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F. J. TRAINOR

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ELECTRIC SNAP SWITCH

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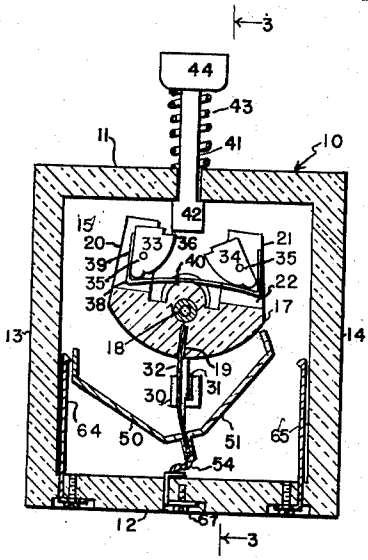


Figure 1

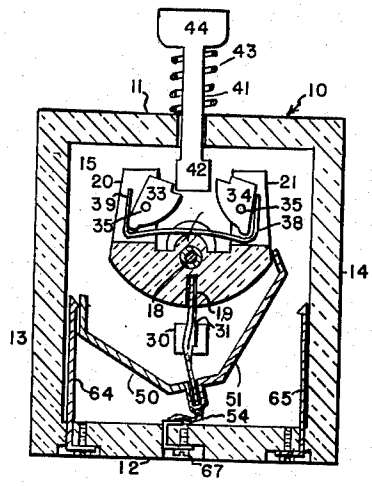


Figure 2

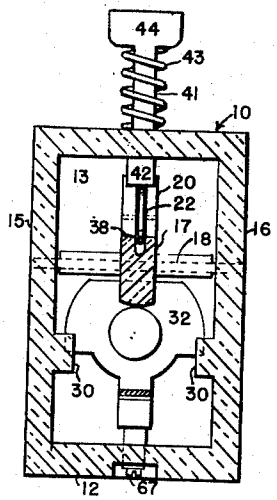


Figure 3



Figure 4

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ELECTRIC SNAP SWITCH

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2 Claims. (Cl. 200—153)

1

This invention relates to electric switches, and more particularly, to an electric switch having a single push-button, the successive operation of which alternately closes and opens the switch contacts.

A principal object of this invention is the provision of a simple and compact switch mechanism.

Another object is the provision of a mechanism for translating successive reciprocal movements of a push-button into oppositely directed rocking motion of a rocking beam.

Another object is the combination of a resilient dished open center snap element with the rocking beam of the previous paragraph whereby successive actuations of the push-button reverse the direction of convexity of the snap element.

Still another and important object is the provision of switch contacts combined with the snap element of the preceding paragraph whereby successive actuations of the push-button alternately close and open the switch contacts with an abrupt motion.

Still another object is the provision of a switch actuating mechanism which provides for a delay in action of the switch contacts after movement of the actuating mechanism has been initiated.

Still another object is the provision of a snap action element which reverses its condition of convexity with a wave motion thereby resulting in easy, quiet and delayed action.

Further objects of the invention will become apparent as the description proceeds with reference to the figures of the drawing in which:

Figure 1 is a cross-sectional side view showing the switch at rest.

Figure 2 is a view similar to Figure 1 with the push-button actuated about two-thirds of its travel.

Figure 3 is a cross-sectional end view on the plane 3—3 of Figure 1.

Figure 4 is a side view of the snap element provided to impart snap action to the switch.

In practicing the invention, I provide an insulated switch housing having a switch chamber therein with one or more fixed contacts supported in the wall of the housing. A movable contact or contacts is secured to a snap action element, the configuration of which is reversed by a rocking beam pivoted from the side walls of the chamber. In the top wall of the housing, an actuating shaft is slidably supported and is provided with an enlarged portion at the end within the switch chamber and a knob on the outside end. The enlarged end of the actuating shaft engages one or the other of cam members pivotally supported at opposite ends of the rocking beam. The cams are linked in such manner that only that cam on the end of the rocking beam which is ready for actuation engages the actuating rod. The movement of the rocking beam flexes the snap element and after appreciable movement has taken place, the flexure in the snap elements moves with a wave motion through the snap element completing its reversal and reversing the position of the moving contact.

2

Referring now to Figures 1, 2 and 3, the switch includes a housing 10 which is preferably fabricated of insulating material, such as, Bakelite or plastic. The housing includes top and bottom walls 11 and 12 respectively, end walls 13 and 14, and lateral walls 15 and 16.

A rocking beam 17 of insulating material is supported on an axle shaft 18 which in turn is anchored in the lateral side walls of the housing. The rocking beam is provided with an extending portion below the axle and contains a slot or bifurcation 19 positioned radially to the axle and symmetrical with respect to the rocking beam. At the ends of the rocking beam are provided a pair of upstanding arms 20 and 21 approximately normal to the length of the rocking beam.

Supported on opposed positions on the inside surface of the lateral housing walls are provided a pair of snap action supporting projections 30. A pair of opposed, upperly open slots 31 cooperate with the snap element in a manner presently to become apparent.

The snap action element, best shown in Figures 3 and 4, is an open center dished resilient member 32. The lower portion is bounded by a pair of curved edges separated by a radially, downwardly depending tongue. Starting at the upper terminations of the first curved edges, the width of the snap action element is increased, thereby providing a pair of horizontal, supporting straight edges approximately tangent to the lower portion of the snap action element open center. The enlarged width is bounded by opposed circumferential curves to a distance above the open center. The upper ends of the circumferential edges terminate in a straight edge parallel to the supporting edges.

The supporting edges of the snap action element are supported in the lateral side wall open slots 31.

The upper straight edge portion of the snap action element is engaged with the rocking beam bifurcation 19.

