

[54] DUST COVER FOR SWITCHES

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[56] **References Cited**

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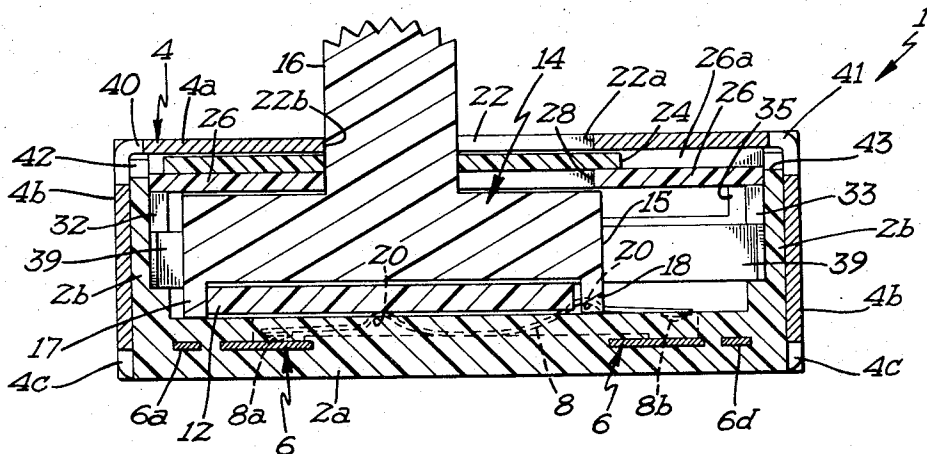
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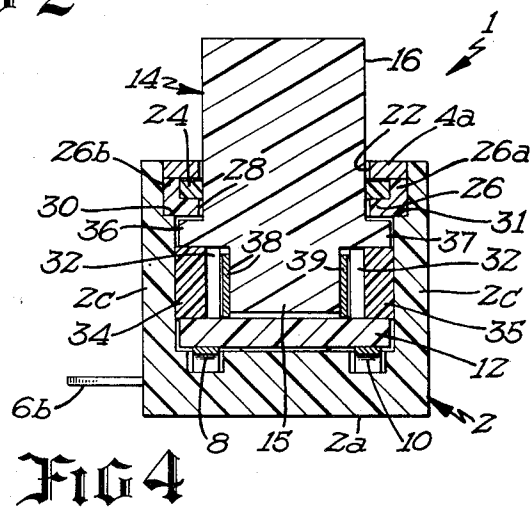
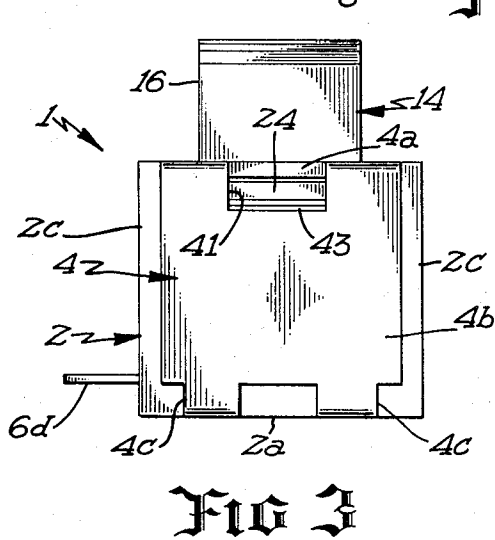
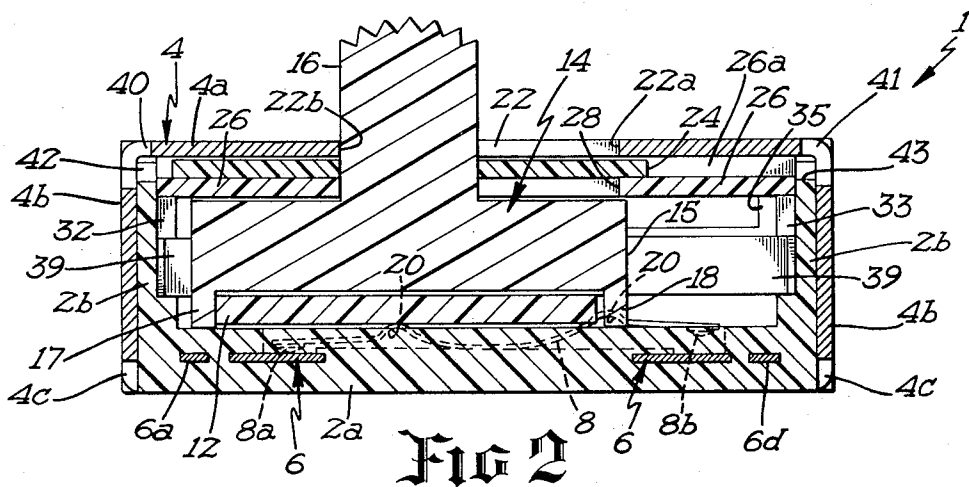
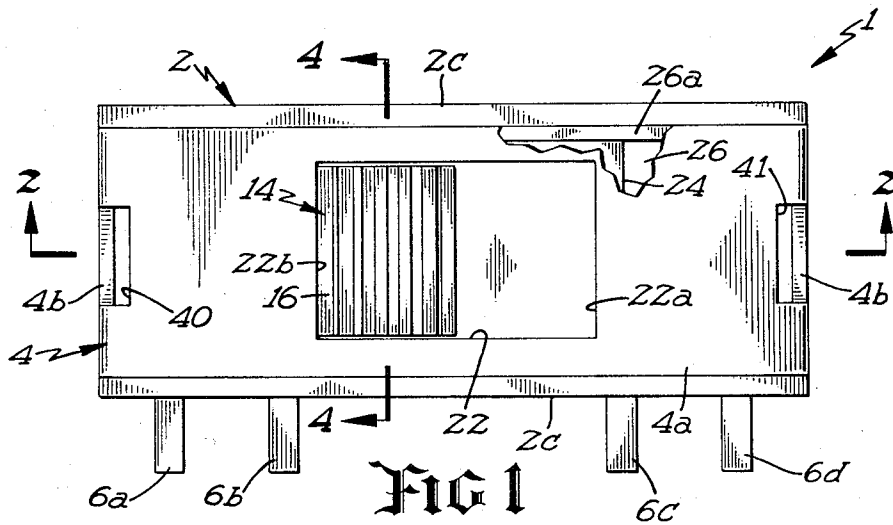
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[57] **ABSTRACT**

