

Jan. 7, 1958

T. Y. KORSGREN

2,819,362

SWITCHES

Filed Dec. 9, 1953

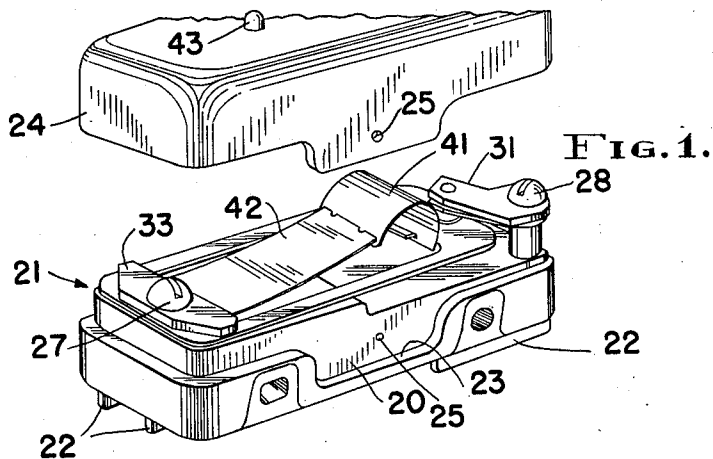


FIG. 2.

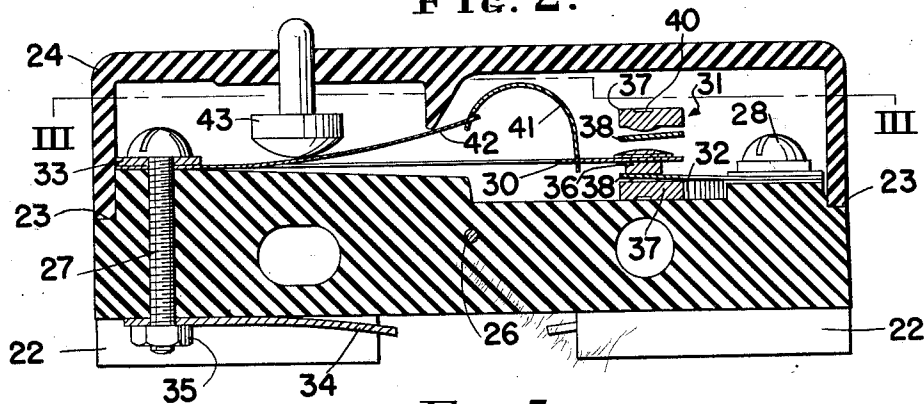


FIG. 3.

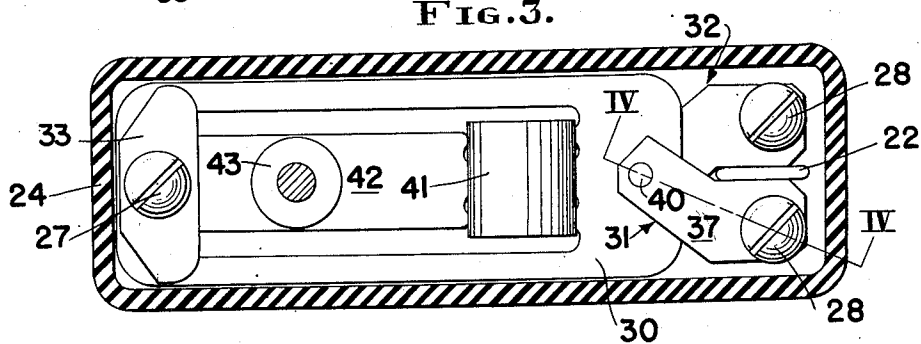
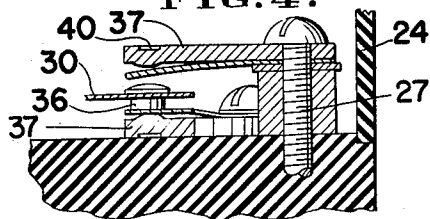


FIG. 4.



INVENTOR.

