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[54] **SNAP-ACTION ELECTRIC SWITCH**

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[58] **Field of Search**..................200/67 D, 83 P, 67 R

[56] **References Cited**

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[57] **ABSTRACT**

The invention relates to a snap action electric switch assembly in which the contact system is completely separated from the snap action system. The separation feature allows adjustments of the snap action system without affecting other properties of the switch.

3 Claims, 3 Drawing Figures

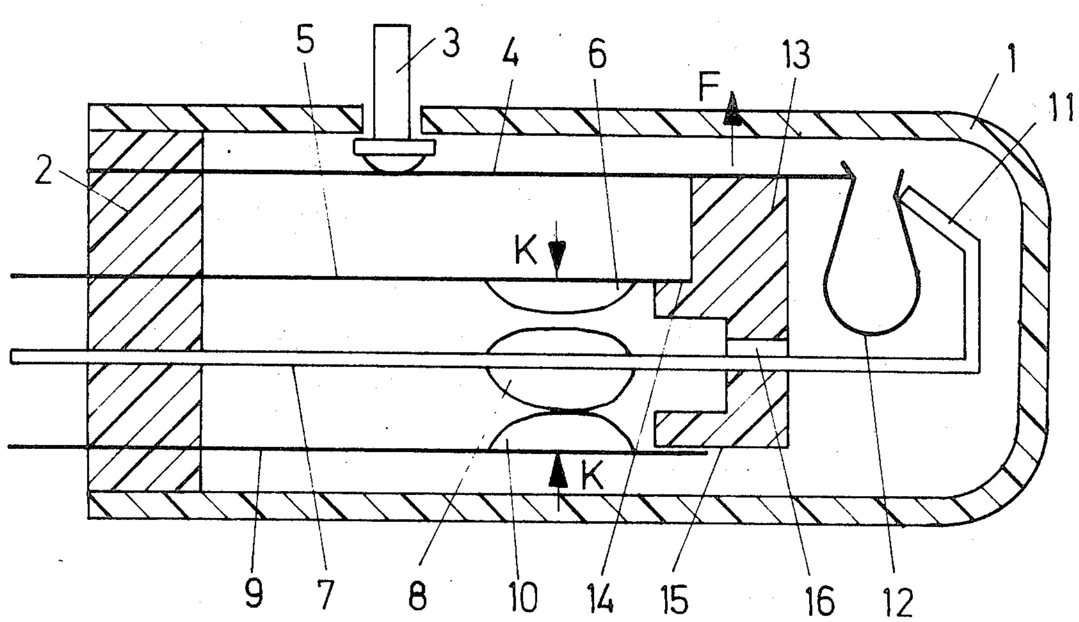
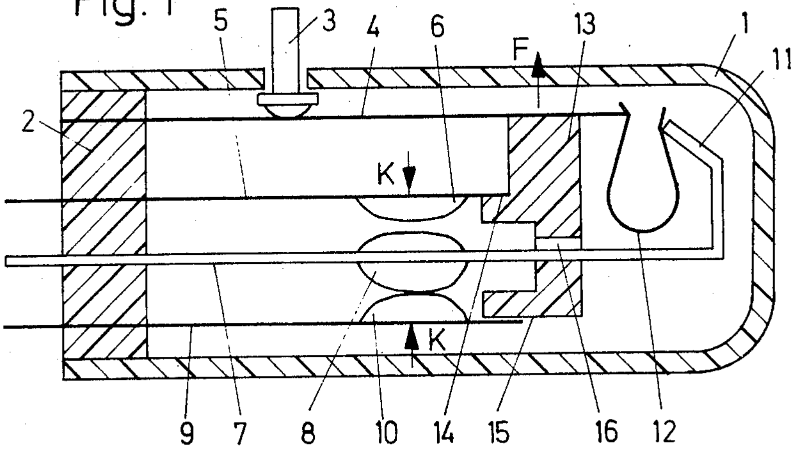


