQUENTIALLY ACTUATED SWITCHES

This invention relates to function operating devices, and has particular reference to the operation of functions on a programmed basis.

In all fields of operation and control function operating devices such as switches, valves, fluidic devices and the like play an important part. This invention relates to mechanical movement devices in the operation of such devices.

Modern systems often require switching on a programmed basis, wherein some switches are actuated before others, some switches are held in or from actuation until others are actuated, some switches are subject to delayed actuation or release. This invention relates to a new and unique device for accomplishing such functions.

Switching and time delays associated therewith to accomplish desired programming, are accomplished in various forms and ways. This invention provides a mechanical device of relative reciprocatory movement between an actuator and a follower for such purpose. The reciprocatory movement of the device of this invention may be straightline or arcuate and is along one path in one direction. Switching is accomplished along one or both of such paths, and delays are accomplished by holding action along at least a part of the extent of at least one of such paths.

In this invention, the change of travel path in such reciprocatory movement is accomplished after passing the follower through a one-way mechanical gate at one end of such reciprocatory movement. Switch actuation is thereafter accomplished by ramp travel of the follower at the inception of its return travel. Delay is accomplished by a holding platform in such return travel, after such ramp travel.

Multiples of combinations of such actuator, follower and travel path forms may be used to accomplish various programming according to specific application needs, with two, three, or more switches gauged or sequenced as desired.

An example of an application of this invention is the programmed firing of electronic flash units in photographic systems. A photographic system using two such flash units and requiring programming of such use is exemplified in the identification card systems described in the following copending patent applications:

Case	Serial No.	Inventor	Filing Date
	864,632	J. F. Pasieka	10/8/70
	864,637	M. F. Eacock	1/2/70
	849,960	B. K. Johnson	6/25/70
4190		M. A. Seiden	
4192		D. E. Moodie	

It is, therefore, an object of this invention to provide a new and useful switch program device.

It is further object of this invention to provide a switch program device on a reciprocatory basis of relative movement between an actuator and a follower, with different paths of such movement in the different directions of such reciprocation.

Other objects and advantages of the invention will be in part apparent and in part pointed out hereinafter and in the accompanying drawings, in which:

FIG. 1 is a perspective showing of a pair of electrical microswitches with a mechanical system of an actuator and a follower thereon for relative reciprocatory movement in accomplishing the actuation of the microswitches in accordance with this invention:

FIG. 2, is a perspective of an alternate structure with respect to that of FIG. 1, on a more involved basis of operation;

FIG. 3 through 6 schematically illustrate the operation of the structure of FIG. 1;

FIGS. 7 through 10 schematically illustrate the operation of the structure of FIG. 2; and FIG. 11 illustrates the system of FIG. 2, in multiple.

The switch system of FIG. 1 comprises an electrical microswitch 10 with an actuator button 11 which is spring pressed outward in a common fashion, and an actuator arm 12 which has one end mounted on the upper end of the microswitch as a pivot 13 which may be in the form of a flexure. The arm 12 overlies the button 11 so that the switch 10 is actuated by moving the arm 12 against the button 11, about the pivot 13. An actuator slide 14 is suitably mounted (not shown) for straight line movement, as indicated by arrow 15, past the microswitch 10 as a means of moving the arm 12 to actuate the microswitch 10. A second microswitch 16 is mounted below the slide 14, with an actuator button 17 therein for engagement by the lower end 18 of the slide 14 at the lower extreme of the downward movement of the slide 14. The slide 14 is provided with a ramp 19 as a guide and movement producing device for moving engagement with a transverse end finger 20 as the lower end of the microswitch arm 12. Thus, as the slide 14 is moved downward by any means, such as a push-button, the finger 20 moves up the ramp 19 to move the microswitch arm 12 about its pivot 13 to engage the microswitch button 11 and actuate the microswitch 10. At the top of the ramp 19, a platform 21 is provided for maintaining the arm 12 against the button 11 for a desired period of continued downward movement of the slide 14. Before this downward travel ends, the finger 20 drops off the upper end of the platform 21 under the spring pressure of the button 11 and, if desired, resilience of the arm 12 itself. Thus the microswitch 10 is released and the microswitch 16 is actuated at or near the low point of travel of the slide 14. As the slide 14 is thereafter moved upward, the microswitch 16 is released, and the finger 20 again reaches the position shown in FIG. 1.

