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CAM ACTUATED SWITCH MECHANISM PROVIDED WITH AN ACTUATOR
LINK HAVING AN EXTENSION FOR TERMINATING WIPING ACTION
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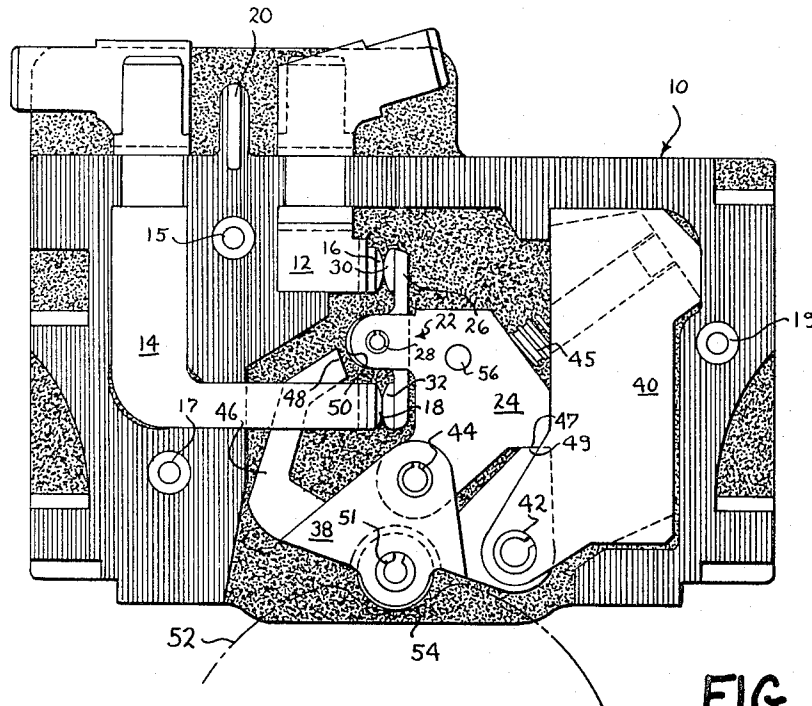