An electrical switch having contact elements housed within an enclosure and including a shiftable actuator for the contacts extending outwardly from the enclosure through a slot in one wall thereof is protected against the entry of foreign particles by a double cover structure behind the slotted enclosure wall, including a slide cover on the actuator movable therewith and a stationary cover behind the slide cover with which the slide cover is in sliding contact. The slide cover is large enough to cover the actuator slot in all positions of the actuator; and as the slide cover shifts with the actuator it serves to expell from the enclosure through a pair of openings in opposite ends thereof dust and foreign particles which collect on the stationary cover.

8 Claims, 4 Drawing Figures





DUST COVER FOR SWITCHES

BACKGROUND OF THE INVENTION

The problem of keeping the contacts of electrical switches free from dust, lint and foreign particles of all kinds is a continuing and serious one because such foreign matter can hold contacts open or closed and otherwise interfere with the actuating mechanism of a switch. This problem is particularly acute on miniature switches now widely employed in miniaturized electronic circuits of various kinds. The contacts, contact space and actuating mechanism space on such micro-miniature switches are so small that the presence of any foreign matter is extremely likely to block the movement of contacts or otherwise interfere with their free actuation. Also, since the contacts of such miniature switches are frequently contained within an enclosure from which it is difficult if not impossible to extract dust or foreign particles which enter, it is all the more important to not only prevent the entry of foreign matter into such switch enclosures, but also to provide some means for periodically expelling foreign matter which collects on the switch actuator or its cover assembly before such matter can find its way into the space where the contacts and actuating mechanisms are contained. The switch closure structure of this invention overcomes these problems and effectively prevents the entry of dust, dirt and foreign matter into the contact space of a switch.

