Jan. 3, 1967 H. W. HULTS 3,296,389

POSITIVE ACTION SWITCH WITH IMPROVED RESILIENTLY BIASED STATIONARY CONTACT AND ASSOCIATED BRIDGING CONTACT STRUCTURE

Filed March 16, 1966

Fig. 1

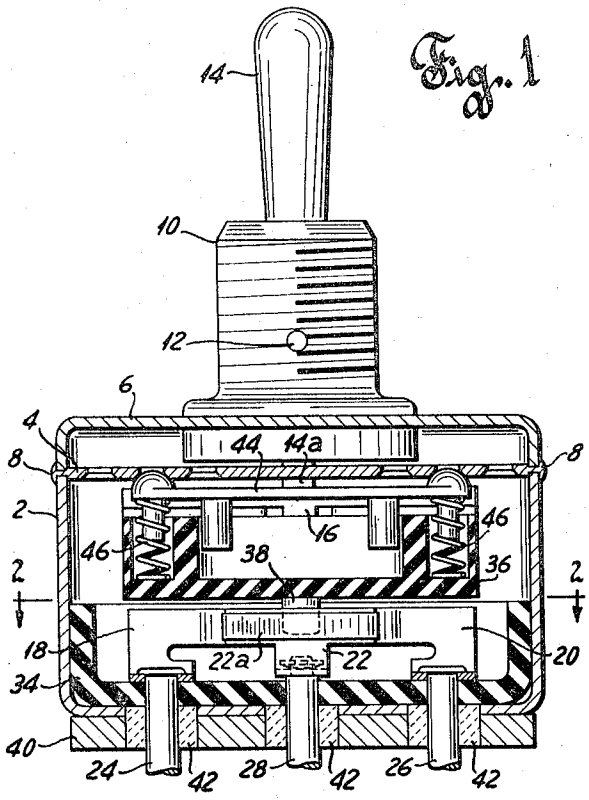
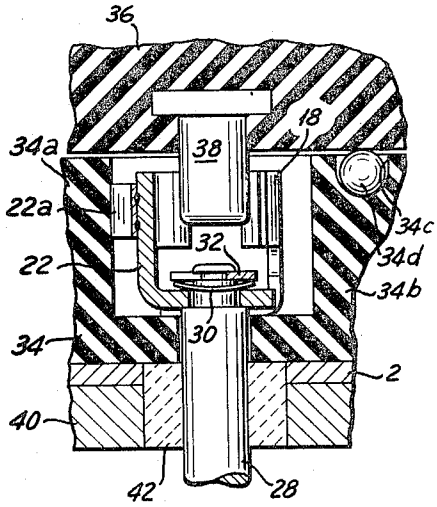



Fig. 3



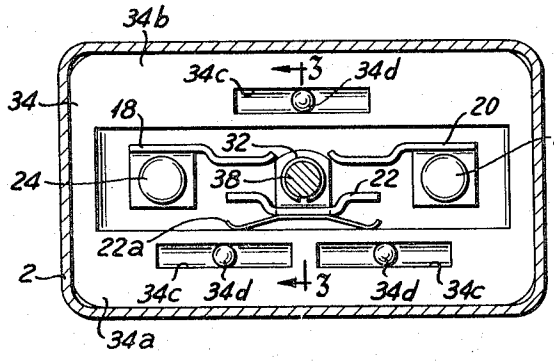
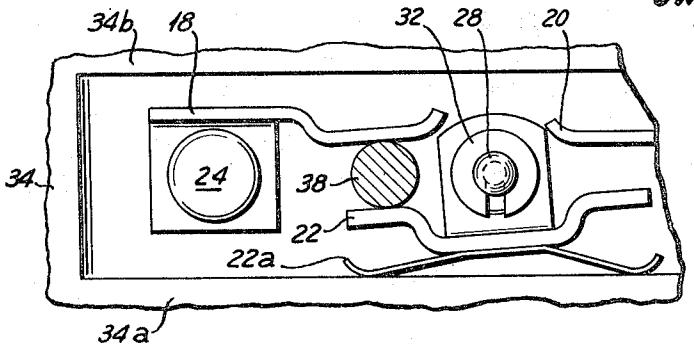




Fig. 2

Fig. 4




Inventor
Harold W. Hults
By Wm. A. Autio
Attorney

United States Patent Office

3,296,389

Patented Jan. 3, 1967



3,296,389

# POSITIVE ACTION SWITCH WITH IMPROVED RESILIENTLY BIASED STATIONARY CONTACT AND ASSOCIATED BRIDGING CONTACT STRUCTURE

Harold W. Hults, Waukesha, Wis., assignor to Cutler-Hammer, Inc., Milwaukee, Wis., a corporation of Delaware

Filed Mar. 16, 1966, Ser. No. 534,864
8 Claims. (Cl. 200—16)

This invention relates to positive action switches and more particularly to manually operable switches of the type having a positive and unyielding connection between the operating member and the movable contact for at least a portion of the operating member movement whereby positive force may be applied to open the contacts combined with snap action and improved contact means therefor.

