SNAP ACTION SWITCH
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This invention relates to switches, and more particularly to an electrical switch having an improved snap action and contacts.

In electrical switches, a primary desideratum is to make and maintain a low resistance contact between the moving and stationary contact members. Another aim is low cost of manufacture. The presented switch embodying my invention, in large part attains both of these aims, while also utilizing a novel snap action mechanism. This mechanism is operated by a small movement of the operating lever, and still allows a considerable degree of overtravel of the lever so as to prevent damaging the parts. By utilizing the simple and inexpensive construction I have devised, a good wiping action is obtained at the contacts which makes possible a close, clean contact between the members. A moderately heavy spring pressure insures the maintenance of good contact.

Because of the sliding action between the contacts it is possible to use a heavy spring for the contacts to maintain a better contact, decreasing contact resistance and, to a greater extent, reduce the possibility of accidental opening of the contacts in the presence of shock.

Other advantages of my invention and a full understanding thereof may be had by reference to the following description and the drawings which form a part of this specification.

Fig. 1 is a front elevational view of my switch with the front cover removed;

Fig. 2 is a sectional view of the switch along line 2—2 of Fig. 1;

Fig. 3 is a rear elevational view with the rear cover removed;

Fig. 4 is an exploded view of the moving switch parts and rear cover removed from the housing;

Fig. 5 is a sectional view from line 5—5 of Fig. 1; and

Fig. 6 is a top plan view of the moving contact member.

Briefly, my invention is a switch including a housing into which is fastened a block. The block holds the fixed contacts in place by pressing them against a liner of rubber and fiber on the walls of the housing, thus eliminating the need for screws or other fasteners in the assembly. The moving contact member is of simple formation, but is curved transversely so that it slides onto a standing fixed contact surface, thus giving a considerable wiping action. The snap action, too, is of inexpensive construction and still is efficient and provides for a considerable amount of overtravel of the operating lever to prevent breakage of parts.

More specifically and referring to the figures, the switch is mounted in a housing 10 formed with appropriate mounting lugs 11. A threaded boss 12 at the upper end is provided to receive a conduit carrying the requisite electrical leads (not shown).

Within the housing an irregular shaped block 14 is mounted and carries the fixed or stationary contact members 15 and 15a. These contact members are loosely disposed in grooves formed in the sides of the block 14 and are held in place by compression of the members between the block 14 and bosses 16 formed on the inside of the housing walls. This compression is enhanced by the insulation between the boss and the contacts which preferably comprises a layer of treated paper 17 and a layer of sheet rubber 18 or rubber-like synthetic material, all of which materials are well known in the art. The block 14 is held in place by being disposed over a boss 20 (Fig. 5) formed in the rear wall of the housing and may be fastened thereto by a screw 21. The customary screws 22 for connection of wires to the contacts are provided. However, the holding of the contacts in place in the housing is done solely by the form of the block 14 and the housing 10. In order to facilitate assembly, and to avoid the necessity for drilling the block 14, grooves 23 are formed therein extending from the side to accommodate the screws 22. To assemble the contacts then, it is necessary only to slide them in from the side after the screws 22 are in place. Only one screw is necessary for the complete assembly of the contacts in the housing, and this screw is in a blind hole inside the housing eliminating the need of screw holes through the housing which may cause leakage permitting ingress of moisture. It will be readily apparent to those skilled in the art that considerable savings may be realized in the assembly time and in material for this type of a device.

At their lower ends, the contacts are bent away from the sidewalls of the housing at an angle which may be approximately 45 degrees. Suitable contact faces 24 may be sweated or otherwise fixed to the contact members.

The moving parts of the switch are best shown in Fig. 4 where they are exploded in the order of their assembly on the shaft 25. The shaft is journaled in the front lower part of the housing 10 and also in a boss 26 in a rear cover 27. It is held in place in the housing by a keeper 28 having a slotted end 29 which engages a groove 30 in the shaft. Thus, with the keeper 28 on one side and an operating lever 32 clamped or otherwise fixed to the shaft on the other side of the housing wall, the shaft is kept from longitudinal movement. An oil seal 34 may be provided within the wall of the housing surrounding the shaft.