As an example of an application of this switch system, electronic flash units are represented at 22 and 23 as operable in response respectively to actuation of switches 10 and 16. Such an application may be used in a photographic system for sequentially photographing two different scenes or subjects, with an example of an advantage being that flash 22 cannot be actuated a second time before or while flash 23 is actuated. The particular length of slide platform 21 relates to the extent and timing of the out-of-action condition of the flash 22 while finger 20 is riding on platform 21.

FIG. 2 illustrates a variant of the system of FIG. 1 in which the slide 14 is provided with a sub-platform 24 which the finger 20 drops onto from the top of platform 21 and stays thereon as a time delay while the slide 14 moves upward, then dropping off to again achieve the location shown in FIG. 1. With this arrangement, both microswitches can be released together.

As in FIGS. 1 and 2, one-way mechanical gates 28 and 29 are provided as apertures between the ramp member 19 and the body of the slide 14. These apertures are sufficient to allow passage of the follower finger 20 in one direction but small enough to resist reverse movement therethrough. The angle of the ramp 19 is in aid of movement of the finger 20 through the apertures 28 and 29 in one direction. If desired, the material of the ramp 19 and the body of the slide 14 may be sufficiently flexible to allow the finger 20 to snap through the apertures 28 and 29. With this arrangement, the apertures can be smaller than the diameter of the finger 20 to allow one-way passage therethrough with full assurance that return passage will not occur. That is, when the slide moves down, finger 20 must ride up the ramp 19. Similarly, when the finger 20 is on the platform 21, reversal of the movement of the slide 14 will not cause the finger to travel down the ramp 19. Thus the slide 14 must be moved the full operational distance down, so that the finger 20 will drop off the top of the platform 21, or the microswitch 10 will not be released, even if the slide 14 is fully moved upward.

The FIG. 2 sub-platform 24 receives the finger 20 when it drops off the top of the platform 21, without releasing the microswitch 10. Accordingly, as the slide 14 is moved upward, the finger 20 travels down the sub-platform 24 and drops off into the position shown in FIG. 1 in an arrangement such that switches 10 and 16 are released together.

Various combinations of such timing relations may be obtained as desired, according to the lengths and dispositions of platform **21** and sub-platform **24**.

FIGS. **3** through **6** illustrate a cycle of movement of the structure of FIG. **1**. As indicated by the movement arrows, movement of the slide **14** from the location of FIG. **3** to that of FIG. **4** results in travel of the follower finger **20** up the ramp **19** and onto the delay platform **21**. As, in FIG. **5**, the slide **14** reaches its lowest point, the switch **16** is actuated by the bottom of the slide and the finger **20** is dropped off the top of the platform **21**, to release the microswitch **10**.

The switch **16** is shown below the slide **14** for purposes of illustration, but it may be located elsewhere and operated through a suitable mechanical connection to the slide **14**, such as a cable to a cam (not shown) for rotation of such cam to engage the button **17** and so actuate the switch at the same time as it is actuated in the system shown.

FIG. **6**, shown by its arrow as a condition of movement upward of the slide **14**, indicates that both switches **10** and **16** have now been released and the structure is back in the FIG. **3** situation, ready for another switching cycle.