THEODORE Y. KORSGREN

BY

Herschel C. Omohundro
attorneys

1

2,819,362

SWITCHES

Theodore Y. Korsgren, Columbus, Ohio, assignor, by mesne assignments, to Robertshaw-Fulton Controls Company, Greensburg, Pa., a corporation of Delaware

Application December 9, 1953, Serial No. 397,096

12 Claims. (Cl. 200—67)

This invention relates generally to electrical equipment and more particularly to switch mechanisms used to control electric circuits. Still more particularly the invention relates to precision snap switches of the type requiring minute and/or gradual movement of the actuator to effect their operation. Attempts have been made to use switches of this type in aircraft and guided missiles where continuity of electrical contact is of prime importance, but difficulties have been encountered due to the conditions of extreme vibration, shock and other forces which are inherent in devices of this character. It is important, in providing switches for such use, to so design and construct them that they will have the requisite sensitivity and yet be rugged enough to have a long life and sufficiently high current carrying capacity.

One of the primary objects of this invention is to provide a precision snap switch which will be relatively unaffected by external forces and which will maintain continuity of electrical contact under extreme conditions of vibration and shock ordinarily causing the separation of contacts in switches constructed according to previous designs.

Another object of the invention is to provide a precision snap switch having a differential between the movement required to initiate electrical current conduction and the total movement of the mechanical elements of the switch so that any tendency of the contacts of the switch to separate caused by vibration, shock or other undesirable force will not cause an interruption in current flow.

Another object of this invention is to provide a switch mechanism in which arcing tendencies will be appreciably reduced.

Another object of the invention is to provide a switch mechanism in which the travel of the movable contacting element between on and off positions is retained at a minimum.

Still another object of the invention is to provide a switch mechanism having a movable contact element and one or more relatively stationary contact elements, the mechanism having means for facilitating the completion of current conducting engagement between the contacts prior to the termination of movement of the movable contact.

A further object of the invention is to provide a switch mechanism having a movable blade and one or more stationary contacts for such blade and to dispose a flexible, highly conductive element between the blade and each contact so that the distance travelled by the blade to initially make current conducting engagement will be appreciably less than the distance travelled before movement is interrupted by the stationary contact member, the effect of such construction being to increase the speed of operation of the switch and effectively reduce arcing and consequent deterioration of contacts.

A still further object of the invention is to employ a highly conductive spring material, such as spring silver, for the conductive elements disposed between the movable blade and the stationary contact members of the

2

switch mentioned in the previous paragraph, the spring silver material being highly conductive of electrical current and resistant to arcing, the resiliency of the material being retained under severe conditions of use for sustained periods.

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 form of embodiment of the invention is clearly shown.

In the drawings:

Fig. 1 is a perspective view of a switch formed in accordance with the present invention, the cover for the switch being shown separated from the base;

Fig. 2 is a vertical longitudinal sectional view of the switch shown in Fig. 1;

Fig. 3 is a horizontal sectional view of the switch taken on the plane indicated by the line III—III of Fig. 2; and

Fig. 4 is a detail vertical sectional view on the plane indicated by the line IV—IV of Fig. 3.

Referring more particularly to the drawing, the numeral 20 designates the base of the switch 21 forming the subject matter of the invention. This base 20 is formed of a moldable dielectric material and is provided with suitable reinforcing and/or insulating ribs 22 on the top and bottom surfaces. The side walls are also provided with a suitable shoulder 23 against which the lower edge of the cover 24 may rest when it is applied to the base, these elements being formed with openings 25 which register with one another for the reception of a wire or pin 26 employed to retain them in assembled relationship.

The base is also provided with transversely extending openings through which screws or similar fastening devices may extend to mount the switch for use. Vertical openings also extend through the base for the reception of screws 27, 28 used in mounting the operating elements of the switch on the base. The operating elements comprise a flexible blade 30 and a pair of contact assemblies 31, 32. Blade 30 is secured at one end to the base 20 by screw 27 and a clamp bar 33, the lower end of the screw receiving a connector plate 34 and retaining nut 35. The blade 30 has a contact element 36 mounted in its free end for alternate engagement with contact assemblies 31, 32 which are supported above and below the free end of the blade in the path of movement thereof.