The driving member 33 of the snap action is keyed to the shaft by keys 34 formed thereon and disposed in keyways 35 in the shaft, and is thus adapted to move with the shaft. The driven member 36 is journaled on the shaft and is of irregular formation. A boss on the member 36, however, is formed similar to the driving member 33. Each has a body portion 37 of annular form and a neck 38 extending outwardly therefrom. The member 33 has a head 39 on the neck 38 while the driven member 36 is formed with slanting shoulders 40 to provide a similar shape. A spring 41 formed of a plurality of laminations in the shape of a cylinder split at one radial plane, surrounds the body parts 37 of the driving and driven members. The split is opened up and the ends 43 of the spring engage the neck portions 38 of both the driving and driven members. Thus, any displacement of either member with respect to the other widens the split between the ends 43 and stores up energy in the spring 42. The stored energy is effective to snap the contacts when they appear hereinafter. Any tendency of the housing of the spring 42 to turn sideways because of the displacement angularly between the two members is counteracted by the keeper plate 28 which holds the spring in line between it and the wall of the driven member 36.

The member 36 is preferably molded of a plastic material such as bakelite or the like and contains a pair of upward extending arms 45 preferably formed of metal and molded in the member 36. These arms are bent toward each other at the ends 46 and therefore enclose a rectangular opening. The movable contact member 47
is disposed in this opening and is held in place in part by a spring 48. Adjacent the shoulders 40, the member 36 is formed with a ledge 49 overhanging the head 39 of this drive member 33 and adapted to engage the edge of the keeper 28 to hold it in position on the shaft (Fig. 2). The contact member 47 (Fig. 6) is substantially H-shaped having a cross member 50 and two slide members 51. The side members are both bowed in the form of a cylinder whose axis is parallel to the cross member 50. At each of the four ends of the side members, contact face pieces 52 are attached in position to engage the fixed contact faces 24. The movable contact member is assembled by inserting the edge of the cross member 50 between the ends 46 of the arms 45 and inserting the member therebetween. The sides 51 engaging the arms 45 prevent axial movement of the member. The driven member 36 is formed with a dished shape at 53 (Fig. 1) to match the cylindrical form of the contact member 47. The spring member 42 is received by the contact member 47 into this seat. A dimple 54 is formed on the contact member, and a part of the ends 46 of the arms 45 are either struck down or dimpled at 55 to extend into the spring and locate it properly.

As is best shown in Fig. 1, the contact member 47 is adapted to slide up on the fixed contacts 15 and 15a as the switch is thrown. As the face piece 52 first engages the face 24 on the fixed contacts, the member 47 rocks out of the hollowed surface 53. As the motion is continued, the two faces 52 and 34 slide over each other providing the desired "wiping action" on bringing of the two surfaces together which improves the conductance of the contact. Also as the movable contacts ride up on the sloping fixed contacts, the spring 48 is compressed, thus further improving the characteristics of the contact. This operation enables the use of a stiffer spring 48 to thus provide a strong contact pressure.

A flange member 56 is journaled on the shaft 25 adjacent the driven member and is held in fixed relation to that member by the engagement of a pair of fingers 57 engaged in slots 58 formed in the driven member 36. A flange 59 formed on this member 56 extends over the next adjacent piece, the cam member 60. This latter member 66 is formed to provide keys 62 which are engaged in the keyways 35 in the shaft so that the member 60 is driven by the shaft. A pair of stops 63 are also formed on the member 60 for a reason to be made obvious hereinafter. Adjacent the flange 59, a pair of rising cams 64 are formed, rising to a continuous dwell 65 between the cams.

