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E. R. CARLSON

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LEAF TYPE SNAP ACTION SWITCH

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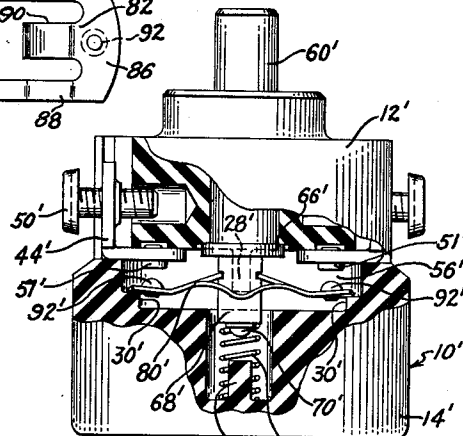
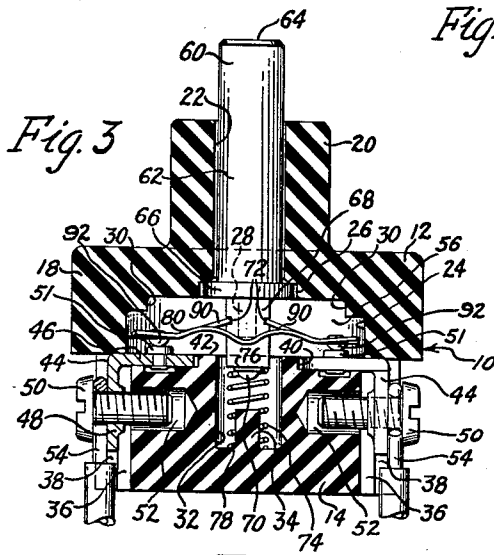
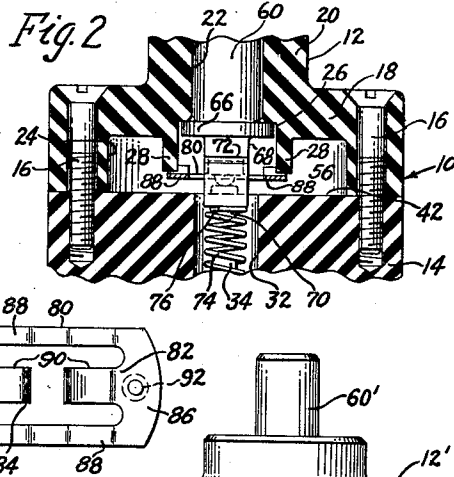
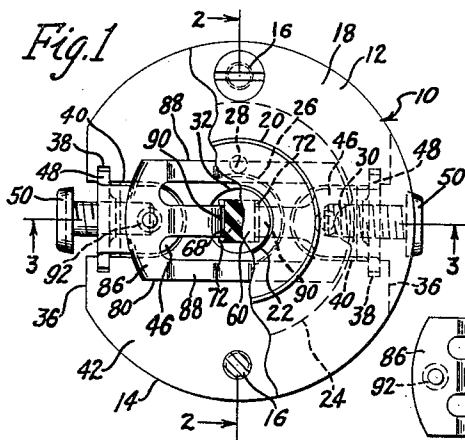


Fig. 6

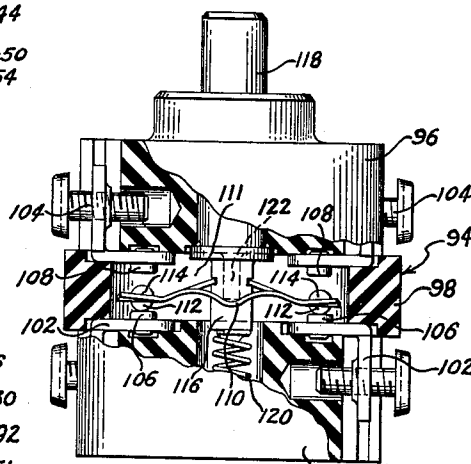
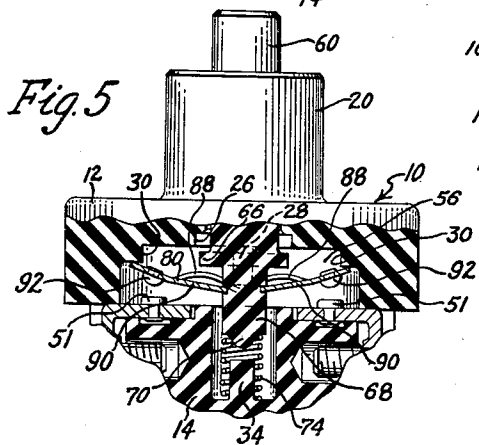