FIG. 1

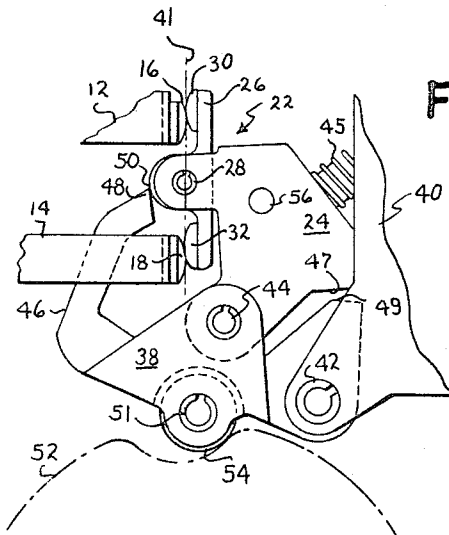


FIG. 2

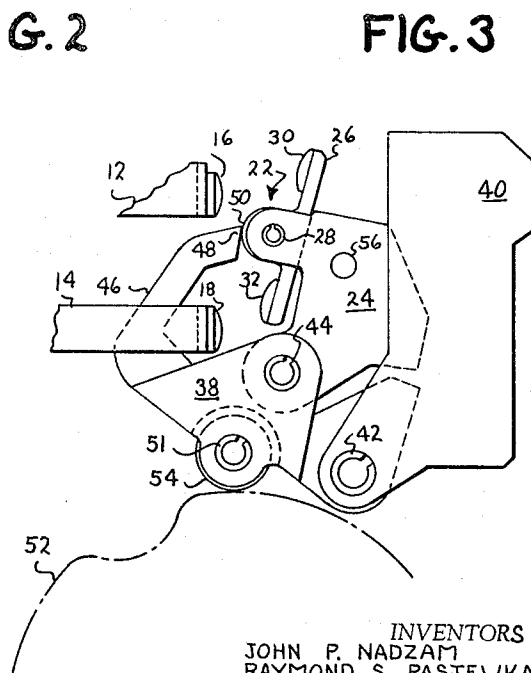


FIG. 3

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1

3,383,485

CAM ACTUATED SWITCH MECHANISM PROVIDED WITH AN ACTUATOR LINK HAVING AN EXTENSION FOR TERMINATING WIPING ACTION

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ABSTRACT OF THE DISCLOSURE

An electric switch includes a pair of spaced stationary contact members and a bridging contact member therefor arranged for relative movement. An actuating link is mounted for rotation about a fixed point in a casing for the switch. A carrier link, pivotally mounted on the actuating link, has the bridging contact member pivotally mounted thereon in such a manner that a spring urges the bridging member into a normally closed position with respect to the stationary contact members.

As a cam which actuates the electric switch rotates the actuating link through a preselected arc, contact wiping action is produced between the bridging contact member and the stationary contact members. During a rotation of the actuating link beyond this preselected arc, an extension member forming a part of the actuating link engages the bridging contact member, terminating the wiping action and holding the bridging contact member rigid while the switch is opened.

Background of the invention

This invention relates to electric switches and, more particularly, to improved electric switches wherein switch contacts are cleaned by a wiping action, that is by a tangential movement of a movable contact on the surface of a stationary contact.

Electric switches are often used in environments which subject them to severe mechanical shock. For example, electric switches used in railroad vehicle controls are subject to mechanical shock each time the vehicle passes over an uneven portion of the tracks. As a result of the vibratory forces produced by such mechanical shocks, any loose parts of the switches are caused to wear at an excessive rate thereby undesirably shortening the operating life of the switch.

Also, for electric switches used in a contaminated environment or in applications where heavy arcing occurs between switch contacts, it is desirable, and sometimes necessary, to provide for some contact wiping action. To minimize wear and reduce cost, switch actuation, including any required wiping action between the stationary and movable contacts, should be accomplished with as few movable parts as possible. Moreover, it is desirable to provide a switch mechanism, especially for switches subjected to mechanical shock, wherein the movable parts thereof are prevented from vibrating throughout the entire operating cycle.

It is an object of this invention to provide improved electric switches in which wear due to vibration caused by mechanical shock is minimized.

2

It is another object of this invention to provide electric switches requiring few movable parts.

It is a further object of this invention to provide improved electric switches which are compact, require a minimum of movable mechanical parts and have a long operating life.

Summary of the invention

Briefly stated, in accordance with one aspect of the invention, a new and improved electric switch includes stationary contact means mounted within a suitable housing and a movable contact carrying structure operably associated therewith to provide for a circuit making and breaking operation. The movable contact carrying structure includes a contact means pivotally carried by a carrier link which is in turn pivotally carried by an actuating link pivotally mounted within the housing for rotation about a first point. The actuating link includes an extension at one end thereof arranged and adapted to engage the contact carrying structure during a portion of the travel of the actuating link. There is also provided resilient means for urging the contact carrying structure to a preselected normal position. The resilient means is so positioned that rotation of the actuating link without engagement of the extension with the contact carrying structure is operative to provide for a positive tangential movement (wiping action) of the movable contact means with respect to the stationary contact means; engagement of the extension with the contact carrying structure being operative to arrest such tangential movement and cause rotary movement of the contact carrying structure in unison with the actuating link.

The specification concludes with claims particularly pointing out and distinctly claiming the subject matter of this invention. The organization, manner and process of making and using this invention, together with further objects and advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a front elevation of a normally closed switch in accordance with the principles of this invention;

FIG. 2 shows the switch mechanism at the time when the switch contacts are making (or breaking) contact;

FIG. 3 shows the switch mechanism at a time when the contacts are in an open position.

Description of the preferred embodiments

In the various figures of the drawing, there is shown a normally closed switch constructed in accordance with one embodiment of this invention. As shown, the switch includes stationary contact means 12 and 14 mounted within a casing 10. One end of stationary contact means 12 and 14 extends within the casing 10 and terminates in suitable contact tips 16 and 18, respectively, while the other ends thereof extend outside casing 10 for suitable connection with a circuit to be controlled. The stationary contact means may be mounted within the casing 10 in any convenient manner, such as, by mounting them in suitable recesses molded in the casing. Preferably, casing 10 is provided with an extension 20 adapted to separate the extending portion thereof within the casing to prevent arcing between such stationary contact means. The casing 10 may be made up of two separate portions secured together in any suitable manner, such as, by bolts, rivets, or the like, extending through the holes 15, 17 and 19.

