SNAP ACTING OVERRUNNING MOTION TRANSFER MEANS
FOR ELECTRICAL SWITCH

Fig. 1.

Fig. 3.

INVENTOR,
CARL N. JOHNSON,
SNAP ACTING OVERCENTERING MOTION TRANSFER MEANS FOR ELECTRICAL SWITCH

Carl N. Johnson, Braintree, Mass., assignor to Texas Instruments Incorporated, Dallas, Texas, a corporation of Delaware

Filed Jan. 3, 1966, Ser. No. 518,360

4 Claims. (Cl. 200—67)

This invention relates to snap acting, electrical switches of the overcenter type which are capable of being actuated by externally operated motion transfer member.

It is an object of the instant invention to provide an improved electrical overcenter switch which achieves maximum forces retaining the contacts in engagement to minimize contact bounce, which requires minimum operating forces and hence a minimum amount of work for switch operation, that is for switching from one position to another. It is a further object of the instant invention to provide an improved overcenter type switch in which the forces tending to separate contacts in engagement are relatively high at points relatively close to the operating point of the switch.

Other objects will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction and arrangements of parts which will be exemplified in the structures hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings of which one of the various possible embodiments of the invention is illustrated,

FIG. 1 is a plan view partly in section and partly broken away of an overcentering switch including a thermally responsive actuating device;

FIG. 2 is a sectional view taken on line 2—2 of FIG. 1;

FIG. 3 is a view similar to FIG. 1 of a portion of the device showing it in overcentered position;

FIG. 4 is a view taken on line 4—4 of FIG. 1; and

FIG. 5 is an exploded perspective view of portions of the device shown in FIG. 1.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

Dimensions of certain of the parts as shown in the accompanying drawings have been modified for the purposes of clarity of illustration.

Referring now to the drawings there is shown in FIG. 1 an actuator and overcenter switch combination generally referred to by reference numeral 10. The device 10 includes a thermally responsive actuator generally indicated by reference numeral 12 and an overcentering electrical switch according to the instant invention generally designated by reference numeral 14. Thermally responsive actuator 12 includes a cup-shaped housing 16 on one end of which is formed a shoulder 18 on which rests a disc or diaphragm 20 which may be of the bimetallic snap-acting type. Disc 20 may include a deformed portion responsible for its snap action. Thermally responsive switch 12 also includes an end plate 22 formed of a thermally conductive material and including an annular shoulder portion 23 formed therein which operates to retain disc 20 in position. Thermally responsive actuator 12 also includes a wall portion 24, a housing 16 through which is formed an aperture 25 in which is received a motion transfer member 26 formed of a suitably electrically insulating material. One end of motion transfer member 26 abuts the central portion of disc 20 and is movable in response to movement of disc 20 between the solid-line position shown in FIG. 1 and the dotted-line position shown in FIG. 1. The other end abuts a portion of overcenter switch to be described.

As shown in FIG. 1, overcenter switch 14 includes a header plate 30 which closes the cup-shaped portion of housing 16 to form a cavity or recess 31. The switch 10 may be made hermetically sealed if desired and in which case housing 16 and 30 may be formed of a corrosion resistant metallic material and may be joined by welding as at 32. As shown in FIG. 1, header plate 30 includes apertures 33 in which are received terminals 35, 36 and 37. The terminals 35, 36 and 37 are retained in apertures 33 by glass sealing material 38 which provides hermetic sealing for the cavity 31.

Mounted in electrically conductive relationship on terminals 35 and 36 are upper and lower lower and actuating spring arms 52 and 54 all of which are cantilever mounted on terminal 35. The fixed ends of the cantilever mounted springs are sandwiched between washers 56 and end terminal 35 is riveted over as at 58 to retain the cantilever mounted springs in fixed position.

Mounted on the free ends of cantilever mounted resilient member 50 are upper and lower actuating arms 52 and 54 (as viewed in FIG. 1) which may be, for example, silver contact buttons mounted in electrically conductive relationship on the member 50. It will be noted that contacts 60 and 62 are mounted for engagement respectively with conductive portions 43 and 45 in washers 40 and 41.