Fig. 7

INVENTOR  
Ernest R. Carlson  
BY  
Worster, Davis & Cifelli  
ATTORNEYS

1

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## LEAF TYPE SNAP ACTION SWITCH

Ernest R. Carlson, Fairfield, Conn., assignor to Harvey Hubbell, Incorporated, Bridgeport, Conn., a corporation of Connecticut

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1 Claim. (Cl. 200-67)

This invention relates to electrical switches, and particularly to electrical switches which are of the snap-acting type.

The electrical switch art is highly developed, and therefore, improvements therein normally reside in providing improved electrical switches which operate effectively for their intended purposes, which have simplified constructions, and which are low in cost of production.

It is an object of this invention to provide an improved electrical switch which operates effectively, which is simple in construction, and which is inexpensive to produce.

It is another object of this invention to provide an improved switch of the type set forth in the preceding paragraph, which operates with snap action and, more particularly, which is push rod operated.

It is still another object of this invention to provide an improved electrical switch that is of the push rod operated, snap-acting type, and which readily lends itself to a variety of different practical applications by being susceptible of modification to operate in different manners.

It is a further object of this invention to provide an improved toggling contact bridging member, principally for use in electrical snap-acting switches.

The above and other objects of my invention and further details of that which I believe to be novel and my invention will be clear from the following description and claim taken with the accompanying drawings, wherein:

FIG. 1 is a top plan view, with portions cut away and shown in section for the sake of clarity, of a preferred form of electrical switch which incorporates the instant invention, showing the switch contacts in their normal engaged condition;

FIG. 2 is a sectional view taken substantially on line 2-2 of FIG. 1;

FIG. 3 is a sectional view taken substantially on line 3-3 of FIG. 1;

FIG. 4 is a top plan view of the toggling contact bridging member which constitutes an important element of the switch;

FIG. 5 is a view somewhat similar to FIG. 3, but showing the switch contacts in their disengaged condition;

FIG. 6 is a side elevational view, with portions cut away and shown in section for the sake of clarity, of a modification of the preferred (FIGS. 1-5) form of the invention; and

FIG. 7 is a side elevational view, with portions cut away and shown in section for the sake of clarity, of another modification of the preferred (FIGS. 1-5) form of the invention.

FIGS. 1-5 of the drawings illustrate the preferred form of the invention, wherein the electrical switch 10 is constructed so as to operate to normally maintain a closed electrical circuit by having its electrical contacts engaged normally, and wherein depression of a push rod results in disengagement of the electrical contacts in a snap-acting manner, and maintains the electrical contacts disengaged as long as the push rod is depressed. One practical application of the FIGS. 1-5 form of the invention, for example, is to control a closet illuminating lamp automatically in response to the opening and closing of the closet door in such a manner that it is energized when the closet door is open and de-energized when it is closed. It will be readily understood by those skilled in the art that in such a

2

practical application, the push rod is depressed when the closet door is closed, and therefore, the electrical circuit controlling the closet illuminating lamp is open, because the electrical contacts of the switch are disengaged, and therefore, the illuminating lamp is de-energized. Opening of the closet door results in release of the push rod, because of the improved switch construction, and its being moved to its normal position wherein it causes the electrical contacts to be snapped to their engaged condition wherein the circuit controlling the closet illuminating lamp is closed, and therefore, the illuminating lamp is energized. It should be understood that there are other practical applications of the FIGS. 1-5 form of the invention, and that the closet illumination controlling application is merely exemplary. It will also be understood by those skilled in the art that snap-acting switches have many advantages, among which is the minimization of arcing on engagement and disengagement of the contacts and the consequential increase in contact life.