Contact assemblies 31, 32 each include a substantially rigid contact bar 37 formed of brass, copper or other electric current conducting material which may be provided with silver inlays, if desired, and a flexible contact leaf 38 made from a highly conductive spring material, such as spring silver, which possesses extraordinary electric current carrying characteristics in addition to that of retaining resiliency over sustained periods at relatively high temperatures. The contact leaves 38 are clamped or otherwise held at one end in engagement with the stationary contact bars and are initially formed at the other end to project toward the flexible blade. In use, the free ends of the flexible contact leaves are moved into engagement with and backed up by the rigid contact bars 37. Each stationary contact bar has a dimple 40 pressed into it to form a small hump to be engaged by the contact leaf when it is moved by the flexible blade. Since the contact leaves project toward the flexible blade, the latter will engage them a short interval of time before blade movement is discontinued by the stationary contact bars. Each contact leaf will be flexed into engagement with its respective stationary contact bar by the movable blade as it moves toward such stationary contact bar. Due to the high electrical current conducting characteristic of the spring silver or other material selected, good contact will be established as soon as the

contact element 36 engages either of the contact leaves 38. After the flexible blade forces a leaf 38 into engagement with the hump on the adjacent contact bar, current will flow substantially at right angles through the leaf to the stationary contact bar. While the flexible contact leaves receive the full current load when engaged by the flexible blade, they are required to carry this load only the short interval that it takes to move them into engagement with the stationary contacts; they are then backed up by the stationary contacts which are rugged enough to safely carry the full electrical load.

To effect the movement of the flexible blade 30, a spring 41 is provided, this spring being flexed into an inverted U form and having one end connected with the blade 30 adjacent the contact element 36 and the other end connected with a tongue 42 formed by blanking out portions of the center of the blade. The tongue projects from the end portion of the blade secured to the base toward the free end thereof. The tendency of the spring 41 to straighten out urges the blade either up or down depending upon the position of the tongue. Under normal conditions, the tongue 42 is disposed in position to cause the spring to urge the blade downwardly, as shown in Fig. 2. In this condition, the contact element 36 holds the lower contact leaf 38 against the lower contact bar. If it is desired to use the switch as a normally closed one, the current leads are joined with the connector plates 34 connected to the flexible blade and the lower contact bar.

The flexible blade is moved into engagement with the upper contact leaf 38 by depressing the tongue 42 until the spring urges the free end of the blade in an upward direction. The engagement of the blade with the lower contact leaf 38 will be maintained until the end of the spring in engagement with the tongue passes a certain point then the blade will flip upward disengaging the contact thereon from the lower leaf 38 and engaging it with the upper leaf 38. Due to the spring characteristic of the leaves 38, the time interval between disengagement of the flexible blade from the lower leaf and engagement thereof with the upper will be much shorter than in previous switch designs using stationary contact bars alone.

To move the flexible blade, a push button 43 is supported for sliding movement in the top wall of the cover. This button rests against the tongue and, when the button is depressed, it will impart similar movement to the tongue causing the free end thereof to move the adjacent end of the spring in the same direction. Since the button engages the tongue at a point which is relatively close to the point of attachment of the flexible blade, the movement of the button necessary to effect the operation of the switch will be very slight.

It is within the concept of the invention to operate the switch in other ways, the form of operating mechanism shown being selected for illustration only and not for the purpose of limitation.

While the form of embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

I claim:

1. A switch mechanism comprising a dielectric base; a flexible blade secured at one end to said base; a relatively inflexible member mounted on said base in spaced registering relation with the free end of said blade; a flexible contact supported on said base between said inflexible member and the free end of said blade, said contact being formed of a material possessing good current conducting characteristics and being engaged by said blade and moved into engagement with said inflexible member when said blade is flexed toward said member; and means for urging said blade toward said member.

2. A switch mechanism comprising a dielectric base; a flexible blade secured at one end to said base; a pair of

relatively inflexible members mounted on said base at opposite sides of the free end of said blade; resilient means tending to urge said blade toward one of said members; means for moving said resilient means to cause it to tend to urge said blade toward the other of said members; and a flexible contact supported between said inflexible members and the adjacent sides of said blade, said contact members being formed of material possessing good current conducting characteristics and being moved by said blade into engagement with the respective inflexible member when said blade is flexed toward said member.

3. A switch mechanism comprising a dielectric base; a flexible blade secured at one end to said base; a relatively inflexible member mounted on said base in the path of movement of the free end of said blade; a contact supported adjacent said inflexible member, said contact being formed of spring silver and being initially sprung to project into the space between said inflexible member and said blade; and means for flexing said blade into engagement with said contact to move the latter into engagement with said inflexible member.

4. A switch mechanism comprising a dielectric base; a flexible blade supported at one end on said base, the opposite end of said blade being movable when said blade is flexed; a pair of relatively inflexible members disposed in electrically spaced order on opposite sides and in the path of movement of the free end of said blade; a contact supported adjacent each inflexible member, said contacts being formed of spring silver and being initially sprung to project into the space between the respective member and the adjacent side of said blade; and means for flexing said blade to move it into engagement with either of said contacts and the latter into engagement with the respective inflexible member.