BRIEF SUMMARY OF THE INVENTION

The switch cover structure of this invention is particularly adapted for use with slide switches having a slide actuator for the contacts of the switch which projects outwardly through a slot in a closure wall within which the actuator is free to shift to various positions of use. The cover structure is particularly characterized by a double cover arrangement including a first, slide cover located under or behind the slotted wall of the switch enclosure through which the actuator extends and carried on the actuator for movement therewith. The slide cover is large enough to be in covering relation to the actuator slot in the enclosure wall at all operating positions of the actuator. A second, stationary cover is located behind the slide cover and serves as a collecting surface for foreign matter to prevent its entry into the portion of the switch assembly housing the contacts, the stationary cover cooperating with the adjacent walls of the switch enclosure to close the end of the switch assembly through which the actuator extends.

In a preferred embodiment of my cover structure, both the slide cover and the stationary cover are planar members, the stationary cover having a slot therein in alignment with the actuator slot in the enclosure wall and of sufficient length to accommodate the full, shifting stroke of the actuator to its operational positions. The slide cover and the stationary cover are preferably separate, removable elements with the slide cover being removably attached to the actuator by an aperture therein which snugly embraces the actuator and through which the actuator and its outer, gripping head or knob extend.

A particularly advantageous feature of the cover structure resides in the provision of a pair of opposed openings in the switch enclosure in alignment with the

slide cover and the stationary cover, whereby any foreign particles accumulating on the stationary cover will be expelled from opposite ends of the enclosure through said opposed openings by the opposite ends of the slide cover as it reciprocates with the actuator on the stationary cover. By virtue of this cover structure arrangement, dust, lint and foreign particles which periodically accumulate on top of the stationary cover are expelled from the switch enclosure before they have an opportunity to find their way into the contact containing space of the switch assembly.

These and other objects and advantages of my invention will become readily apparent as the following description is read in conjunction with the accompanying drawings wherein like reference numerals have been used to designate like elements throughout the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top, plan view of a switch assembly incorporating the cover structure of this invention;

FIG. 2 is a vertical section view taken along lines 2—2 of FIG. 1;

FIG. 3 is a right end view of the switch and cover structure of FIG. 1; and

FIG. 4 is a vertical section view taken along lines 4—4 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, I have shown in FIGS. 1 through 4 a slide action switch of the general type for which the dust cover of this invention has been particularly developed. The entire switch assembly is generally indicated by reference numeral 1, and includes an enclosure comprised of a housing 2 made of insulating material and a closure frame 4 of inverted, U-shape which is mounted in closing relation to the open, top end of housing 2. Housing 2 includes a base wall 2a, upstanding end walls 2b and opposed, upstanding side walls 2c. Closure frame 4 includes a generally planar, top closure wall 4a and a pair of downwardly depending wall segments 4b at opposite ends thereof. Wall segments 4b extend downwardly in overlying relation to opposed end walls 2b of housing 2 and cooperate therewith in providing a complete switch enclosure. Closure frame 4 is secured to housing 2 by means of lock tabs 4c at the bottom of wall segments 4b which engage the underside of base wall 2a of housing 2.

Positioned on base wall 2a of housing 2 is a conductor insert 6 having a plurality of conductor strips 6a, 6b, 6c, and 6d projecting outwardly from housing 2 for connection within an electrical circuit. The switch assembly 1 disclosed herein is of the micro-miniature type designed for use in electronic circuits in combination with other miniature electronic components. For such applications, switch assembly 1 is on the order of three-quarters of an inch in length, ¼ inch in height, and ¼ inch in width. Thus, the switch operating and contact space within housing 1 is quite small.

The inner ends of conductor strips 6a, 6b, 6c and 6d are positioned within housing 2 to form contacts which are located to be bridged by a pair of contact springs 8 and 10 extending lengthwise along base wall 2a on opposite sides thereof. The inner ends of contact strips 6a,