Switch 10 comprises essentially a two-part body which is made of electrical insulating material, such as any of the suitable available known plastics, and principally comprises cover 12 and base 14 which are secured to each other by screws 16 that may be received in appropriate openings in the base and cover. When assembled, the cover and base cooperate to form a self-contained body which supports the remaining elements of the switch and may be bodily mounted at any convenient location.

The cover 12 comprises a main cylindrical portion 18 and a reduced cylindrical portion 20. The cover 12 has a number of coaxial counterbores 22, 24 and 26 formed therein. Centrally of and within the cover 12 in the area where the counterbores 24 and 26 intersect, there is formed a pair of spaced stop lugs 28. On the interior of the cover 12 near the periphery of the counterbore 24, there is formed a pair of spaced stop projections 30. The purpose of the stop lugs and stop projections will become apparent subsequently.

The base 14 is somewhat cylindrical and includes a central well 32 having a positioning lug 34 formed centrally at its base, and a pair of spaced parallel flat walls 36 which are formed by cutting away portions of the base 14. Spaced inwardly of and parallel to walls 36 are a pair of spaced slots 38 and a pair of associated spaced recessed portions 40 which are formed in the flat top wall 42 of the base. Mounted on the base 14 is a pair of angle-shaped, electrical terminal and contact units 44. Each unit 44 comprises an electrical contact supporting wall 46 which is disposed in a recessed portion 40, and a binding plate wall 48 which is disposed in a slot 38 and frictionally held therein to mount the units 44. Each of the walls 46 rigidly supports a stationary electrical contact 51, and each of the walls 48 supports an adjustable binding screw 50. This construction can most clearly be seen in FIGS. 1 and 3, wherein it also can be seen that the base 12 has a pair of spaced cavities 52 into which the binding screws 50 may project, and that each of the units 44 may have an electrical lead 54 connected to its terminal portion by the binding plate walls 48 and binding screws 50 to wire the switch in a circuit.

When the cover and base are assembled, the cover counterbore 24 and the base top wall 42 cooperate to define a switch chamber 56 which communicates with the cover counterbores 22 and 26 and the base well 32, and which houses many of the switch elements. The cover 12 supports means for operating the switch in the form of a push rod 60 which is made of an electrical insulating material. By reference to FIG. 3, it can clearly be seen that push rod 60 comprises main cylindrical portion 62 which is mounted for reciprocation in the counterbore 22, flat end 64 which is adapted to have a pushing force

applied thereto, enlarged cylindrical stop flange 66 which is normally disposed in the counterbore 26 and makes interference contact with a shoulder thereof to define one limit of axial movement of the push rod, and switch actuating end 68 which is disposed in the switch chamber 56 and base well 32.

The push rod actuating end 68 is generally square in cross section and includes a bead 70 which is formed at its free end and faces the positioning lug 34 in the base well 32 when the parts are fully assembled, and a pair of spaced, parallel, straight grooves 72 which are formed on opposite sides thereof. A coiled compression spring 74 is disposed in the base well 32 and has its end 76 in contact with the free end of the push rod actuating end 68 and located thereon by the bead 70, and its other end 78 in contact with the base of the well 32 and positioned by the lug 34 formed therein. The spring 74 is axially compressible when stressed, and normally biases the push rod 60 to its normal position wherein its stop flange 66 is disposed within the counterbore 26, as shown in FIG. 3. This normal position of the push rod 60 constitutes one axial limit of movement of the push rod wherein the electrical contacts of the switch are in engaged condition. The bias of spring 74 may be overcome and the spring compressed by an axially directed force applied to the push rod flat end 64. This force may be applied manually or by an operating part, such as a closet door in the closet illumination application of the invention referred to. Such a force causes the push rod 60 to be moved to its other axial limit and to snap the electrical contacts to their disengaged condition, as shown in FIG. 5. On release of such a force, the spring 74, which has been stressed by the force, unstresses itself and automatically returns the push rod 60 to its normal (FIG. 3) position, thereby causing the electrical contacts to snap to their engaged condition. It will, therefore, be observed that in the FIGS. 1 to 5 modification, the normal positions of the push rod 60 and the spring 74 (and the electrical contacts) are shown in FIG. 3, and the positions of these elements when the push rod is depressed to cause disengagement of the contacts are shown in FIG. 5.

