The present invention relates to an electrical switch, and more specifically to a window regulator switch for controlling opening and closing movement of a window for an automotive vehicle.

Switches that are available in the art for use as window regulator switches have several well-known drawbacks making their use in the environment in which they operate rather unsatisfactory. Some of the more significant disadvantages of the above-mentioned switches are their susceptibility to oxidation and wear after prolonged periods of usage. Another significant drawback is the lack of a positive actuating contact member as well as the tendency of such switches to sometimes overtravel.

The present invention obviates several of these well-known difficulties by providing a rack and pinion drive between the switch actuator and the contact carrier, utilizing a teeter-totter type contact plate for the bridging function, providing a quick acting means for bringing about the actual circuit switching and utilizing the contact bridging plate to limit the travel of the contact carrier when switching has been accomplished. Additionally, the switch of the present invention has a slidable movable contact that minimizes oxide buildup on the contacting elements and provides means integral with the switch housing for limiting the extent of the movement of the contact carrier so as to positively position the contact carrier in the actuated mode.

An object of the present invention is to provide a new and improved three-position switch that utilizes multiple guide means to insure positive location of the switching elements in the actuated mode.

Another object of the present invention is to provide a new and improved switch mechanism wherein a free floating, bridging contact member is snapped into engagement with a fixed contact while contemporaneously utilizing the bridging contact member as a contact carrier travel limiting means.

Still another object of the present invention is to provide a new and improved centering device for a switch of the character described in the preceding objects which include a coil spring whose longitudinal axis is parallel to the direction of actuator movement.

A further object of the present invention is to provide a new and improved switch having a rack and pinion type drive means which is not susceptible to the destructive environmental elements normally found in the environment in which a window regulator switch operates.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

FIGURE 1 shows the subject invention in its operative environment mounted on a door of a vehicle;

FIGURE 2 is an enlarged fragmentary sectional view of the subject invention taken approximately along line 2-2 of FIGURE 1;

FIGURE 3 is a fragmentary sectional view taken approximately along line 3-3 of FIGURE 2;

FIGURE 4 is an enlarged fragmentary sectional view taken approximately along line 4-4 of FIGURE 3;

FIGURE 5 is a fragmentary sectional view taken approximately along line 5-5 of FIGURE 1 and with the operative mechanism shown in an actuated position; and

FIGURE 6 is a fragmentary sectional view taken approximately along line 6-6 of FIGURE 3.

As representing a preferred embodiment of the present invention, FIGURE 1 of the drawings shows an electric switch, generally designated by reference numeral 10, mounted on an inside door panel 11 of a door of an automotive vehicle 13. The switch 10 is utilized to control operation of a reversible electric motor (not shown) of a suitable or conventional window regulator mechanism (not shown) for raising or lowering a window 12. As seen in FIGURE 1, only an escutcheon plate and the switch actuator are visible from the interior of the vehicle 13 while the main operative components of the switch 10 are disposed on the opposite hidden side of the door panel 11 in an environment in which moisture and temperature are similar to that of the outdoors.

Referring to FIGURE 2 the switch 10 comprises a switch housing 14 having a rectangularly shaped housing portion 18 which extends through a complementary shaped aperture 20 in the door panel 11 and a decorative escutcheon portion 21 which is positioned against the side of the door panel 11 facing interiorly of the vehicle 13. As clearly shown in FIGURE 3, the switch housing 14 is removably secured to the door panel 11 by a pair of mounting springs 22. The springs 22 are carried by the housing 14 and have free ends 23 which are flexed inwardly when the housing 14 is inserted into the opening 20 in the panel 11 and then resiliently snap behind the panel 11 to securely attach the housing 14 thereto.

The housing portion 18 at its rearward or left end, as viewed in FIGURE 2, carries a generally rectangularly shaped base plate 24 made of insulated material. The base plate 24 is slidable received within a complementary shaped axially extending opening 25 in the housing portion 18 and is retained therein by snaps or beads 28 and by inwardly bent tabs 29 of the mounting springs 22. The tabs 29 of the springs 26 serve to hold the base plate in abutting engagement with the snaps 28. The base plate assembly 24 is secured to the housing portion 18 by forcing the same past the snaps 28, the snaps 28 flexing outwardly when the base plate 24 is forced therethrough and then snapping behind the base plate 24 to hold the latter in the housing portion 18.

Referring to FIGURE 2, terminal 30 extends base plate 24 and present an essentially flat contact surface 32. Terminal 30 would be typically in conductive engagement with an electrical power source. Terminals 34 and 36 extend through base plate 24 and present stepped contact heads 38 and 40, respectively.