Fig. 1



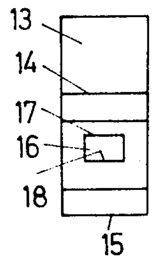


Fig. 2

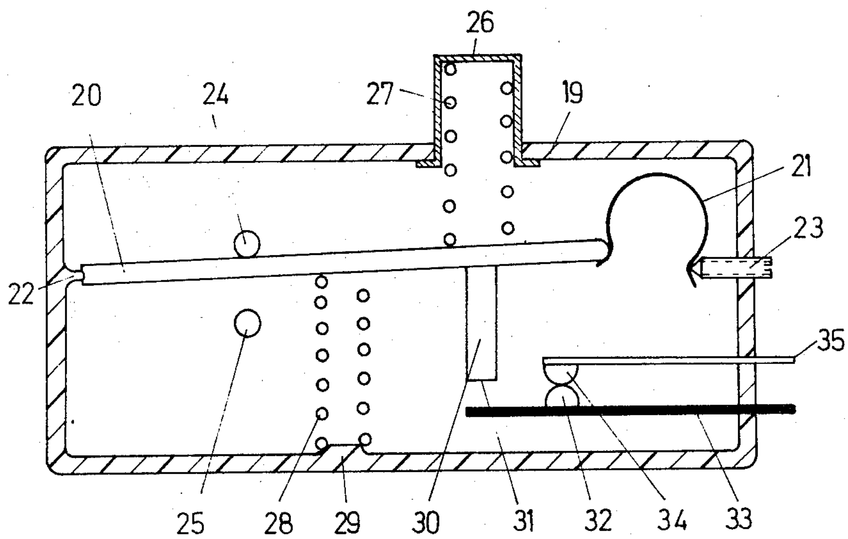


Fig. 3

SNAP-ACTION ELECTRIC SWITCH

The invention relates to a snap-action electric switch having a snap-action system which can be switched over in dependence upon the distance travelled by an actuating element.

Switches of this kind that are actuated in dependence upon distance are widely used in the form of micro-switches. They comprise a three-part snap-action system, i.e., an actuating lever, a contact lever and a snap-action spring. A plunger acts on the actuating lever, and when the plunger is displaced it moves the actuating lever through a dead-center position, where-upon the contact lever moves suddenly from a first position to a second position. The actuating lever follows the return movement of the plunger. A dead-center position is again reached in which the contact lever springs back into its first position.

In this system difficulties arise in adjusting the difference, i.e., that distance that the plunger has to travel between the two switching operations, since this difference is dependent upon the distance that the contact lever has to travel. However, the greater this distance, the greater is the impact velocity and thus the tendency of the switch to bounce. The behavior of the switch during its operation therefore varies with alteration of the difference. Furthermore, the difference may not fall below a predetermined minimum value since a predetermined minimum distance must be present to enable the system to snap over.

Snap-action switches are also known which have a snap-action system consisting of only two parts, i.e., only a lever in addition to the snap-action spring. If this lever is subjected to an actuating force, i.e., if it is actuated in a condenser thermostat by an operating element filled with saturated steam, or takes a form of a bimetal in a room thermostat itself, then the snap-over action takes place as soon as the actuating force overcomes the force of the snap-action spring effective in the at-rest position. In this connexion a force-proportional snap-action switch of this kind comprising a bimetal lever is also known in which the movable contact of the snap-action system is independently pressed in a resilient manner against the fixed contact and is separated from this contact by the snap-action system.

The object of the invention is to provide a distance-responsive snap-action switch of the initially described kind in which the above-mentioned difficulties in adjusting the difference can be avoided.

According to the invention this object is achieved by the snap-action system consisting of only one lever and a snap-action spring, by the movable contact of the snap-action system being pressed independently against the fixed contact in a resilient manner and being separable from the fixed contact by the snap-action system, and by a change-over spring being fitted between the actuating element and the snap-action system.

With this switch, adjustment of the difference, whether carried out at the point where the switch is fitted or in the factory where it is manufactured, does not lead to any appreciable changes in the other properties of the switch. This is due not only to the separation of the contact system from the snap-action system, but also to the fact that the snap-over distance remains substantially the same for all adjustments of the difference, since the difference can be obtained by adjusting the snap-action spring and thus its characteristic curve. The spring provided between the actuating element and the snap-action system changes the initial factor effecting pure distance control into an initial force factor adapted to suit the snap-action system here under consideration. Moreover, because of the force adjustment, considerably smaller differences may be set than have been possible in the case of the known micro-switches. Additionally, assembly is easier since only a single movable linkage point is present. Furthermore, it is unnecessary to cause the snap-action system to snap-over through a dead-center point. Instead, the two positions into which the system snaps over may be located on one side of the line connecting the two fixed linkage points of the snap-action system.

A particularly simple construction results if the changeover spring is formed by a lever portion located between the point of engagement of the actuating lever and the link of the snap-action spring. This results in an arrangement which saves a great deal of space. If the entire lever is formed as a resilient element, no additional element at all is required for the change-over action.

It is very advantageous if an insulating book carries the lever, a fixed stay, which provides at its bent-over end the fixed bearing for the snap-action spring, and at least one spring carrying a contact, all these being disposed substantially parallel with each other, and if the stay carries the fixed contact, and a contact-separating element is fitted on the lever near the link with the snap-action spring. This results in a snap-action switch which is very small and occupies little space, while retaining all the above-stated advantages.

