June 18, 1963 R. A. HILL 3,094,591

SWITCH ACTUATING APPARATUS

Filed Oct. 30, 1961

FIG. 1

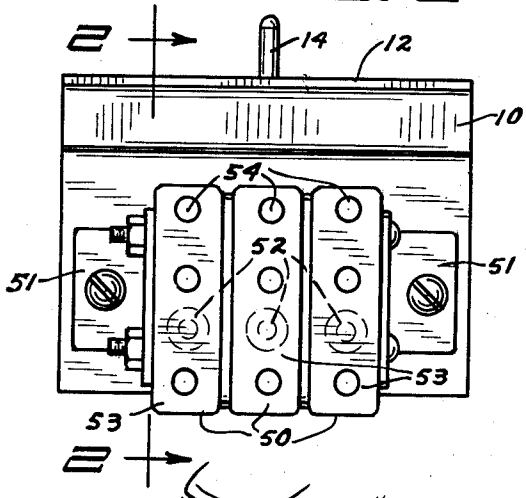

FIG. 2

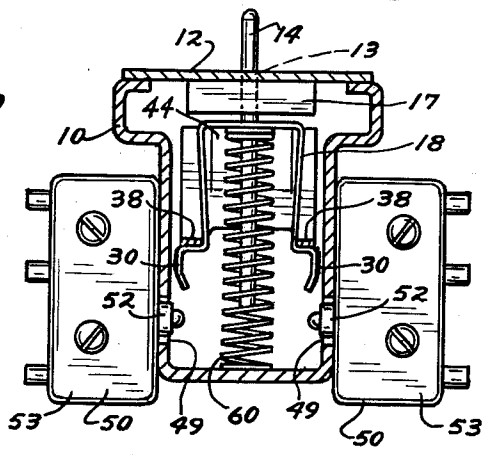

FIG. 3

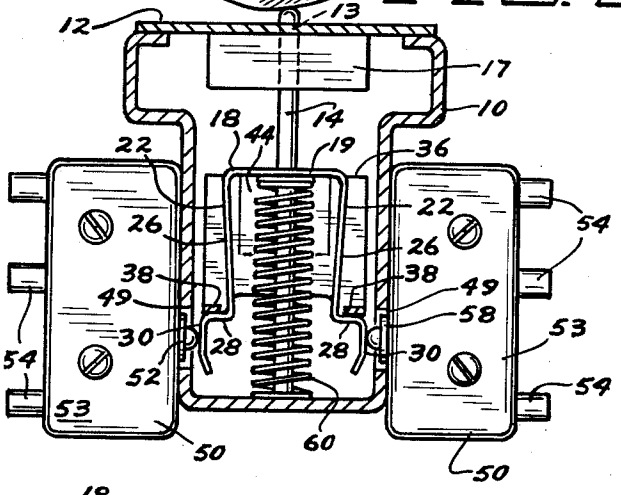

FIG. 4

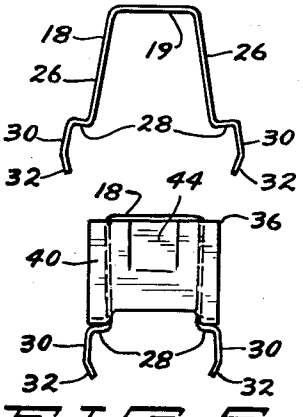

FIG. 5

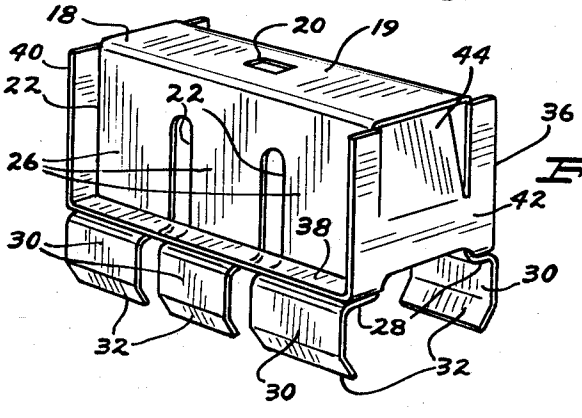

FIG. 6

INVENTOR.
ROBERT A. HILL

BY

Carlsen and Carlsen

ATTORNEYS

United States Patent Office 3,094,591 Patented June 18, 1963

3,094,591

SWITCH ACTUATING APPARATUS

Robert A. Hill, Wayzata, Minn., assignor to American Monarch Corporation, Minneapolis, Minn., a corporation of Minnesota

Filed Oct. 30, 1961, Ser. No. 148,572
10 Claims. (Cl. 200—5)

The present invention relates to electrical switches and more particularly to actuators used for operating a plurality of electrical switches.