As is illustrated in Fig. 3, these cams are effective to release the snap action to permit quick motion of the switching elements. Holding the snap action to prevent premature motion is a pair of similar latches 66 journaled on pins 67. The pins 67 are held in holes in bosses 68 in the housing and are prevented from sliding out of the bosses by bottoming in holes in bosses 69 formed on the rear cover 27 (Fig. 4). The bosses 68 and 69 are proportioned so that the latches 66 are positioned therebetween in the plane of the flange 59. The ends 70 of the latch then are in position to engage this flange to prevent motion. Springs 72 engaged between the housing and the latches 66 and held by projecting parts 73 urge the latches around the pins into engagement with the flange 59.

Follower arms 74 are engageable by the rising cams 64 to release the holding. Since the latches are on the housing, and the cam member 60 is keyed to the shaft, it is apparent that the shaft must move in the housing to release the latches. However, the flanged member 56 which is keyed to the contact carrier 36 is held in fixed relation to the housing by the latch. There must be relative movement therefore between the shaft 25 and the contact carrier 36. In the preferred embodiment this motion is of the order of 10 degrees of angular motion.

The relative motion stores energy in the spring 42 sufficient to cause a rapid snap of the contact carrier 36 upon release of the appropriate latch. Because the latches are fixed in relation to the housing, after the cam 64 has engaged the latch and the flange 59 has been released, the latch does not become re-engaged or cocked again, as it might in those switches where the latches are carried by the moving contact carrier. This results in a freedom of movement in the same direction for the operating lever 32 not found in other snap action devices. For example, in the embodiment shown, the lever 32 is free to turn the shaft 25 for 15 degrees clockwise beyond the normal position shown in Fig. 3. The same degree of freedom is allowed in the other direction after the switch has been snapped. Thus there is considerable freedom for overtravel of the lever 32, and this travel is limited only by the engagement of the stops 63 with abutments 75 on the housing.

The shaft of the switch may be biased to either one or the other side by a coil spring 78 which, at one end 79, is hooked over a foot 80 bent from the cam member 60. The other end 81 may be engaged in any of a plurality of slots 82 cut in the boss 26 on the rear cover. Thus, the tension of the spring may be altered by changing the end 81 from one slot to another, and merely by reversing the spring, the direction of bias of the shaft may be reversed.

It will be appreciated that in some instances it may be desirable to eliminate the spring where the switch is used for manual operations and to enable the contacts to be held in either of their alternate locked positions. It will also be apparent that the curvature of the movable contact member may be exactly opposite to that shown, in which event the angular relation of the fixed contacts would be changed to provide the proper contact. In this instance, the spring 48 would be underneath the movable contact pressing it against the arms 46.

Thus it is apparent that by my invention, I am able to provide an inexpensive snap action switch, which is very flexible. Provision is made for considerable overtravel of the operating lever, and the contacts are of such formation that lessened contact resistance results therefrom.

Having thus described my invention, I am aware that numerous and extensive departures may be made therefrom without departing from the spirit or scope of my invention.

I claim:

1. A switch comprising a housing, an insulating block disposed in said housing, fixed contacts coaxially held between said block and said housing, said contacts having contact surfaces extending away from the walls of said housing at an oblique angle thereto, a contact carrier including a block member pivotally journaled in said housing, a pair of angular arms extending from said block member and enclosing a rectangular opening therewith, a movable contact member having a cross member disposed in said opening and side members adapted to engage said arms to retain said movable member, a spring engaged between said arms and said movable member to urge said movable member against the cross member of said movable contact member being formed with arcuate contact surfaces, said carrier being adapted to move said movable contact surfaces into and out of engagement with said fixed contact surfaces, and said block member engaging said movable contact member upon pivotal movement of said contact carrier and being capable to slide said arcuate contact surfaces tangentially relative to said fixed contact surfaces upon initial engagement of said contact surfaces.