6b, 6c and 6d may obviously be positioned in cooperative relation with the contact ends of contact springs 8 and 10 to provide any desired switch and circuit arrangement. For example, the inner ends of contact strips 6b and 6c may be positioned for bridging by contact spring 8 with the inner ends of contact strips 6a and 6d angled inwardly to be bridged by the opposite ends of contact spring 10. Contact ends 8a and 8b of contact spring 8 are shown in FIG. 2. Various operating mechanisms may be employed in order to actuate contact springs 8 and 10 into a closed position with the inner, contact ends of strips 6a, 6b, 6c and 6d. For illustrative purposes I have shown an actuating mechanism comprised of a driver plate 12 slidably positioned on top of base wall 2a and a slide actuator 14 having a driver head portion 15 slidably positioned within housing 2 and a gripping head or knob portion 16 projecting outwardly therefrom. Actuator 14 is slidably shiftable within housing 1 and includes a pair of pick-up fingers 17 and 18 depending downwardly from its driver head 15 which are positioned to engage and slidably move driver plate 12 as actuator 14 is shifted in opposite directions. Each of the contact springs 8 and 10 is provided with upwardly projecting detents 20 aligned with driver plate 12 so that as plate 12 is shifted back and forth, end or shoulder portions provided thereon at predetermined locations will engage detents 20 and urge the contact ends of springs 8 and 10 downwardly into closing position with the inner ends of contact strips 6a, 6b, 6c and 6d. Thus, as actuator 14 is shifted from the left or off position as viewed in FIG. 2 to the right, the right end of driver plate 12 will engage the right detent 20 of contact spring 8 and urge its contact end 8b downwardly into contact with the inner end of contact strip 6c. With the opposite contact 8a of contact spring 8 held downwardly against contact strip 6b, the inner ends of strips 6b and 6c will be bridged by contact spring 8 and a circuit will be established across these contact points. In a similar manner, contact spring 10 will be urged downwardly at its opposite ends by the sliding action of driver plate 12 to bridge contacts 6a and 6d.

Actuator 14 may be positioned and guided for various types of movement along linear or arcuate paths. In the switch assembly illustrated herein, actuator 14 is guided for linear movement to permit its sliding, reciprocal action by means of a rectangular slot 22 provided in top, closure wall 4a of closure frame 4. Gripping knob 16 of actuator 14 projects upwardly through slot 22, the length of slot 22 being such as to accommodate a shifting stroke of actuator 14 sufficient to open and close contacts contained within housing 2 as desired. Elongated slot 22 obviously presents an opening through which dust, lint and foreign particles of various kinds might pass into switch housing 2 as gripping knob 16 is shifted back and forth. In order to prevent the entry of such foreign matter into the switch operating and contact space within housing 2, I have provided a cover structure comprised of a pair of planar cover members 24 and 26. Cover 24 is a slide cover positioned on gripping knob 16 of actuator 14 and slidably shiftable therewith. Although slide cover 24 may be attached to actuator 14 in various ways, I have found it convenient to accomplish this by providing an aperture in slide cover 24 which tightly and

snuggly embraces gripping head 16 and through which gripping head 16 extends. Slide cover 24 is removably attached to gripping head 16 by sliding it thereover in a force fit therewith. Slide cover 24 is positioned under or behind closure wall 4a of closure frame 4 and extends longitudinally on opposite sides of gripping knob 16 by a distance sufficient to project beyond the opposed, transverse edges 22a and 22b of slot 22 in covering relation thereto at all operational positions of actuator 14. Slide cover 24 is also of greater width than slot 22 to thereby serve as a closure device with respect to this slot.

Cover 26 is positioned behind slide cover 24 and is a stationary cover with which slide cover 24 is positioned in sliding engagement. The peripheral edges of stationary cover 26 abutt against the inside surfaces of adjacent wall portions 2b and 2c of housing 2 and cooperate therewith, as well as with slide cover 24, to close the open, upper end of housing 2. Stationary cover 26 is provided with a central aperture or slot 28 in alignment with slot 22 in closure wall 4a and of sufficient length to accommodate the full, shifting stroke of actuator 14 to its various operational positions, gripping knob 16 extending through slot 28 as well as through aligned slot 22. Stationary cover 26 is removably positioned in place on housing 2 by placing it over actuator 14 and its gripping knob 16. Cover 26 is supported along its side edges on elongated shoulders 30 and 31 provided on the inside, upper surface of side walls 2c of housing 2, in the manner illustrated in FIG. 4. At its opposite ends, stationary cover 26 rests on upright housing ribs 32 and 33 and on a pair of removable spacers 34 and 35. As may be most clearly understood by reference to FIG. 4, spacers 34 and 35 extend along opposed side walls 2c of housing 2 in abutting contact therewith and provide sliding support for laterally projecting shoulders 36 and 37 on actuator 14, as well as serving to space and support actuator 14 at the desired vertical location within housing 2.