Although the push rod 60 operates to disengage the electrical contacts, and the spring 74 automatically returns the push rod to its normal position to re-engage the electrical contacts, the actual snap action to cause engagement and disengagement of the electrical contacts is effected by a unique toggling contact bridging member 80. Toggling bridging member 80 preferably comprises a formed slotted plate 82 made of a thin, flexible, deformable material, such as those materials that metallic leaf springs are made of. As can best be seen in FIG. 4, the plate 82 is slightly elongated, having parallel, spaced, straight, long side edges and curved spaced end edges, and has an H-shaped slot 84 formed therein, with the parallel legs of the H disposed parallel to the long side edges of the plate. The H-slot forms in the plate 82 a pair of spaced end legs 86, a pair of spaced parallel side legs 88 that connect the end legs, and a pair of opposed central legs 90 which extend toward each other from central portions of the end legs 86 and which are spaced between the side legs 88. Each of the end legs 86 rigidly supports an electrical contact 92. The side legs 88 when viewed from the side are bent in a sinuous manner (see FIG. 3) and are springy. The central legs 90 mount the entire toggling bridging member 80 within the switch chamber 56 on the push rod actuating end 68 by having their opposed adjacent ends received in the grooves 72 formed in the push rod actuating end. When fully mounted, the toggling bridging member 80 is disposed so as to have the electrical contacts 92 which it supports oriented to engage and disengage the stationary electrical contacts 51. The normal contacts-engaged condition of the toggling bridging member and its associated switch elements is shown in FIG. 3. The toggling bridging member 80 is constructed and dimensioned so as normally to exert a

slight contact-closing force between the electrical contacts when they are in their engaged condition. This force is principally caused by the extensible and contractible property of the springy sinuous side legs 88. The sinuous side legs may be stressed by force to elongate, and after the force abates, they will be biased to contract by their inherent tendency to unstress. In the FIG. 3 condition, which is the normal, undeformed, substantially unstressed condition of the toggling bridging member 80, the side legs 88 of the member 80 are slightly stressed as a result of said member's mounting, and therefore, tend to exert a contact-closing force on the electrical contacts with a slight wiping action.

The toggling bridging member 80 when in its normal FIG. 3 condition has its central legs 90 bowed in one direction (upwardly in this figure). The legs 90 may be moved by the push rod actuating end 68 (downwardly in FIG. 3) to cause the toggling bridging member 80 to deform and pass through an "over-center" position and snap to the condition shown in FIG. 5, which is the deformed substantially stressed condition of the member 80. During this operation, the stop lugs 28 formed on the cover 12 contact central portions of the side legs 88 of the toggling bridging member 80, and thereby prevent movement of the side legs in one direction (upwardly in FIG. 3). Such restraint at the side legs 88 contributes to crisp snapping of the toggling bridging member. After the toggling bridging member 80 has snapped to its FIG. 5 condition, the electrical contacts 92 have been moved out of engagement with the stationary electrical contacts 51, the central legs 90 are bowed in the opposite direction (downwardly in FIG. 5) and the end legs 86 contact the stop projections 30 and are slightly biased against them because the side legs 88 are still slightly stressed and tend to contract.