2. In a switch having a housing, fixed contacts mounted in said housing, and movable contacts adapted to hold said fixed contacts, snap action means comprising a shaft journaled in said housing, a contact carrier member adapted to carry said movable contacts journaled on said shaft, a driving member keyed to said shaft adja-
2,761,080 5 cent said carrier member, said carrier member and driving member both being formed with similar body portion and neck portions extending from said body portions, a spring disposed about said body portions and engaging said neck portions, said spring being adapted to store energy upon displacement between said carrier member and said driving member, a flange member having a flange extending away from said carrier, a cam member keyed to said shaft adjacent said flange member and under said flange, latch members pivotally mounted in said housing having arms adapted to engage said flange in a holding relationship, follower members on said latch members adapted to engage said cam member, said cam member being formed to provide cams, said follower when moved by said cams being adapted to release said flange to allow said carrier member to be snapped to a second position.

3. In a switch having a housing, fixed contacts mounted in said housing, and movable contacts adapted to bridge said fixed contacts; snap action means comprising a shaft journaled in said housing, a contact carrier member adapted to carry said movable contacts journaled on said shaft, a driving member keyed to said shaft adjacent said carrier member, said carrier member and said driving member both being formed with similar body portion and neck portions extending from said body portions, a spring disposed about said body portions and engaging said neck portions, said spring being adapted to store energy upon displacement between said carrier member and said driving member, a flange member having a flange extending away from said carrier, a cam member keyed to said shaft adjacent said flange member and under said flange, latch members pivotally mounted in said housing having arms adapted to engage said flange in a holding relationship, follower members on said latch members adapted to engage said cam member, said cam member being formed to provide cams, said follower when moved by said cams being adapted to release said flange to allow said carrier member to be snapped to a second position.

4. In a switch having a housing, fixed contacts mounted in said housing, and movable contacts adapted to bridge said fixed contacts; snap action means comprising a shaft journaled in a front wall of said housing and in a boss on said rear cover, an operating lever fixed to said shaft, a contact carrier member adapted to carry said movable contacts journaled on said shaft, said member being formed with a body part surrounding said shaft and a part extending from said body part, a driving member keyed to said shaft formed with a similar body and neck part, said body and neck parts on the driving and carrier member being normally in alignment, a leaf-type spring surrounding said body part and having ends engaging said neck parts, a keeper rotatably movable but longitudinally fixed on said shaft adjacent said driving member, said keeper being formed and positioned to hold said spring aligned with said members, said carrier member being formed to engage said keeper to hold it on said shaft, a flange member keyed to said carrier member and having a flange extending away from said carrier member, a cam member keyed to said shaft formed to provide said surfaces beneath said flange, latch members pivotally mounted in said housing having arms adapted to engage said flange to hold said flange member relative to said housing, said latch members also being formed with a following part in position to engage said flange and latch members pivotally mounted on said housing in position to engage said holding means, latch release means on said shaft adapted to release said latch means upon a predetermined rotation of said shaft, said boss being formed with a plurality of radial slots therein, and a coiled spring operably connected to said shaft and having one end engaged in one of said slots to bias said shaft in a certain direction, said spring being reversible in said slots to reverse the direction of bias.

5. In a switch having a housing, fixed contacts mounted in said housing, and movable contacts adapted to complete an electrical circuit between said fixed contacts; snap action means comprising a shaft journaled in said housing, a carrier member adapted to carry said fixed contacts journaled on said shaft, means engaged between said carrier member and said shaft adapted to store energy upon displacement therebetween, holding means fixed to said carrier member, latch means pivotally mounted in said housing adapted to engage said holding means at a predetermined position of said carrier member, release means on said shaft adapted to engage said latch means as said shaft is turned to release said latch means, abutment means formed on said housing adjacent said release means, and stop means on said release means adapted to stop the travel of said shaft at a point beyond the point of release of said latch means by engagement with said abutment means.