In many electrical devices it is necessary to activate a plurality of electrical switches with a single manually or power operated actuator. It is a common occurrence for such switches to have slight differences in dimensions. Thus, to reliably actuate these switches, means must be provided to compensate for such manufacturing variations as button height, maximum travel of the switch buttons and actuating point of the switches. Moreover, as the actuator member is moved from the inoperative to the operative position adjacent the switches, excessive friction should not be encountered. For most efficient and trouble-free operation, the switches to be actuated should be protected from dust and other foreign material.

It is thus one object of the present invention to provide an improved actuator for reliably operating a plurality of electrical switches regardless of differences in button height, the length of travel of the switch button and contact members and the actuating point of the switches.

It is a further object of this invention to provide an improved switch actuator wherein a minimum amount of friction is encountered during movement of the actuator from the inoperative to the operative position.

It is a further object of this invention to provide an improved switch actuator for simultaneously actuating a plurality of totally enclosed miniature switches.

It is a still further object of this invention to provide an improved switch actuator of the type described which will operate reliably over a relatively long period of time.

It is yet a further object of this invention to provide an improved switch actuator of the type described which is simply constructed and low in cost.

These and other more detailed and specific objects will be disclosed in the course of the following specification, reference being had to the accompanying drawings, in which—

FIG. 1 is a side elevational view of one form of this invention.

FIG. 2 is shown a vertical sectional view taken on line 2—2 of FIG. 1 with the actuator element in the inactive position.

FIG. 3 is a view similar to FIG. 2 illustrating the actuator element in the operative position between the switch buttons.

FIG. 4 is an end elevation view showing the actuator element as it appears in the free or unstressed condition.

FIG. 5 is an end elevational view of the actuator element operatively connected to the keeper member.

FIG. 6 is a perspective view of the actuator member with the keeper member operatively connected to it.

Referring now to the drawings which illustrate a preferred form of my invention, there is shown a frame including a U shaped channel 10. Secured by suitable means to the upper end of channel 10 is a frame member 12 suitably bored at 13 to receive one end of an elongate movable push button member 14. Member 14 is slidably mounted in bore 13 and can be moved between an upper position and a lower position manually as by the pressure of a finger 16 or alternatively by a suitable drive mechanism (not shown). Secured to the lower side of frame member 12 and operatively associated with the member 14 is a releasable latch or lock 17 of any suitable known construction for holding the member 14 in the depressed position after the finger pressure is released.

Affixed to member 14 is a generally U shaped actuator element or member 18. Actuator member 18 includes a center piece 19 having a central opening 20 which allows the actuator to be placed in position over the member 14. The actuator is formed from resilient sheet material and includes a plurality of pairs of longitudinally spaced apart leg members 22 which extend downwardly from the center piece 19. The resiliency of the sheet material from which the actuator member is formed urges the lower ends of each of the leg members outwardly. Each pair of legs includes two segments 26 which are positioned generally parallel to each other, a pair of outwardly extending segments 28 near the free ends of segments 26, segments designated 30 which extend parallel to the segments 26 and at the free end of the segments 28 are provided terminal segments 32 which bend inwardly.

Operatively connected to the actuator member 18 is a keeper 36. Keeper 36 includes a pair of parallel spaced apart longitudinally extending spacer members 38 positioned adjacent the segments 28 of the leg members. Corresponding ends of the spacer members 38 are held together by connecting members 40 and 42 which extend upwardly parallel the end edges of the keeper member 18. Each of the connecting members 40 and 42 includes an inwardly extending tongue 44 the end of which engages the inner surface of the center piece 19 to securely retain the keeper member in position on the actuator member 18.