In view of the foregoing, the construction and operation of the FIGS. 1-5 modification should be apparent. Functionally the operation is such that an electrical circuit controlled by the electrical contacts of the switch is closed when the electrical contacts are engaged in the normal condition illustrated in FIG. 3, and wherein the electrical contacts are disengaged with snap action by depressing the push rod 60 and the electrical contacts are maintained in disengaged condition as long as the push rod is depressed. The snap action is caused by the unique toggling bridging member 80 which is mounted to assume two general positions, and to be crisply "toggled over center" from one position to the other in response to movement of its central legs 90, which is principally caused by movement of the actuating end of the push rod 60. Such movement is caused in one direction by depressing the push rod 60. Release of the push rod 60 results in such movement in the other direction, for it allows both the stressed spring 74 and the substantially stressed, distorted, toggling bridging member 80 to unstress and return the push rod 60 to its normal condition. During such return, the toggling bridging member 80 snaps back, both in response to having its central legs 90 moved by the push rod and by its bias toward its normal, undistorted, substantially unstressed condition, and causes its contacts 92 to re-engage the contacts 51. It should be noted that snap-acting engagement and disengagement is effected with a desirable wiping action, and that in both conditions the side legs 88 are slightly stressed and firmly position the toggling bridging member in such conditions. It will be understood by the skilled in the art that "toggling" of the member 80 principally results from the cooperating action of the side legs 88, the central legs 90 and the associated mounting parts in providing two extreme static positions for the member 80, and a dynamic critical central position, whereby the member 80 inherently snaps over the central position to one of the static positions when the central legs 90 are moved by an external force.

It will be understood that the switch 10 may be asso-

5

ciated with cooperating structure, such as a closet door and associated parts, so as to assume the FIG. 3 condition whenever the closet door is open and thereby automatically illuminate the closet at such times, and to assume its FIG. 5 condition whenever the closet door is closed to thereby extinguish the closet lamp. It will be understood by those skilled in the art that the FIGS. 1-5 modification may be utilized in many other and different applications; for example, as by being manually held by a user to permit the selective temporary disengagement of the electrical contacts by the manual depression of the push rod, and to maintain the electrical contacts disengaged as long as manual depression is maintained.

It will also be understood by those skilled in the art that the electrical switch elements may be reversed to effect the reverse operation to that of the FIGS. 1-5 modification. Such an arrangement is illustrated in FIG. 6, which basically constitutes the same structure as that of the FIGS. 1-5 modification, and wherein corresponding structural elements are identified by the same reference numerals as are employed in FIGS. 1 to 5 with a prime (') added. It will be observed in FIG. 6 that the following elements have their positions reversed: the electrical terminal and contact units 44', which are mounted on the cover 12', the stop projections 30', which are formed on the base 14', the stationary electrical contacts 51' which face downwardly, and the movable electrical contacts 92', which are supported by the toggling bridging member 80' and face upwardly. The general operation of the FIG. 6 modification is similar to that of the FIGS. 1-5 modification, except that in the normal condition of the former illustrated in FIG. 6, the electrical contacts are disengaged, and temporary engagement of the electrical contacts may be caused by depressing the push rod 60'. It will, therefore, be understood that the FIG. 6 modification may be utilized in practical applications wherein it is desired to normally have an open electrical circuit and to temporarily close the circuit selectively, either by manual operation or by the operation of an associated part.

Another modification of the invention is illustrated in FIG. 7, and this modification may be employed to control two separate electrical circuits in a manner so as to have one opened and the other closed at all times, and wherein the circuit conditions may be reversed by depressing a controlling switch element. In FIG. 7, the switch body is indicated generally by 94 and comprises three parts, upper section 96, central section 98, and lower section 100. A pair of electrical terminal and contact units 102 is mounted on the lower section 100 in a manner generally similar to that of the units 44 in the FIGS. 1-5 modification. A pair of electrical terminal and contact units 104 is mounted on the upper section 96 in a manner generally similar to that of the mounting of the units 44' in the FIG. 6 modification. The units 102 rigidly support spaced stationary contacts 106, and the units 104 rigidly support spaced stationary contacts 108. Toggling bridging member 110 is disposed in the switch chamber 111 formed within the switch body 94 by the body sections 96, 98 and 100. The toggling bridging member 110 is generally similar to the toggling bridging members employed in the other modifications, except that it supports both a pair of downwardly facing contacts 112 and a pair of upwardly facing contacts 114. The toggling bridging member 110 is supported by the actuating end 116 of the push rod 118, which is normally biased to the FIG. 7 condition by the coiled compression return spring 120, which normally biases the push rod 118 to its FIG. 7 position. In the FIG. 7 modification, the stop lugs 122, which function in the same general manner as the stop lugs 28 of the FIGS. 1-5 modification, are employed, but stop projections corresponding to the stop projections 30 of the FIGS. 1-5 modification are omitted.