FIGS. **7** through **10** illustrate a cycle of movement of the structure of FIG. **2**. As indicated by the incremental illustrations and the movement direction arrows, the action and procedure is the same as that of FIGS. **3** through **6** until the situation of FIG. **9** is reached. At this point, the finger **20** has dropped off the top of platform **21** and rests on sub-platform **24**, still maintaining the actuated condition of switch **10**. Thereafter, as in FIG. **10**, when the slide **14** is moved upward, both switches are released essentially together, as the finger **20** travels down the face of the sub-platform **24** to drop off the lower end thereof to release switch **10** and again achieve the situation of FIG. **7**, ready for a new cycle of operation.

Many variations of structure and operation of such switch program systems may obtain by using more switches, with or without individual followers, or more ramps and platforms or subplatforms in multiples of the combinations or units shown, to delay one switch or bank of switches, to actuate some on the down-stroke and others on the up-stroke, and so on, in great variety to achieve suitable program cycles for particular applications. The fail-safe concept of the one-way mechanical gate **29** of FIG. **1**, which requires the full stroke of slide **14** for proper operation of the system, may be applied in various other ways at various other locations in the structural system.

FIG. **11** is an illustration of such multiple structure. This is the structure of FIG. **2**, with a second follower finger **27** for operating another switch (not shown) like switch **10**. An extra ramp, platform and sub-platform **30**, **31**, and **32** respectively, are supplied for controlling the movement of the second follower finger **27**. Fingers **20** and **27** are shown in locations indicative of their situation in the system before the slide **14** is moved down. The paths of fingers **20** and **27** in the course of the reciprocatory sliding movement of the operation of these switch systems are indicated by dotted line paths for each of the fingers **20** and **27**.

Switch **16** provides a third factor in the system of FIG. **11**. Many variants of this structure, with various programs, may readily be developed by further combinations of such switches, ramps, and platforms, with variants in the lengths and positions of the platforms, and like alternatives, using more switches when desired. In the FIG. **11** system, in the downstroke of slide **14**, the switch of finger **20** is actuated first, then that of finger **27**, then the switch **16**. In the reverse, the variant of switch **16** being actuated first, then the switch of finger **20**, and finally the switch of finger **27**.

This invention, therefore, provides a unique program switch device, based on reciprocatory movement of an actuator with respect to a follower, with the reciprocatory movement relative to the follower following different paths in the different directions of such reciprocation, with one of such paths structured for switch actuation through such follower and for delay of release of such actuation.

As many embodiments may be made of the above invention, and as changes may be made in the embodiment set forth above without department from the scope of the invention, it is to be understood that all matter set forth hereinbefore and in the accompanying drawings is to be interpreted as illustrative only and not in a limiting sense.

I claim:

1. In a device for programming the operation of a plurality of functions, the improvement comprising:

an actuator arm;

a follower member connected to said arm; and

an actuator slide member including means for establishing a first path of movement of said follower along said slide responsive to a first relative motion being effected between said slide and said follower in a first direction, means for establishing a second path of movement of said follower along said slide responsive to subsequent relative motion being effected between said slide and said follower in a direction opposite to said first direction and a one-way gate through which said follower can only pass during said first relative motion to direct said follower onto said second path during said subsequent relative motion.

2. The improvement of claim **1** wherein said slide is adapted to be displaced relative to said follower and additionally including a first switch disposed in operable relationship to said actuator arm to be actuated by said arm when said follower is displaced from said first path along said second path and a second switch operably associated with said slide to be actuated whenever said slide reaches a predetermined position during said first relative motion.

3. A switch device according to claim **1**, additionally comprising a first electrical switch operable by said follower and a second electrical switch operable by said slide.

4. A switch device according to claim **1**, additionally comprising an electrical switch operable by each of said members and delay means for said follower, embodied in said second path.

5. A switch device according to claim **1**, additionally comprising a switch operable by one of said members, said switch being held in said operation according to a delay period, as determined by at least a part of said travel along one of said paths.

6. A switch device according to claim **1**, additionally comprising a first switch operable by one of said members, and a second switch operable by the other of said members and held in such operation according to a delay period until said first switch is operated.

7. A switch device according to claim **1**, additionally comprising a pair of electrical switches sequentially programmed in operation by said members according to a delay period.