5. A switch mechanism comprising a dielectric base; a flexible blade supported at one end on said base, the opposite end of said blade being movable when said blade is flexed; a relatively inflexible member supported by said base on each side of the movable end of said blade and in the path of movement thereof; a spring silver leaf disposed in engagement with each inflexible member at its point of support and initially flexed away from said member into the spaces between said members and said blade; and spring means causing the free end of said blade to move toward one or the other inflexible member, said blade engaging the respective contact and moving the same toward said inflexible member.

6. In a snap switch of the precision type, a contact element supported for movement between "off" and "on" positions; a second contact element stationarily disposed to discontinue the movement of said movable element in its "on" position; and a supplemental flexible highly conductive contact element projecting into the space between said movable and stationary contacts when the former is in "off" position, said supplemental contact element being flexed into engagement with said stationary contact by the movement of said movable contact into "on" position.

7. In a snap switch of the precision type, a contact element supported for movement between "off" and "on" positions; a second contact element stationarily disposed to mechanically locate said movable contact element in the "on" position; means for establishing an electrical connection between said contact elements before said movable contact element reaches the "on" position determined by said second contact element, said means having a flexible highly conductive spring leaf projecting into the space between said contact elements and electrically connected to one thereof.

8. In a snap switch of the precision type, a contact element supported for movement between "off" and "on" positions; a second contact element stationarily disposed to mechanically locate said movable contact element in the "on" position; means for establishing an electrical connection between said contact elements before said mov-

able contact element reaches the "on" position determined by said second contact element, said means including a leaf of highly conductive spring material overlapping one of said contact elements and formed to project toward the other.

9. In a snap switch of the precision type, a pair of substantially rigid contact elements supported in spaced relation; a third contact element supported for movement between circuit closing positions mechanically located by said rigid contact elements; means for shortening the length of the electrical movement differential over the mechanical movement differential, said means including a leaf of highly conductive spring material adjacent each rigid contact element and projecting into the path of movement of said third contact element.

10. A switch mechanism comprising an insulated base; a movable contact element on said base; a relatively stationary contact element supported in spaced relation from and in the path of movement of said movable contact element; and a flexible leaf member projecting into the space between said movable and stationary contacts, said leaf member being electrically connected with said stationary contact and formed of highly conductive spring material, said leaf member also being engaged by said movable contact element and moved into engagement with said stationary contact.

11. In a snap switch of the precision type, a base; a substantially rigid contact element supported on said base; a second contact element supported for movement toward and away from a circuit closing position mechanically located by said rigid contact element; means for shortening the length of the electrical movement differential over the mechanical movement differential, said means including a leaf of highly conductive spring material disposed in current transmitting contact with said rigid contact element and projecting into the path of movement of said second contact element, said leaf being engaged by said second contact element and held in engagement with said rigid contact element by said

second contact element when the latter is in circuit closing position.

12. In a snap switch of the precision type, a base; a substantially rigid contact element supported on said base; a second contact element supported for movement toward and away from a circuit closing position mechanically located by said rigid contact element; means for shortening the length of the electrical movement differential over the mechanical movement differential, said means having a leaf of highly conductive spring material connected at one end with said rigid contact element, the other end of said leaf projecting into the path of movement of said second contact element, the latter end of said leaf being engaged by said second contact element and held in engagement with said rigid contact element by said second contact element when the latter is in circuit closing position.

References Cited in the file of this patent

UNITED STATES PATENTS

1,879,349	Lederer	Sept. 27, 1932
1,989,277	Jeffrey	Jan. 29, 1935
2,077,362	Holmes	Apr. 13, 1937
2,077,622	Field	Apr. 20, 1937
2,098,032	Favre	Nov. 2, 1937
2,237,705	Kohl	Apr. 8, 1941
2,265,297	Little	Dec. 9, 1941
2,418,068	Cornelius	Mar. 25, 1947
2,425,159	Meyer	Aug. 5, 1947
2,429,069	Murray	Oct. 14, 1947
2,490,280	Rees	Dec. 6, 1949
2,558,219	Kohl	June 26, 1951
2,558,258	Kohl	June 26, 1951
2,571,780	Stoller	Oct. 16, 1951
2,644,052	Martin	June 30, 1953
2,727,114	Kesselring	Dec. 13, 1955
2,742,543	Hurd	Apr. 17, 1956