The operation of the FIG. 7 modification is generally

6

the same as that of the other modifications, in that the toggling bridging member 110 is normally biased to one position (that illustrated in FIG. 7) and wherein it may be snapped to and temporarily held in a second position by depression of a push rod. With the FIG. 7 construction, one pair of contacts supported by the toggling bridging member 110 engages one pair of stationary contacts in one position of the member 110 to close one electrical circuit and open the other electrical circuit, and the other pair of electrical contacts supported by the toggling bridging member 110 engages the other pair of stationary contacts when the member 110 is snapped to its other position to reverse the conditions of the electrical circuits. In FIG. 7, the toggling bridging member supported electrical contacts 112 are shown engaging the stationary electrical contacts 106 while the electrical contacts 114 and 108 are disengaged; this is the normal condition of the FIG. 7 modification switch. Depression of the push rod 118 causes the toggling bridging member 110 to snap over center to a condition wherein its electrical contacts 114 engage the stationary electrical contacts 108, and this results in disengagement of the electrical contacts 112 and the electrical contacts 106. Release of the push rod 118 results in the toggling bridging member 110 and electrical contacts being returned to the FIG. 7 condition as a result of the return spring 120 moving the push rod 118 to its normal FIG. 7 position, and the consequential snapping of the toggling bridging member 110 back to its FIG. 7 condition.

It will, therefore, be apparent in view of the foregoing, that I have provided a push rod operated, snap-acting, electrical switch which satisfies the objects of this invention. Whereas I have disclosed a preferred form and two additional modifications of the invention to adapt it for different practical applications, it should be realized that other adaptations can be readily made for other practical applications. It should be observed that every disclosed form of the invention employs a similar, unique, toggling bridging member and associated push rod operated mechanism for actuating said member. It will be apparent that the unique toggling bridging member is of maximum utility when combined with associated electrical switch structure in the manner of the disclosed forms of the invention; however, it should be realized that said member will be of general utility in other environments where a snap-acting, toggling bridging member is needed.

As will be evident from the foregoing description, certain aspects of my invention are not limited to the particular details of construction of the examples illustrated, and I contemplate that various and other modifications and applications will occur to those skilled in the art. It is, therefore, my intention that the appended claims shall cover such modifications and applications as do not depart from the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

A snap-acting electrical switch comprising: a body made of an electrical insulating material; a chamber in said body; a pair of stationary electrical current-carrying contacts in said chamber and adapted to be wired into an electrical circuit; a toggling bridging member comprising a flexible plate having an H-shaped slot formed therein which thereby forms a pair of spaced end legs, a pair of spaced longitudinally extensible and contractable springy side legs which connect said end legs, and a pair of aligned central mounting legs which are spaced between said side legs, extend from central portions of said end legs toward each other and are spaced at their adjacent ends; a second pair of electrical current-carrying contacts, one carried by each end leg of said bridging member; said bridging member being mounted in said chamber and deformable between two principal conditions, one wherein the contacts it carries are in engagement with said stationary electrical contacts and the other wherein the contacts it carries are out of engagement

with said stationary electrical contacts; and snapping means for selectively causing said toggling member to snap to assume either of its conditions comprising a manually operable movably mounted push rod to which the adjacent ends of the central mounting legs of the bridging member are operatively connected so as to be movable thereby on movement of said push rod, and stop means formed on said body and in contact with the central portions of said side legs which prevent movement of said central portions in the direction toward said stop means. 10

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