Although in the drawing, spaced contacts means 12 and 14 are illustrated, it is to be understood that any suitable arrangement of stationary contacts may be employed. As is well known, spaced stationary contacts with a suitable contact bridge for shunting such contacts provides for increased contact area to dissipate energy during contact arcing so that this arrangement is especially suitable for switches required for high current density applications.

In accordance with a feature of this invention, there is provided a compact, high current capacity switch wherein the switch actuating mechanism includes parts arranged for a limited amount of free movement to provide for a desired definite amount of wiping action between the stationary contact means and a movable contact means associated therewith and yet wherein such parts exhibit a minimum amount of relative vibratory movement as a result of mechanical shocks to which the switch may be subjected.

To this end, there is provided a contact carrying structure, generally shown as 22, including a carrier member 24 and a movable contact means 26 pivotally mounted thereon by a pivot pin 28. For the arrangement illustrated, wherein spaced stationary contacts are employed, movable contact means 26 has contact tips 30 and 32 which make contact with contact tips 16 and 18, respectively, of the stationary contact means 12 and 14.

The switch also includes an actuating member comprising actuating link 38 pivotally mounted on a stationary member 40 by a pivot pin 42 for rotation thereabout. The member 40 may be made of any suitable metal and must be capable of withstanding the stresses encountered during opening and closing the switch. As an alternative, the actuating link may be mounted directly on the casing 10 or on another convenient member within the casing.

Although the switch may be actuated in any suitable manner, the embodiment illustrated in the drawing is arranged to be actuated by a suitable cam 52 which engages a suitable cam follower associated with actuating link 38. For example, the cam follower may include a cylinder 54, preferably of hard metal, rotatably mounted on a portion of actuating link 38 by pin 51. Pin 51 is located on link 38 to provide for most of the force delivered by cam 52 through the cam follower to be applied through pins 44 and 28 in a direction to impart a shearing motion operative to shear contact tips 16-18 from contact tips 30-32 should they become welded together.

Means are provided to assure that during a portion of the travel of actuating link 38 there is relative engagement between the contact carrying structure 22 and the actuating link 38. This is provided, as shown in the drawing, by providing actuating link 38 with a suitably extending portion 46. Also, the carrier link 24 is pivotally mounted on the actuating link 38 by means of a pivot pin 44 which is suitably located on the actuating link 38 to assure that some portion of the contact carrying structure 22 is in the path of the extension member 46 for engagement therewith during a portion of the rotation of the actuating link 38 about the pivot pin 42. Alternatively, some portion of the contact carrying structure 22 might include a suitable extension member which engages the actuating link 38. In either case, at some point during rotation of the actuating link 38, the actuating link 38 and the contact carrying structure 22 must come into engagement to arrest further contact wiping action of the switch and cause bridging contact member 26 to move out of contact with the stationary contact means 12 and 14 by rotating in unison with actuating link 38 about the pivot pin 42.

In the illustrated embodiment, the extension member 46 has a generally arcuate configuration which enables a surface 48 thereof to engage a surface 50 of the bridging contact member 26. When the surfaces 48 and 50 are in engagement, the bridging contact member is held rigidly against the pivot pin 28. Should the switch be jarred

with the contacts in their open position, the bridging contact member 26 cannot vibrate because it is held in a fixed position by the extension member 46. Thus, one cause of wear between the bridging contact member 26 and its pivot pin is eliminated, contributing to a longer switch life.

Resilient means, shown as the spring 45, urges the contact carrying structure 22, and bridging contact member 26 associated therewith, toward a predetermined normal position. For the arrangement illustrated, spring 45 urges the contact carrying structure to the normally closed switch position. In this normally closed position, the surface 47 of the carrier link 24 abuts the surface 49 of the actuating link 38.