8. A switch device according to claim **1**, additionally comprising a multiple pair of switches operable by multiple combinations of such members according to predetermined sequence combinations to provide a selection from a variety of operational programs of such switches.

9. An electrical switch sequential system comprising a movable actuator, a follower in contact with said actuator, first switch means operable responsive to displacement of said follower as said actuator is moved, second switch means thereafter operable by further movement of said actuator, and means for preventing reactuation of said first switch means until said second switch means has been so actuated, said reactuation prevention means including a one way mechanical gate carried by said actuator through which said follower can pass in only one direction.

10. A switch system according to claim **9** wherein electrical microswitches are provided as said first and second switch means.

11. A switch system according to claim **9** wherein said actuator is a member mounted for sliding movement past said first switch means to said second switch means.

12. A switch system according to claim **9** wherein a riser is provided in said actuator as means for accomplishing said operation of said first switch means, said riser being extended

along said movable actuator sufficiently to accomplish said prevention of reoperation of said first switch means.

13. An electrical, multiple switch system in which at least one switch is actuated and kept from reactuation until at least one other switch is actuated;

said system comprising first means for electrical switching, second means for electrical switching and third means for sequentially operating said first and second means;

said third means comprising a member mounted for linear reciprocal movement from a first position to a second position and then back to said first position adapted to first engage and actuate said first switch means in moving away from its said first position towards its said second position and to prevent reactuation of said first switch means and to engage and actuate said second switch means while further moving towards its said second position.

14. A mechanically operated electrical switch program system comprising:

a microswitch, an actuator arm on said microswitch, a follower finger on the free end of said actuator arm, a reciprocatory slide member mounted for movement past said microswitch and in spring pressed engagement with said follower finger;

a baffle extending toward the main body of said slide member to provide a one-way passage for said follower finger between said baffle and said main body, said baffle being in the form of a ramp on the downstream side of said one-way passage, whereby said follower finger travels up said ramp away from said main slide body when the movement of said slide is reversed, said ramp travel resulting in actuation of said microswitch by said arm, and a platform along which said follower finger is thereafter travelled as said slide reverse movement is continued, as a holding device for said microswitch.

15. A switch system according to claim 14, additionally comprising a second microswitch, operable at least indirectly by the movement of said slide member and separate from said operation of the first said microswitch, whereby said switches are operable on a sequentially programmed basis.

16. A switch system according to claim 15, wherein multiples of said switches and said actuating are provided in predetermined combination to achieve one of a variety of switch operation programs.

17. In a device for programming the operation of a plurality of functions, the improvement comprising:

an actuator arm;

a follower connected to said arm; and

an actuator slide including a first platform along which said follower is adapted to travel responsive to a first relative motion being effected between said slide and said follower in a first direction, a second platform along which said follower is adapted to travel responsive to subsequent relative motion being effected between said actuator slide and said follower in a direction opposite to said first direction, and means for displacing said follower from said first platform onto said second platform during said subsequent relative motion.

18. The improvement of claim 17 wherein said displacing means comprises a ramp connected to one end of said second platform and extending towards said first platform to define therewith a one-way gate capable of permitting said follower to pass therethrough during said second relative motion while precluding the passage of said follower therethrough during said subsequent relative motion.

19. The improvement of claim 17 wherein said slide is adapted to be displaced relative to said follower and additionally including a first switch disposed in operable relationship to said actuator arm to be actuated by said arm when said follower is displaced from said first platform onto said second platform and a second switch operably associated with said slide to be actuated whenever said slide reaches a predetermined position during said first relative motion.

20. A sequential control system comprising a movable actuator, a follower in contact with said actuator, first control means operable responsive to displacement of said follower as said actuator is moved, second control means thereafter operable by further movement of said actuator, and means for preventing reactuation of said first control means until said second control means has been so actuated, said reactuation prevention means including a one way mechanical gate carried by said actuator through which said follower can pass in only one direction.

* * * * *