While not limited thereto, the invention is especially applicable to toggle switches of the self-enclosed type.

An object of the invention is to provide an improved positive action switch.

A more specific object of the invention is to provide improved contact means for a positive action switch.

Another specific object of the invention is to provide improved switch structures affording positive action followed by snap action for switch operation together with the use of wiping switch action for maintaining the contacts clean.

Another specific object of the invention is to provide a positive action and snap action switch with improved bridging contact means of the sliding type.

Another specific object of the invention is to provide a combined positive action and snap action switch with improved bridging contacts and means affording contact pressure in the closed position.

Another specific object of the invention is to provide an improved switch structure especially adapted for hermetic sealing.

Other objects and advantages of the invention will hereinafter appear.

These and other objects and advantages of the invention and the manner of obtaining them will best be understood by reference to the following description of an exemplary embodiment thereof taken in conjunction with the accompanying drawing, wherein:

FIGURE 1 is a front elevational view partly in section showing a toggle switch in its open condition;

FIG. 2 is a cross-sectional view showing a top view of the contacts taken along line 2—2 of FIG. 1;

FIG. 3 is an enlarged fragmentary cross-sectional view of the contacts taken along line 3—3 of FIG. 2; and

FIG. 4 is an enlarged fragmentary top view of the contacts showing them in a closed condition.

Referring to FIG. 1, there is shown a toggle switch of the single-pole double-throw type constructed in accordance with the invention. This switch is provided with a substantially rectangular metal housing comprising a cup-shaped base portion 2 open at the top on the rim of which rests the reduced edge portion of a metal indexing plate 4 and a relatively shallow cup-shaped cover portion 6 inverted over the base portion so that its rim rests on



the reduced edge portion of indexing plate 4. The adjacent rims of the base portion and cover portion are secured to one another as by welding over and to the thin edge of the indexing plate, this weld being depicted by 8 in FIG. 1.

Cover portion 6 is provided with a large hole at its center into which is rigidly secured the lower enlarged end of a bushing 10 having a cross pin 12 therethrough above the housing for pivoting therein a toggle lever 14. The toggle lever has a handle portion extending upwardly from the bushing so that it can be grasped by the hand to operate the switch. The toggle lever has a lower end 14*a* projecting into the housing as shown in FIG. 1 and terminating in a spherical end portion extending into a hole in a laterally reciprocable driving plate 16. This hole in the driving plate is round except for approximately its upper half which is frusto-conical in form to provide clearance as the toggle lever is rocked from its middle position to either the left or the right side. For an illustration and description of driving plate 16 and its cooperation with the other parts, reference may be had to H. W. Hults copending application, Serial No. 534,719, filed concurrently herewith.

Bushing 10 is threaded externally so that it can be inserted in a hole in a mounting panel and a nut threaded thereon to secure the switch to the panel.

The switch is provided with sliding contacts of the bridging type so that normal operation maintains them clean to afford a good electrical connection. As shown in FIGS. 1 and 3, base portion 2 of the switch housing is provided at the bottom with holes through which stationary contacts 18, 20 and 22 are connected by connectors 24, 26 and 28, respectively, to suitable external terminals whereby the switch is adapted to be connected to the circuit in which it is used. Stationary contacts 18 and 20 are rigidly secured as by riveting to the upper ends of connectors 24 and 26, respectively. Stationary contacts 18 and 20 have single-end contacting portions projecting toward one another in a substantially common plane with a space therebetween for the movable contact as shown in FIG. 2.

Stationary contact 22 is rotatably secured to the upper end of connector 28. For this purpose, as shown in FIG. 3, connector 28 is provided with a reduced end portion which extends through a hole in stationary contact 22. A bowed spring washer 30 is placed over contact 22 and a split washer 32 is inserted in an annular groove in the extreme end of the reduced portion of connector 28 whereby the contact is resiliently retained while permitting rotation on the connector. Stationary contact 22 is double ended so that the lateral contacting portions extend in opposite directions in overlapping spaced relation to contacts 18 and 20, this spacing being slightly less than the diameter of the movable contact hereinafter described. The stationary contacts are bent so that their contacting portions are offset toward one another into parallel planes to facilitate camming of the round movable contact therebetween. A leaf spring 22*a* is rigidly secured as by welding along its midportion to the middle non-contacting surface of stationary contact 22 and the ends thereof are biased against an interior wall of an insulating base 34 and the extreme ends are bent back to form curved shoes for sliding along the wall of the insulating base without digging thereinto.