Terminals 34 and 36 are typically in conductive engagement with leads operatively connected with the opposite ends of a suitable or conventional reversible electric motor of the window regulator mechanism (not shown). Therefore, it is obvious that a bridging of contact heads 38 and 32 or contact heads 40 and 32 will bring about a different direction of motor rotation.
3 The switch 10 further includes an actuator 42 supported by the housing 14 for pivotal movement relative thereto about a pivot axis 44. Referring to FIGURE 3, projections 45 extend laterally from actuator 42 and are slidably received in adjacent located slots 46 in the housing portion 18 of the housing 14 to enable the actuator 42 to pivot about the axis 44. Referring to FIGURES 3 and 4, the actuator 42 is illustrated as being provided with a pair of spaced, arcuate gear sectors 48 having teeth 50. Gear teeth 50 are in meshed engagement with gear teeth 51 on the upper side of a rack portion 52 of a linear contact carrier 54.

Referring to FIGURE 2, spaced abutments 56 are integrally formed with base 24 and carry a compression spring 58 which is compressed therebetween very slightly. A flat contact bridge plate 60 is normally biased toward the flat head 32 of terminal 30 by spring 62 which is movable with the contact carrier 54. Bridge plate 60 is free to move toward and from the plane of the base plate 24 carrying the contact head 32, but is restrained against lateral and endwise movement relative to the contact carrier 34 by containing wall portions 63 and 64 of the contact carrier 54.

The contact carrier 54 is linearly movable relative to the base plate 24 and with its movement being guided by the actuator 42. To this end, the contact carrier 54 has a projecting portion 65 of generally rectangular cross-sectional shape which is slidably received between the spaced gear sectors 48 of the actuator 42. Moreover, the base plate 24 has a raised portion 68 which is straddled by guide rails 70 on the contact carrier 54 to further guide the contact carrier 54 when it is moved. Therefore, it can be seen that an alignment between contact plate 60 and contact heads 32, 38 and 40 is maintained by the relationship of rails 70 to raised portion 68, projection 65 and actuator 42 and projections 45 which are engageable with the housing 14 at the upper end of the slots 46.

In operation, when it is desired to energize the window lift motor, actuator 42 is manually pivoted about the axis 44 from its neutral position, as shown in FIGURE 2, in which the contact plate 60 is only in engagement with contact head 32. Referring to FIGURE 5, this pivoting is illustrated as being completed in the lower direction and it is seen that contact carrier 54 has moved upwardly relative to the base plate 24 from its neutral position to an upper extreme position of movement within housing 14. When being moved toward this position, flame portions 42 of carrier 54 engage the lower surface of the compression spring 58 to further compress the latter against the upper abutment 56. Referring to FIGURE 3, it is shown that contact carrier 54 straddles abutments 56 on the housing 14 while in turn being straddled by the actuator 42. When the actuator 42 is pivoted downwardly, as shown in FIGURE 5, the gear sectors 48 are rotated in a clockwise direction and the meshed engagement between the gear sectors 48 and rack portion 52 of the contact carrier 54 causes the latter to be moved upwardly.

As the contact carrier 54 is moved from its neutral position, as shown in FIGURE 2, toward its uppermost position, as shown in FIGURE 5, the contact plate 60, which is restrained against lateral or endwise movement relative to the contact carrier 54, is moved from its normal position of rest on the contact head 32 to a tilted position by the spring 62 wherein it engages both the contact head 32 and the stepped contact head 40. When the contact plate 60 is in this tilted position, a circuit is completed to the motor (not shown) to energize the same. It should be noted that as plate 60 moves along head 32, a scraping action is generated which tends to remove oxide deposits and, when plate 60 teeters onto the stepped head 40, a scraping movement along the lower step or portion 40 of the stepped head 40 likewise takes place. Likewise, the plate 60 will eventually engage the side edge or surface 75 of the upper step of the contact head 40 to stop any further travel of contact carrier 54. In this manner, a movement limiter for contact carrier 54 has been provided. Likewise, as plate 60 teeters from head 32 on to lower step of contact head 40, the spring 62 will extend slightly causing a "feel" to be generated which can be sensed by a switch operator to inform him of proper contact engagement.

When the actuator 42 is released, the spring 58 will expand toward its free position and move the contact carrier 54 from the upper position, as shown in FIGURE 5, downwardly toward its neutral or centered position, as shown in FIGURE 2. As the contact carrier 54 moves toward its neutral position, the plate 60 disengages from contact head 38 to break the electric circuit to the motor (not shown) to de-energize the same, and the actuator 42 is moved toward its centered position, as shown in FIGURE 2, by the rack portion 52 of the contact carrier 45. As the contact carrier 54 approaches its neutral position, the spring 58 will engage the lower abutment 56 on the housing 14 whereby further movement of the carrier 54 is prevented.