6. In a switch having a housing, a rear cover, fixed contacts mounted in said housing, and movable contacts adapted to be carried toward said fixed contacts to complete therebetween; snap action means comprising a shaft journaled in the front wall of said housing and in a boss on said rear cover, an operating lever fixed to said shaft, a contact carrier member adapted to carry said movable contacts journaled on said shaft, said member being formed with a body part surrounding said shaft and a part extending from said body part, a driving member keyed to said shaft formed with a similar body and neck part, said body and neck parts on the driving and carrier member being normally in alignment, a leaf-type spring surrounding said body part and having ends engaging said neck parts, a keeper rotatably movable but longitudinally fixed on said shaft adjacent said driving member, said keeper being formed and positioned to hold said spring aligned with said members, said carrier member being formed to engage said keeper to hold it on said shaft, a flange member keyed to said carrier member and having a flange extending away from said carrier member, a cam member keyed to said shaft formed to provide said surfaces beneath said flange, latch members pivotally mounted in said housing having arms adapted to engage said flange to hold said flange member relative to said housing, said latch members also being formed with a following part in position to engage said flange and latch members pivotally mounted on said housing in position to engage said holding means, latch release means on said shaft adapted to release said latch means upon a predetermined rotation of said shaft, said boss being formed with a plurality of radial slots therein, and a coiled spring operably connected to said shaft and having one end engaged in one of said slots to bias said shaft in a certain direction, said spring being reversible in said slots to reverse the direction of bias.
member being arcuately curved and spring means between the abutment and the contact member to hold it onto said arcuate seat, said fixed contacts on each opposite side of the housing extending inwardly from the side walls in a plane which is tangent to the arcuate surface of said contact member when said contacts are contacting each other, said contact carrier being swingable to swing said contact member into circuit closing engagement with each of said pairs of oppositely disposed fixed contacts and upon engagement therewith, said spring compressing and permitting tipping of the contact member on the seat, said movable contacts engaging said fixed contacts upon swinging of said carrier to slide the movable contacts onto the fixed contacts.

9. A switch including a housing with fixed contacts supported on opposite sides thereof, a contact carrier having movable contact carrier means for engagement with said fixed contacts and operating means for said movable contact means comprising a slotted shaft journalled in bearings in the front and rear of the housing, said contact carrier being freely journalled on said shaft and including a base having a boss formed on one side thereof with a neck extending from the periphery, means for communicating movement from the shaft to said carrier including an operating lever including a body surrounding said shaft and having at least one lug in one of said slots, said lever having a neck juxtaposed to the neck and said boss and spring means engaging said necks on opposite sides to hold them in alignment, means for holding said shaft against movement comprising a flange member surrounding the shaft and having lugs engaging said carrier member on opposite sides for driving engagement therewith and a pawl engaging flange, pawls pivotally supported on the opposite sides of said housing and having portions for alternate engagement with said flange and spring means for moving said pawls into engagement with said flange, cam means surrounding said shaft and having at least one lug interlocked in said groove and a cam surface on said cam arranged for alternate engagement with said pawls to release said pawls upon movement of the shaft.

10. In a switch having a housing, fixed contacts mounted in said housing, and movable contacts adapted to bridge said fixed contacts; snap action means comprising a shaft disposed in said housing, a contact carrier member adapted to carry said movable contacts disposed on said shaft, a driving member disposed adjacent said carrier member, said carrier member and driving member both being formed with portions that are adjacent to and in alignment with and movable relative to each other, a spring means engaging said aligned portions to hold them in alignment said portions being movable out of alignment against the pressure of the spring said spring being adapted to store energy upon displacement between said carrier member and said driving member, a member keyed to said carrier member having a part extending away from said carrier, a cam member keyed to said shaft adjacent said member and adjacent said part, latch members pivotally mounted in said housing having arms adapted to engage said part in a holding relationship therewith, follower members on said latch members adapted to engage said cam member, said cam member being formed to provide cams, said follower when moved by said cams being adapted to release said part to allow said carrier member to be snapped to a second position by said spring.

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