From the foregoing, it is seen that the snap action element tends to urge the rocking beam

in one direction or the other from a middle condition. That is to say, the combination of rocking beam and snap action element has two stable positions with an intervening unstable position. Transition from one stable position to the other is obtained by an outward movement of the appropriate rocking beam upstanding arms causing, first, a flexure of the upper portion of the snap element, and with increased movement of the rocking beam, increased flexure, until, by a wave motion, the snap action element reverses its direction of convexity.

Each of the upstanding arms is bifurcated at 22 along the median lines thereof and in a plane axial to the axle.

A pair of cam members 33 and 34 are pivotally supported in the bifurcated portions 22 by pivots 35 in the rocking beam upstanding arms 20 and 21 respectively.

The cam members are roughly isosceles triangles in shape, having an approximately convexly involute curved boundary along the hypotenuse side. A step 36 is provided in each cam at one junction of the curved boundary and the short straight side, and a cusp is provided at the other junction of the curved boundary and the longer, straight side. The cams are pivotally supported with the curved boundaries opposed by traverse axles positioned about one-third the distance from the lower or cusped end and about one-third the cross-wise distance normal to the long, straight edge.

The two cams are linked by a spring member 38 having upstanding arms 39. The connecting arm of the spring rests on a convex portion 40 of the rocking beam, passes under the cam cusps and presses upwardly against them. The upstanding arms of the spring engage at least a portion of the opposed straight edges or backs of the cams.

Operation of the switch by pressing inward an actuating shaft 41 is explained with reference to Figures 1 and 2. The snap action element is convex to the left. Therefore, the rocking beam is in its extreme clockwise position. The step in left-hand cam 33 is in the path of the actuating shaft enlarged end 42.

As the actuating shaft 41 is pushed inwardly against the restoring force of spring 43, the cam 33 rotates, thereby increasing the horizontal distance between the cam step and its pivot. This action forces the rocking beam left-hand upstanding arm 20 to the left, thereby rotating the rocking beam counter-clockwise.

Referring to Figure 2, the actuating shaft is shown approximately two-thirds depressed. The clockwise rotation of left cam 33 results in shifting spring 38 to the left, thereby rotating right-hand cam 34 clockwise to clear it from the path of the actuating shaft and readying it for action for the next succeeding push-button actuation.

Flexure of the snap action element has taken place in the upper portion only. Further inward motion of the actuating shaft causes further counter-clockwise rotation of the rocking beam and a condition of flexure of the snap element whereby the forces present therein reverse from a restoring force to a propelling force. The snap element, therefore, completes the operation and rotates the rocking beam to its ultimate counter-clockwise condition.

The right-hand cam 34 now rests with some force against the actuating arm enlarged portion due to pressure of spring arm 39. Upon release of the push-button 44, the actuating shaft is withdrawn to the ready position and upon the enlarged portion receding from the curved boundary of cam 34, the cam rotates counter-clockwise under the action of spring cam 39 a small amount. This action positions the step in the right-hand cam under the actuating shaft enlarged portion so that the mechanism is now readied for the next actuation.

Secured to the depending snap action element tongue are outwardly extending movable electrical contacting arms 50 and 51.

It follows that reversing the condition of convexity of the snap action element causes one or the other of the movable contact arms 50 or 51 to press against one or the other of the laterally positioned fixed contacts 64 or 65.

The movable contacts are connected by pigtail 54 to terminal 67. It is understood that, although the form of switch shown is of the single pole double-throw variety, any desired number of poles and throws may be used. For instance, if a single pole single-throw switch is desired, only one moving contact arm need be supplied.

Therefore, what has been described is a novel mechanism for translating successive reciprocating motions into alternately directed rocking motion and, in addition, a novel combination of such mechanism with a snap element of the dished type having an open center whereby operation is easy, relatively quiet and reliable.

What is claimed is:

1. In a device of the class described, a dished open center resilient snap element, means for supporting the lateral edges thereof, a rocking beam having a bifurcation depending normally to the arms thereof, means for pivotally supporting said rocking beam for rocking motion in a plane normal to the line of separation between the snap action element supporting means, said snap action element upper portion being nested within the rocking beam bifurcation, an arm integral with each end of the rocking beam and extending generally normal thereto and in a direction opposed to that of the bifurcation, each of said rocking beam arms being bifurcated and pivotally supporting therewithin a cam member, a reciprocal actuating member and spring means for orientating said cam members so that only the cam member corresponding to the convex side of the snap element engages the actuating member.

2. In a snap action switch, a housing comprising lateral side walls, end walls and top and bottom walls, a snap action element having a dished configuration and an open center, opposed supporting members affixed in opposed relation on the lateral side walls along the vertical median lines thereof and having slots lying in the plane defined by said vertical median lines, said snap action element having a pair of lateral edgewise extending projections nested in said opposed supporting member slots, an elongated rocking beam having journals in the lateral side walls vertically aligned above the snap action supports, said rocking beam having a bifurcation normal to the elongation thereof and straddling the upper portion of the snap action element, a pair of arms substantially normal to the elongation of the rocking beam and affixed to the ends thereof, a cam element pivotally supported on each of the rocking beam arms and having inwardly opposed arcu-

ate edges terminated at the top in a notched portion, a U shaped spring element engaging the outer edges of the cam elements and having a length such that one cam is erected when the other cam is inclined, an actuating rod slidably supported in the housing top wall in said median plane, and having an enlarged bottom end for engaging the erect cam notched portion, a spring engaging the actuating rod to urge the same into outward ready position, and a tongue-like portion extending from the lower edge of the snap action element, a movable electrical contact affixed to the tongue-like portion, at least one fixed contact supported on a housing end wall, and positioned to engage the movable contact when said switch is in on-position, whereby successive actuations

of said actuating rod alternate the opened and closed condition of said switch contacts.

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