When the actuator 42 is pivoted upwardly to energize the motor for reverse rotation, the switch 10 operates in the same manner except that the movements of the parts are reversed and the plate 60 tilts onto contact head 38.

The novel switch 10 of the present invention has a very positive switching movement due to the gear and rack drive arrangement. In addition, the stacked straddling arrangement of the contact carrier and actuator results in an excellent switch movement control arrangement which minimizes wear on the parts that move while allowing for the inclusion of a loosely dimensioned tiltable contact plate that automatically adjusts for wear. Moreover, by providing a spring which maintains a constant bias on the contact plate, a diminishing of the thickness of the plate after prolonged usage is automatically compensated for. Furthermore, the loosely dimensioned contact plate not only provides for a very positive contact engagement, but also serves as a contact carrier movement limiter due to the integrity of dimension of the edges of the contact plate.

While the embodiment of the present invention, as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is:

1. An electric switch comprising: a switch housing defining a chamber, said switch housing including a base adjacent one end thereof and having an opening in communication with said chamber at its other end; a pair of spaced fixed contacts carried by said base and with said fixed contacts having portions disposed inferiorly of said chamber; manually manipulable means including a contact carrier supported by said housing for movement in opposite directions between first and second positions; a contact plate disposed between said carrier and base and being movable with said contact carrier when the latter is moved; said contact carrier having guide means thereon which restrain the contact plate against end-wise and side-wise movement relative to the contact carrier, but which permit movement of the contact plate relative to the contact carrier toward and from the base, said contact plate when said contact carrier is in said first position engaging one of said fixed contacts and when said contact carrier is in said second position engaging both of said fixed contacts to provide a conductive path between said one fixed contact and the other fixed contact; and spring means in engagement with said contact carrier and said contact plate for biasing the latter toward said base, said other fixed contact being stepped to define first and second surfaces extending transversely of each other, said first surface lying in a plane spaced from and located closer to the base than the plane containing the innermost end surface of said one contact, said contact plate, as said contact carrier is being moved from said first position toward said second
position, sliding on said one fixed contact and being tilted into engagement with said other contact with a snap action by said spring means, said contact plate engaging said second surface of said other contact when said contact carrier is in said second position to positively stop movement of the latter.

2. An electric switch as defined in claim 1 wherein said manually manipulable means further includes an actuator pivotally supported by said housing and having an inner end in the form of a pinion which is meshingly engaged with teeth defining a rack on the contact carrier.

3. An electric switch for use in controlling energization of an electric motor of a window regulator mechanism for raising and lowering a window of an automotive vehicle comprising: a switch housing defining a chamber, said switch housing including a base adjacent one end and having an opening in communication with said chamber at its other end; a plurality of spaced fixed contacts carried by said base and with said fixed contacts having portions disposed interiorly of said chamber; a contact carrier supported by said housing for linear movement in opposite directions from a center position, said contact carrier having a plurality of teeth at spaced locations to define a pair of racks; an actuator pivotally supported by said housing for movement in opposite directions from a center position, and actuator having a bifurcated end and with each leg of said bifurcated end including an arcuate portion having teeth at its outer peripheral surface which are in meshed engagement with the adjacent rack on the contact carrier whereby pivotal movement of the actuator causes said contact carrier to be linearly moved, a pair of spaced abutments on said base and extending interiorly of said housing; a compression spring slightly compressed between said abutments and engageable with portions on said contact carrier to bias the contact carrier and actuator toward its center position; a contact plate disposed between said contact carrier and said base and being movable with said contact carrier when the latter is moved, said contact carrier having guide means thereon which restrain the contact plate against end-wise and side-wise movement relative to the contact carrier, but which permit movement of the contact plate relative to the contact carrier toward and from the base; spring means in engagement with said contact plate and said contact carrier for biasing said contact plate toward said base, said contact plate when the contact carrier is in its centered position engaging one of said fixed contacts and said contact plate bridging said one fixed contact and another fixed contact to provide a conductive path therebetween when moved in either direction from its centered position, said another fixed contacts being stepped to define first and second surfaces extending transversely of each other, said first contact surface lying in a plane spaced from and located closer to the base and the plane containing the innermost end surface of said one fixed contact, said contact plate, as said contact carrier is being moved from its center position, sliding on said one fixed contact and being tilted into engagement with one of said another fixed contacts with a snap action by said spring means, said contact plate engaging said second surface of said another fixed contact when said contact carrier is moved from its centered position to positively stop movement of the latter.

4. An electric switch as defined in claim 3 wherein the legs of said bifurcated end portion of said actuator straddle a portion of the contact carrier whereby said contact carrier is linearly guided for movement by said actuator means.

5. An electric switch as defined in claim 4 wherein said base and said contact carrier include cooperative guide surfaces to further guide the linear movement of said contact carrier.

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