Secured by means of brackets 51 to the outer surface of the channel member 10 are a plurality of longitudinally spaced apart switches 50. The switches are secured in pairs to opposite sides of the frame member 10. Each pair of switches includes an inwardly facing pair of opposed switch buttons 52. The sides of the channel member 10 include appropriate openings 49 through which the switch buttons 52 project. Each of switches 50 also includes a casing 53 which protects the operating parts of the switch from the foreign material and a plurality of electrical terminals 54. When the switch button 52 is elevated from the surface of the switch, the circuit between terminals 54 can be either completed or interrupted. If the circuit is interrupted under these conditions, depression of the switch button into the casing 53 will cause the circuit to be completed between terminals 54.

As best shown in FIG. 2, when the movable member 14 and the actuator member 18 are in a first or elevated position, the end portions 30 of actuator member will not engage the switch buttons 52. The resilient material from which the actuator members are formed will urge leg members 22 outwardly into contact with the keeper which limits the outward movement thereof. When the member 14 and the actuator 18 are moved downwardly to the position of FIG. 3, the end portions 30 will contact the switch buttons 52 causing them to move in opposite directions thereby depressing each of the switch buttons 52 into its casing and either making or breaking an electrical circuit through the switch.

Operatively connected between the movable member 14 and the switch actuator 18 is a return spring 60. The return spring 60 yieldably biases the actuator 18 and member 14 to the upper position of FIG. 2.

During operation, when member 14 is pushed downwardly, the actuator member 18 moves downwardly from the position of FIG. 2 to the position of FIG. 3 with the end segments 30 of the actuator in contact with the switch buttons 52. As the actuator moves downwardly, the segments 30 slide over the switch buttons 52 forcing each button into the body of its associated switch and thereby

actuating all of the switches simultaneously. By sliding the actuator upwardly, the switch buttons **52** are released. It should be noted that the keeper member retains the legs of the actuator member inwardly so that the segments **30** thereof cannot rub against the switch frame **10** as the actuator moves either upwardly or downwardly thereby eliminating any retarded force due to friction between the switch frame **10** and the segments **30**.

As with all mass produced items, the length of the switch buttons, the amount of travel of the button and the physical size of the case of each of the switches **50** will vary somewhat from one unit to another. The above described apparatus will very ably compensate for these variations in dimensions since each of the leg members can move independently. Thus, when the end segments **30** move between the switch button **52**, the buttons will move outwardly until they strike a stop inside the switch. Continued downward movement of the actuator **18** will cause the leg members to bend inwardly against the spring force of the material from which the actuator is formed. It can thus be seen that as the actuator is pressed downwardly, the force required to compress the legs of the actuator inwardly acts against the force sliding the actuator downwardly. This retarding force is proportional to the spring constant of the actuator. By using the keeper as disclosed above, the actuator can have a relatively low spring constant and as a result, the retarding force encountered when the actuator is depressed can be kept to a minimum.

It should also be noted that the moving parts of the switches **50**, except for the switch buttons **52**, can be totally enclosed and thus protected from dust and other foreign material.

It is understood that suitable modifications may be made in the structure as disclosed, provided such modifications come within the spirit and scope of the appended claims. Having now therefore fully illustrated and described my invention, what I claim to be new and desire to protect by Letters Patent is:

1. Apparatus for actuating a plurality of electrical switches, each of said switches including a switch button, said apparatus comprising in combination means to support said switches in longitudinally spaced apart pairs, the switches of each such pair being positioned in opposed relationship and the switch buttons of each pair being positioned in opposed face to face relationship, movable means slidably mounted between said switches for movement on an axis perpendicular to the plane of said switch buttons, resilient actuator means mounted on said movable means, the resiliency of said actuator means yieldably biasing portions of said actuator means toward said switches and means for limiting the movement of said portions toward said switches, said movable means and actuator means being on said axis movable between a first position wherein the actuator means is out of contact with said switch buttons to a second position wherein the actuator means contacts the switch buttons and the resiliency of said actuator means forces said switch buttons to a depressed position.