The lower portion of base portion 2 is lined with insulating base 34 about half way to its rim as shown in FIGS. 1 and 3. This insulating base has rather thick front and rear walls 34*a* and 34*b* as shown in FIG. 2 to provide flat surfaces on which an actuator block 36 will slide. For this purpose, the upper surfaces of insulating base 34 are provided with rounded grooves 34*c* having a ball bearing 34*d* in each on which the actuator block rolls to reduce friction. This actuator block 36 is molded of insulating material and is similar to that shown and described in my copending application aforementioned except that the cam slot has been eliminated from the lower surface thereof and replaced by a molded-in movable contact 38 as shown in FIGS. 1 and 3. This movable contact 38 is cylindrical in form and has an enlarged head shown in FIG. 3 which is embedded in the actuator block. This movable contact hangs down from the actuator block into the space between the stationary contacts and is wedged between contacts 18 and 22 when the toggle lever is moved in one direction as shown in FIG. 4 or between contacts 20 and 22 when the toggle lever is moved in the other direction. As the movable contact is wedged between the stationary contacts, stationary contact 22 rotates a small amount to allow entry of the movable contact but is restricted and biased by spring 22*a* which provides the required contact pressure.

As shown in FIGS. 1 and 3, a steel plate 40 is rigidly secured as by welding to the bottom of switch base portion 2 of the housing to thicken the bottom. This plate has holes coextensive with and in registration with the holes in the base portion which are substantially larger than connectors 24, 26 and 28 extending therethrough to accommodate insulation whereas the holes in insulating base 34 through which connectors 24, 26 and 28 extend snugly surround these connectors. These holes in base portion 2 and plate 40 around the connectors are filled with vitreous or ceramic material 42 or the like which has the qualities of strength, sealing and electrically insulating. As will be apparent, this material rigidly secures connectors 24, 26 and 28 to the base portion of the housing and electrically insulates them from the latter.

When the toggle lever is pivoted to operate the switch, it slides driving plate 16 relative to actuator block 36 and an arm on the driving plate compresses one of two snap-action helical springs between the driving plate and actuator block for a limited amount of the movement. The details of these springs and driving plate are shown in my copending application aforementioned. When this spring has been compressed a certain amount, lateral arms on the driving plate then engage the actuator block at one end of its spring pocket to afford an unyielding connection from the toggle lever to the movable contact.

The switch is provided with indexing means comprising indexing plate 4 and a pair of spring biased indexing plungers 44, one on each side of the driving plate, one of which is shown in FIG. 1. These indexing plungers are held in slots in the actuator block and are biased upwardly by helical compression springs 46 so that the hemispherical portions thereof are pressed into beveled or counter sunk holes in the indexing plate in the operating and "off" positions of the switch. These indexing plungers and their cooperation are more fully illustrated and described in my copending application aforementioned.

It will be apparent that after the toggle lever has been moved enough to compress the snap-action spring, positive action is applied through the driving plate to slide the actuator block and movable contact 38 mounted thereon. This positive action then causes the hemispherical portions of the indexing plungers to be cammed out of the beveled holes in the indexing plate whereafter the snap-action spring accelerates the actuator block and if the toggle lever was being operated clockwise, the snap-action spring causes the movable contact to be wedged between stationary contacts 18 and 22 as shown in FIG. 4. When the toggle lever is now moved in the other direction, the positive action is applied to break any weld or sticking between the movable and stationary contacts to insure that the switch will be opened.

While the apparatus hereinbefore described is effectively adapted to fulfill the objects stated, it is to be understood that I do not intend to confine my invention to he particular preferred embodiment of positive action switch disclosed, inasmuch as it is susceptible of various modifications without departing from the scope of the appended claims. For example, while the stationary contacts have been shown as mounted in the bottom of the housing, they could as well be mounted in one or both front and rear walls of the base and one or more movable contacts could project horizontally from the actuator block for cooperation therewith.