It will be seen in FIGS. 2 and 5 that cantilever mounted member 50 includes an aperture 66 thrust out of its central position, on which is provided a tongue 68. A U-shaped compression spring 70 includes a slot in one end thereof 72 in which is received tongue 68 to connect end of the U-spring to the cantilever member, contact-carrying spring members at a point intermediate the cantilever mounting and te contact carrying free end of a resilient member 50. Lower actuating spring 54 includes a tongue portion 74 which is received in a corresponding slot 76 in the other end of U-shaped compression spring 70 to provide a tongue and slot connection between the other end of U-shaped compression spring 70 and the free end of lower actuator spring 54.

It will be noted that cantilever mounted, resilient upper actuator spring 52 lies along and is in intimate contact throughout a major portion of its length with lower actuator spring member 54. The free end of upper actuator spring 52 includes a bent-out portion 80 which avoids the projection end of U-shaped spring 70 in which slot 76 is contained. Bent-out portion 80 includes a slot 82 in which is received the distal end of tab 74 to provide a connection between the end of tab 74 and actuator 54 and upper resilient actuator spring arm 52.

Bent-out portion 80 has a further function in that in the arrangement shown in the drawings projects through aperture 66 in contact-carrying arm 50 and abuts the lower end of motion transfer member 26, whereby movement of the motion transfer member 26 between the upper position shown in FIG. 1 and the lower or depressed position shown in FIG. 2 (which corresponds to the dotted line position of disc 20 shown in FIG. 1), is transferred through actuating springs 52 and 54 to overcenter U-shaped spring.

It will be understood that if desired contact carrying member 50 may be positioned below actuating members 52 and 54, 70 to resilient spring member 50 through tab 58 on slot 72 and contacts 60 and 62 to cause the con-
It will be seen that a relatively low operating force is required to operate the switch, that is, the force which is required to move motion transfer pin 26 in order to move the device to the overcenter position is relatively low. In addition, it will be seen that the contact forces decrease at a very high rate and hence pass through the regions of low contact force very rapidly. This diminishes the contact bounce and provides high vibration resistance. This is in contrast with the operation of prior art devices where high rates of decrease in contact forces are obtained only by the use of very high operating forces. The construction of this device is ideally adapted to use with actuators developing low forces since relatively low operating forces are required to operate the switch 14.

I claim:

1. A snap-acting electrical switch comprising in combination:
   (a) a base;
   (b) a stationary electrical contact mounted on the base;
   (c) a first resilient member cantilever mounted at one of its ends on the base;
   (d) a movable electrical contact mounted on the first other end of the cantilever mounted resilient member in position for movement into and out of engagement with the stationary electrical contact;
   (e) a second resilient member cantilever mounted at one of its ends on the base;
   (f) a U-shaped compression spring, one end of which is connected with the free end of the second cantilever mounted resilient member and the other end of which is connected with a portion of the first resilient cantilever mounted member at a point intermediate its ends;
   (g) a motion transfer member having one end thereof abutting the free end of the second resilient cantilever mounted member; and
   (h) a third resilient cantilever mounted member lying along the length of the second resilient member in intimate contact therewith and having a first portion thereof protruding through an aperture in the first cantilever mounted member for engagement with the motion transfer member, the third resilient member including a further portion connected to a portion of the second resilient member whereby movement of the motion transfer member is transmitted to the U-shaped spring through the second and third resilient cantilever mounted members to cause the U-shaped spring to move through an overcentering position thereby causing the first resilient member to snap move the contacts into and out of engagement.

2. A device as set forth in claim 1 including a third resilient cantilever mounted member overlying the second resilient member and having a protruding portion thereof protruding through an aperture in the first cantilever mounted member for engagement with the transfer member.

3. A device as set forth in claim 1 wherein a pressure sensitive actuator device operates the motion transfer member.

4. A device as set forth in claim 1 wherein the first, second, and third resilient members are cantilever mounted at the same portion of the base and wherein the second resilient member includes a tab portion projecting through slots in the U-shaped spring and the third resilient member.

References Cited

UNITED STATES PATENTS

2,458,518 1/1949 Kohl.
2,507,065 4/1950 Trautman.

ROBERT K. SCHAFFER, Primary Examiner.
D. SMITH, Jr., Assistant Examiner.