As driver head 15 of actuator 14 is slidably shifted back and forth within housing 2, it is supported on the top surface of spacers 34 and 35, the alternate engagement of depending pick-up fingers 17 and 18 with opposite ends or shoulders of driver plates 12 serving to open and close the contacts contained within housing 2. A snap action is imparted to actuator 14, and to the closing of the switch contacts, by utilizing a pair of detent springs 38 and 39. Detent springs 38 and 39 extend longitudinally within housing 2 on opposite sides of driver head 15 and include a pair of inwardly projecting detents which cooperate with outwardly projecting lugs on opposite sides of driver head 15 to provide a snap action to actuator 14 as it is shifted back and forth. The spring detents and cooperating lugs on driver head 15 are not shown in the drawings as they comprise no part of the dust cover invention to which this application is directed. Reference is made to my copending application entitled Snap-Action Switch Mechanism, filed on June 12, 1972 under Ser. No. 262,052, for a clear understanding of the switch operating mechanism including the cooperative relation of the spring detents with driver head 15.

By virtue of the cooperative, structural relationship of slide cover 24 with stationary dust cover 26, any dust particles or lint passing through cover slot 22, will ini-

tially be lodged on slide cover 24, and if any of these foreign particles should fall off the opposite ends of slide cover 24 as it reciprocates back and forth, they will be caught on stationary cover 26 lying thereunder. In this manner, the cover assembly permits the full, reciprocating action of actuator 14 while preventing the entry of foreign matter into the contact containing space of housing 2. It will be appreciated that any small foreign particles finding their way into the interior of housing 2 could have the adverse effect of blocking the contact ends of contact springs 8 or 10 in an open or closed position.

The covering action of slide cover 24 and stationary cover 26 is further enhanced by forming cover 26 to a channel shape defined by opposed, upright side walls 26a and 26b clearly illustrated in FIG. 4. The opposed, side edges of slide cover 24 are in sliding engagement with side wall portions 26a and 26b of stationary cover 26, as well as with its base or bottom wall, whereby the stationary cover 26 serves as a guiding device for slide cover 24 and cooperates with it in forming a relatively tight seal to prevent the entry of foreign particles into the switch enclosure.

As a particularly advantageous feature of my dust cover structure for a switch assembly, apertures are provided at the opposite ends of the enclosure through which dust, lint and foreign particles accumulating on stationary cover 26 may be periodically expelled from the enclosure. For this purpose, a pair of opposed end openings are provided in the enclosure end walls in alignment with slide cover 24 and stationary cover 26. These end openings are defined by apertures 40 and 41 formed in the opposite ends of closure frame 4, and by notches 42 and 43 of equal extent with apertures 40 and 41 formed in housing end walls 2b. Housing end notches 42 and 43 and closure frame apertures 40 and 41 are in horizontal alignment with each other so as to cooperatively define continuous end openings in the enclosure through which foreign particles may be ejected. The upper faces of stationary dust cover 26 on opposite ends of slot 28 therein serve as dust collecting surfaces on which dust particles, lint and small foreign particles of any kind accumulate after passing through slot 22 in upper closure wall 4a. Because of the sliding engagement of slide cover 24 with cover 26, dust and foreign particles collecting on the top faces of stationary dust cover 26 will periodically be picked up by the opposite ends of slide cover 24 as it reciprocates with actuator 14 and ejected from the switch assembly enclosure through the end openings defined by closure frame slots 40, 41 and housing end wall notches 42, 43. Slide cover 24 thus serves as a dust, lint and foreign particle ejector, as well as a covering device. The ejecting action of slide cover 24 thus periodically expels foreign particles accumulating on stationary cover 26 from the switch enclosure, thereby greatly minimizing the likelihood that any foreign particles will find their way into the inner confines of the switch enclosure wherein the switch contacts are located.

While I have described and shown a preferred embodiment of my dust closure structure herein, I contemplate that various changes may be made in the size, shape and construction of the cover components without departing from the spirit and scope of my invention as defined by the following claims.