The spring 45 is mounted between the link 24 and member 40 at an angle with respect to the stationary contacts so that one component of force (horizontal component for the switch orientation illustrated) is operative to maintain an almost constant contact pressure between contact tips 16-30 and 18-32 in the closed position. In addition, spring 45 is operative to provide a component of force in a direction to overcome friction between such contact tips (vertical component for the switch orientation illustrated).

The operation of the switch may best be explained by reference to all of the figures of the drawing. For example, in FIG. 1, the switch is shown in its normally closed position with the spring 45 urging the bridging member 26 of contact carrying structure 22 against the stationary contact means 12 and 14. In this position, a surface 47 of the carrier link 24 abuts a surface 49 of the actuating link 38. As the high part of cam 52 first causes actuating link 38 to rotate about the pivot pin 42, the bridging contact member 26 moves tangentially with respect to the stationary contact means 12 and 14 so that the contact tips 30 and 32 slide along the surfaces of the contact tips 16 and 18. This results in a positive wiping or cleaning action for the contacts as the bridging contact member 26 moves, until such time as the contact carrying structure 22 is engaged by the extension member 46. Once this engagement is made, as shown in FIG. 2, the foregoing tangential movement of the bridging contact member 26 stops and the bridging contact member 26 and the carrier link 24 which carries it both rotate about pivot pin 42 in unison with the actuating link 38 so that all further movement of link 38 causes movement of the contact tips 30 and 32 in a direction away from the stationary contact tips 16 and 18.

FIG. 3 shows the position of the various parts when the switch is in its fully opened position. A similar sliding or wiping action takes place between the contact tips 16-18 and 30-32 when the switch is returned to its normally closed position. That is, rotation of actuating link 38 in the opposite direction first moves the bridging contact member 26 toward the stationary contact means until such time as extension member 46 and contact carrying structure 22 become disengaged whereby for the balance of the travel of actuating link 38 the bridging contact member 26 is again caused to move tangentially with respect to the stationary contacts. Thus, appropriate and positive wiping action is achieved both during opening and closing of the switch and whether the switch be arranged for normally open or normally closed applications.

Carrier link 24 may be provided with a suitable button 56 on each side thereof to prevent link 24 from canting and binding against the sides of casing 10 as link 24 is actuated in response to movement of actuating link 38. Buttons 56 would also function to limit the extent to which carrier link 24 rotates into a recess provided within member 40.

In the arrangement described wherein spaced stationary contacts are employed an additional advantage is realized in that at all times there is a structural member interposed between the spaced apart stationary contacts. For example, in the normally closed position, the portion of carrier link

24 to which bridging contact member 26 is pivotally mounted, lies between the stationary contact means 12 and 14. Similarly both during opening of the contacts and while such contacts are in the open position, the extension 46 lies between such stationary contacts. The presence of such member between the stationary contact means as described has been found to provide advantages which are believed to contribute to more reliable circuit interruption as well as increased contact life.

Preferably, pivot pin 28 mounting the bridging contact member 26 to the carrier link 24 should be located as near as possible to the plane passing through the line of contact of the contact tips 16-30 and 18-32; this plane being illustrated by the line 41 in FIG. 2. Displacement of pivot pin 28 too far from this preferred location can result in intermittent opening of one part of contact tips thereby impairing switch operation especially during contact closing. Such intermittent opening has been found to be more likely when the coefficient of friction between the contact tips exceeds about 0.25. Under such conditions, for example, it has been found that a moment can be produced which tends to cause rotation of bridging contact member 26 about one pair of engaging contacts; for example, contact tips 18-32 during the switch closing operation when pivot pin 28 is displaced too far to the right of the preferred location. This rotation tends to decrease the contact pressure on the other pair of engaging contact tips (16-30) thereby "unloading" such contact tips and resulting in possible contact chatter. Once the frictional force between the contact tips has been overcome, this tendency of bridging contact member 26 to rotate ceases.

It will be appreciated from the foregoing discussion that the moment tending to cause unloading of the contacts increases with an increase in the coefficient of friction between the contact tips and with an increase in the displacement of the pivot pin from the preferred location.