2. A switch actuator for operating a plurality of electrical switches each including a movable switch button, said apparatus comprising in combination a frame, at least a pair of switches mounted on said frame in opposed face to face relationship, said switch buttons facing inwardly toward each other, a generally U-shaped actuator member slidably mounted between said switches, said switch actuator including a pair of generally parallel leg members and a base member between adjacent ends of said leg members, the free end portion of said leg members being positioned to engage said switch buttons when said actuator member is moved on said axis to a position with the ends of said leg members between said switch buttons, the resiliency of said actuator member biasing the free end portions of the leg members outwardly, thereby causing said buttons to be depressed when said end portions move between said buttons and means operatively associated with said actuator member to limit the outward movement of said end portions.

3. The apparatus of claim 2 including a plurality of longitudinally spaced pairs of switches, the switches of each pair being positioned opposed face to face relationship with the switch buttons of each pair facing inwardly and said actuator member including a plurality of longitudinally spaced apart pairs of leg members and each pair of said leg members being positioned between one of said pairs of switches whereby movement of said actuator member to a position with the ends of said pairs of leg members between said switch buttons and which will actuate all said switches.

4. Apparatus according to claim 2 wherein said means to limit the outward movement of said leg members comprises a keeper including a pair of longitudinally extending laterally spaced apart members positioned to engage the outside edges of said leg members and a connecting member extending between adjacent ends of said laterally spaced apart members to maintain the spacing therebetween.

5. Apparatus according to claim 4 wherein said connecting members extend upwardly to the connected ends of said leg members and operatively engage said actuator thereby securing said member in position on said actuator member.

6. An actuator for operating a plurality of switches, each of said switches including a movable switch button, said apparatus comprising in combination a frame, said switches being mounted upon said frame with the switch buttons positioned in the same plane, a movable member also mounted on said frame for sliding movement along an axis perpendicular to the plane of said switch buttons, an actuator member secured to said movable member, said actuator member being formed from resilient sheet material and including a plurality of longitudinally spaced apart leg members positioned in a plane substantially parallel to the path of movement of said movable member, said leg members having the same relative spacing as the spacing between said switch buttons and the resiliency of said actuator member urging the free ends of said leg members toward said switch buttons, a keeper member operatively associated with said leg members to limit the movement of said leg members toward said switch buttons, said movable member and actuator member being movable from a first position with the ends of said leg members out of contact with said switch buttons to a second position with the ends of said leg members in contact with the switch buttons and said leg members urging each of said switch buttons to a depressed position thereby operating each of said switches.

7. Apparatus according to claim 6 wherein resilient means is operatively connected between said actuator and movable member and said frame member to yieldably bias said movable member and actuator member toward said first position.

8. Apparatus according to claim 6 wherein latch means is operatively connected between said frame and said movable member to retain said movable member and actuator member in said second position.

9. The apparatus according to claim 8 wherein the leg members of each such pair include mutually parallel segments, outwardly extending segments at the free ends of said parallel segments, end segments extending parallel to said mutually parallel segments and terminal portions bent inwardly from the end segments, said spacer members being positioned adjacent said outwardly extending portions and outwardly of said mutually parallel segments.

10. In a switch mechanism comprising a plurality of longitudinally spaced pairs of switches, each of the switches including a switch button, the switch buttons of each pair of switches being positioned in face to face opposed relationship, a switch actuator mechanism comprising a movable member, a generally U shaped actuator

member formed from resilient sheet material and including a plurality of longitudinally spaced apart pairs of leg members, the leg members of each pair being adapted to engage one of said switch buttons, and said actuator members being movable with said movable member between a first position wherein the ends of said leg members are out of contact with said switch buttons to a second position wherein the ends of said leg members are positioned between said switch buttons, the resiliency of sheet material urging said leg members outwardly to depress said switch buttons simultaneously when the member and actuator are moved from said first position to said second position, a keeper member operatively associated with said actuator member, said keeper member including a pair

of parallel spaced apart spacer members positioned outwardly of said leg members to restrict the outward movement of said leg members and a pair of connecting members secured between adjacent ends of said spacer members.

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