I claim:

1. On a switch including an enclosure within which electrical contact elements are housed, and a shiftable actuator for said contact elements projecting outwardly from said enclosure, an improved cover structure accommodating the shifting movement of said actuator comprising:

a closure wall with an elongated slot therein over one end of said enclosure, said actuator extending through said slot and terminating at its outer end at a gripping head for shifting movements within said slot;

a slide cover of greater length and width than said slot, on said actuator and shiftable therewith, said slide cover being positioned behind said closure wall and having sufficient length to be in closing relation to said slot at all operational positions of said actuator;

a stationary cover behind said slide cover with which said slide cover is in sliding engagement, the peripheral edges of said stationary cover cooperating with the adjacent walls of said enclosure to close said one end of said enclosure; and

a slot in said stationary cover in alignment with said slot in said closure wall and of sufficient length to accommodate the full shifting stroke of said actuator to its operational positions.

2. A switch and cover structure as defined in claim 1 wherein:

said stationary cover is of channel shape defined by a planar bottom wall and upright side walls against which said slide cover is in sliding contact, whereby said stationary cover serves as a guiding device for said slide cover and cooperates therewith in forming a seal to prevent the entry of foreign particles into said enclosure.

3. A switch and cover structure as defined in claim 1 wherein:

said slide cover and said stationary cover are of planar shape and said actuator is reciprocally shiftable within said closure wall slot; and

a pair of opposed end openings in said enclosure in alignment with said slide cover and said stationary cover, whereby any foreign particles accumulating on said stationary cover will be expelled from said enclosure through said end openings by the opposite ends of said slide cover as it reciprocates with said actuator on said stationary cover.

4. A switch and cover structure as defined in claim 3 wherein:

said closure wall is part of a closure frame of inverted, U-shape having a pair of depending wall segments cooperating with opposed end wall portions of said enclosure to enclose said electrical contact elements, said wall segments of said closure frame having apertures therein defining at least a portion of said end openings in said enclosure through which foreign particles are expelled.

5. A switch and cover structure as defined in claim 1 wherein:

said slide cover and said stationary cover are separate, removable elements, said slide cover being removably attached to said actuator gripping head by an aperture therein which snugly embraces said actuator gripping head and through which said actuator gripping head extend.

6. An enclosed switch assembly comprising in combination:

an enclosure having a closure wall over one end thereof with an elongated slot therein; electrical contact elements contained within said enclosure and movable into and out of contact with each other;

an actuator having a first portion thereof within said enclosure operatively associated with said contact elements and a second, gripping knob portion thereof extending out of said enclosure through said slot in said closure wall, said actuator being slidably reciprocal within said slot;

a slide cover on said actuator movable therewith, said slide cover being positioned behind said closure wall and extending longitudinally on opposite sides of said actuator by a distance sufficient to project beyond the opposed, transverse edges of said slot in covering relation thereto at all operational positions of said actuator, and said slide cover being of greater width than said slot;

planar, dust collecting surfaces behind said slide cover with which said slide cover is in sliding engagement, said dust collecting surfaces being disposed adjacent opposed end walls of said enclosure towards which said actuator slides as it reciprocates; and

an aperture in each of said enclosure end walls in alignment with said slide cover, whereby dust and foreign particles collected on said planar surfaces are picked up by the ends of said slide cover as it reciprocates and ejected from said enclosure through said apertures in said end walls.

7. An enclosed switch assembly as defined in claim 6 wherein:

said planar, dust collecting surfaces are portions of a

stationary cover and are spaced apart by a slot therein in alignment with said slot in said closure wall and of sufficient length to accommodate the full shifting stroke of said actuator to its operational positions.

8. In combination with a switch actuator, a cover structure for an electrical switch mechanism for preventing the entry of foreign particles into the switch operating and contact space, comprising:

a closure member with an elongated slot therein through which said actuator extends, said actuator being reciprocally shiftable within said slot;

a slide cover of greater length and width than said closure member slot on said actuator and shiftable therewith, said slide cover being positioned behind said closure member and having sufficient length to be in closing relation to said slot at all operational positions of said actuator;

a stationary cover behind said slide cover with which said slide cover is in sliding engagement, said stationary cover having a slot therein in alignment with said slot in said closure member and of sufficient length to accommodate the full shifting stroke of said actuator to its operational positions; and

opposed, open spaces at the opposite ends of said closure member in alignment with said slide cover and said stationary cover whereby foreign particles accumulating on said stationary cover are picked up by the opposite ends of said slide cover as it reciprocates with said switch actuator and are expelled through said open spaces.

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