I claim:

1. In an electric switch, the combination comprising:
an insulating base;
stationary contacts mounted in said base in spaced apart relation;
a movable bridging contact;
an actuator block mounted for sliding movement along said base and having said movable bridging contact rigidly secured thereto to project therefrom so that it enters into sliding engagement between a pair of said stationary contacts when said actuator block is moved;
a manually operable lever;
means providing an unyielding connection for at least a portion of the movement of said lever to transmit positive force for closing or opening the contacts in the event they stick or weld;
means mounting one of said stationary contacts for limited pivotal movement to allow said movable bridging contact to enter between it and another stationary contact to close the same;
and means resiliently biasing said one stationary contact toward said other stationary contact of the pair thereof to afford proper contact pressure for a good electrical connection when the contacts are closed.

2. The invention defined in claim 1, wherein said means providing an unyielding connection comprises:
potential energy storing means effective in response to initial movement of said manually operable lever;
positive action means responsive to further movement of said manually operable lever to cause said actuator block to start moving;
and means responsive during said further movement for rendering said potential energy storing means effective to cause snap action movement of said actuator block and the contact carried thereby.

3. The invention defined in claim 2, wherein said means responsive during said further movement for rendering said potential energy storing means effective comprises:
indexing means for holding said actuator block to any one of a number of different operating positions comprising:
a spring biased indexing plunger mounted on said actuator block and having hemispherical portions;
and a stationary indexing plate against which said hemispherical portions are resiliently pressed and having holes for retaining the latter in any one of a number of different operating positions.

4. The invention defined in claim 1, wherein said stationary contacts comprise:
a pair of stationary contacts extending toward one another in spaced apart relation and having contacting portions offset into a common plane to one side thereof:
and said one pivoted stationary contact having contacting portions extending in opposite directions in overlapping relation to the contacting portions of said pair of stationary contacts and being offset into a common plane parallel with and spaced from the

first mentioned common plane less than the thickness of said movable bridging contact to enable the latter to bridge said pivoted stationary contact to either stationary contact of said pair thereof.

5. The invention defined in claim 4, wherein said resilient biasing means comprises:

a leaf spring rigidly secured at its central portion to said one pivoted stationary contact and the opposite end portions thereof bearing against an internal wall of said base resiliently to oppose pivotal movement thereof.

6. The invention defined in claim 1, wherein said means mounting one of said stationary contacts for limited pivotal movement comprises:

a connector extending into the base and having a reduced end portion with an annular groove;

and a split ring in said annular groove securing said one stationary contact to said reduced end portion.

7. The invention defined in claim 1, wherein said movable bridging contact comprises:

a cylindrical member having an enlarged end portion embedded in said actuator block so that the cylindrical portion thereof projects for movement between the stationary contacts.

8. In an electric switch, the combination comprising:

an insulating base;

a plurality of stationary contacts mounted in said base and having connectors adapted for connecting said stationary contacts to external terminals;

a movable contact for engaging said stationary contacts to complete an electrical connection;

an actuator block having means for directly engaging said movable contact;

a pivoted manually operable lever for moving said actuator block;

combined positive action and snap action means providing an unyielding connection from said manually operable lever to said actuator block forcibly to open the contacts if they stick or weld and immediately thereafter causing snap-action movement of said



movable contact for the remainder of its travel comprising:

a driving member having spring-opposed limited movement relative to said actuator block and direct engagement of said actuator block thereafter under positive action of said manually operable lever;

and indexing apparatus including spring-biased indexing plunger means mounted on said actuator block for movement therewith and a stationary indexing plate having beveled recesses for receiving said plunger means in different positions of the switch;

and said combination further comprising a metal housing for said switch including:

a base portion having a bottom through which the stationary contact connectors extend and an open top and walls on the rim of which said indexing plate rests;

a cover portion having walls registering with the walls of said base portion and the rim of which rests on said indexing plate, the rims of the base and cover portions and the edge of said indexing plate being welded together to form a hermetic seal;

and a bushing rising from the middle of said cover portion and having a pivot pin for supporting said manually operable lever.


**References Cited by the Examiner**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,413,135 | 12/1946 | Baumgardner | 200—16 |
| 2,488,670 | 11/1949 | Koenig | 200—16 |

**References Cited by the Applicant**

UNITED STATES PATENTS

| | | |
|---|---|---|
| 1,956,422 | 4/1934 | H. J. Hammerly. |
| 2,241,469 | 5/1941 | G. J. Meuer. |
| 2,395,036 | 2/1946 | J. A. Chilman. |


ROBERT K. SCHAEFER, *Primary Examiner.*

J. R. SCOTT, *Assistant Examiner.*