This invention is not limited to the particular details of the preferred embodiment illustrated. It is contemplated that various modifications and applications of the principles of this invention may be made within the scope of this invention by those skilled in the art. For example, it is contemplated that a switch made in accordance therewith may have a normally open position, or more than one resilient member or spring may be used to urge the switch mechanism to a normal position, if an application of this invention requires it. It is therefore intended that the appended claims cover such modifications and applications which do not depart from the direct spirit and scope of this invention.

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

1. An electric switch comprising:

- (a) a housing having stationary contact means mounted therein;
- (b) an actuating member pivotally mounted within said housing for limited rotary movement about a given point;
- (c) a contact carrying structure carried by said actuating member, said contact carrying structure including a carrier link pivotally mounted on said actuating member, a movable contact means pivotally mounted on said carrier link for contact with said stationary contact means, and means arranged and adapted to provide for relative engagement between said actuating member and said contact carrying structure at a location different from the pivotal connection between said actuating member and said carrier link during a portion of the rotary movement of said actuating member; and

- (d) resilient means for urging said contact carrying structure and said actuating member to a predetermined normal position, said resilient means being operative to provide components of force in directions parallel with and normal to the line of contact between said movable contact means and said sta-

tionary contact means so that movement of said actuating member absent said relative engagement between said actuating member and said contact carrying structure is operative to cause a positive tangential movement between said movable and stationary contact means which tangential movement is arrested by said relative engagement to cause movement of said contact carrying structure and the movable contact means carried thereby in unison with said actuating member about said given point.

2. An electric switch in accordance with claim 1 wherein said actuating member has an extension thereon and said contact carrying structure is arranged in the path of travel thereof so that said relative engagement takes place between said extension and said contact carrying structure.

3. An electric switch in accordance with claim 2 wherein said stationary contact means includes spaced stationary contacts and said movable contact means is a contact bridge arranged to shunt said spaced stationary contacts.

4. An electric switch in accordance with claim 3 wherein said carrier link includes a projection disposed intermediate said spaced stationary contacts to which said contact bridge is pivotally mounted and wherein during a portion of the travel of said actuating member the end of the extension thereof engages the end of the projection of said carrier link disposed intermediate said spaced stationary contacts.

5. An electric switch in accordance with claim 1 wherein said actuating member has a generally arcuate extending portion thereon and said contact carrying structure is arranged in the path of travel of said arcuate extending portion.

6. An electric switch according to claim 1 wherein said resilient means comprises a single spring operably associated with said carrier link which urges said movable contact means into a normally closed position with respect to said stationary contact means by exerting a force against said carrier link.

7. An electric switch according to claim 1 wherein said stationary contact means includes a pair of spaced contacts and said movable contact means includes a bridging contact for shunting said pair of spaced contacts, said bridging contact being pivotally mounted to said carrier link at a location near the plane passing through the line of contact between said stationary and movable carrier means.

8. An electric switch comprising:

- (a) a switch housing having a pair of stationary contacts mounted therein;

- (b) an actuating member pivotally mounted within said housing for rotation about a first point, said actuating member including an extension member which moves in a predetermined path of travel during the rotation of said actuating member;

- (c) a contact carrying structure comprising a carrier member and bridging contact means pivotally mounted thereon for contacting said stationary contacts, means for pivotally mounting said carrier member on said actuating link with said contact carrying structure being arranged in the predetermined path of travel of said extension member to allow said extension member to engage said contact carrying structure during a portion of the rotation of said actuating member; and

- (d) resilient means for urging said bridging contact means into a preselected normal position and for causing said bridging contact means to slide along the surface of said stationary contacts during a portion of the travel of said actuating member when said actuating member rotates with said extension member out of engagement with said contact carrying structure, said bridging contact means rotating about

7

said first point away from said stationary contacts as said actuating member rotates with said extension member engaging said contact carrying structure.

9. An electric switch according to claim 8 wherein said bridging contact means is pivotally mounted on said carrier link at a location substantially in the plane passing through the line of contact between said bridging contact means and said pair of spaced stationary contacts.

10. An electric switch according to claim 9 wherein said extension member engages said bridging contact member between a pair of contacts thereon to hold said bridging contact member in a rigid position as it rotates away from said stationary contacts.

8

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

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John P. Nadzam et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 47, "carrier" should read -- contact --.

Signed and sealed this 16th day of September 1969.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.

Commissioner of Patents