It is also advantageous if a movable contact, actuated by the contact-separating element, is provided on each side of the fixed contact. The snap-action switch can then be used as a change-over switch.

Also, the contact-separating element may carry the stops which limit the distance travelled by the snap-action system and which co-operate with the fixed stay. When the snap-over distance is fixed by these stops, no substantial changes in the other aspects of the behavior of the snap-action switch occur when adjusting the difference.

The invention will now be described in greater detail by reference to two embodiments illustrated schematically in the drawing, in which;

FIG. **1.** Is a schematic section through a first embodiment of the invention,

FIG. **2.** Is a side view of the contact-separating element,

FIG. **3.** Is a schematic drawing of a second embodiment.

FIGS. **1** and **2** illustrate an embodiment in which a cup-shaped casing **1** of plastics material is closed at one end by an insulating block **2.** An actuating element **3** extends through a hole in the casing **1.**

The insulating block carries: a lever **4** in the form of a leaf spring, a contact spring **5** carrying a movable contact **6,** a rigid stay **7** carrying a fixed double contact **8,** and a movable contact spring **9** carrying a movable contact **10,** these elements being supported in the block in the order in which they are mentioned, beginning with the lever **4** at the top. The stay **7** has a turned-over end **11.** Between this end and the lever **4,** is held a snap-action spring **12** in the form of the Greek letter Omega. The lever **4** carries a contact-actuating element

13 of insulating material. This element comprises two stop faces 14 and 15 which co-operate with the free ends of the contact springs 5 and 9; the contact-actuating element also contains an opening 16 comprising two stops 17 and 18. The stay 7 extends through this opening.

The resilient lever 4 has a bias which applies a force F in the upper end position illustrated. Consequently the contact-separating element is pulled upwards until the stop 18 bears against the stay 7. The upper contact 6 is separated from the fixed contact 8. The lower contact 10 bears against the fixed contact 8 under the force K of its spring 9. It should be added that, in addition to the force F, an upwardly directed force component is also derived from the snap-action spring 12.

If the actuating element 3 is now depressed by means of a rigid operating element of the kind usually employed for actuating a micro-switch, the resilient lever 4 is downwardly deflected near the actuating element 3. However, the end connected to the snap-action spring remains in position until the force F reverses its direction at that point and finally exceeds the force component of the snap-action spring 12. At this moment the system snaps over into the lower end position in which the contact-separating element 13 bears by the upper stop 17 against the stay 7. When the snap-over action occurs, the contact 10 is separated from the fixed contact 8. At the same time the movable contact 6 is released and bears against the fixed contact 8 under the force K of its spring 5. If the actuating element 3 is now returned to its initial position, the full bias F of the resilient lever 4 becomes effective, and the snap-action system springs back into the at-rest position illustrated.

The difference in this snap-action system is adjusted by varying the extent of the bend at the end 11 to vary the clamping force on the snap-action spring 12. In this way, although the force necessary for effecting the snap-action and thus the distance that the actuating element 13 has to travel are altered, the function of the snap-action switch nevertheless remains unchanged in the actual snap-over action. This is particularly so at regards the slight bounce which, for all switches in a production batch, can be kept extremely low by appropriate choice of size of the elements involved, even when the switches have greatly varying difference adjustments. Furthermore, very slight difference adjustments can be obtained so that even slight displacement of the actuating element 3, such as could not be obtained with the known distance-responsive snap-action switches, can suffice for effecting the snap-action.

In the embodiment illustrated in FIG. 3, a rigid lever 20 and an omega-shaped snap-action spring 21 are held in a resilient manner in a casing 19 between two bearings 22 and 23. The bearing 23 is constituted by a set-screw. This two-part snap-action system can snap-over between the stops 24 and 25 solid with the casing. The actuating element is a hollow knob 26 which acts on the rigid lever 20 through a change-over spring 27. A return spring 28 is supported on a stud 29 on the casing and moves the lever 20 back to the at-rest position as

illustrated. A contact-actuating element 30 is secured to the rigid lever 20 and through a stop face 31 acts upon a spring 33 carrying a moving contact 32. In the at-rest position illustrated, the contact 32 co-operates with a fixed contact 34, the carrier 35 of which, like the contact spring 33, passes outwardly through the wall of the casing 19 to enable a connection to be made.

With this arrangement too, the snap-action system remains at rest until the actuating element 26 has travelled such a distance that the force applied by the change-over spring 27 to the lever 20 overcomes the force component of the snap-action spring 21. The snap-action movement then proceeds as far as the fixed stop 25, the movable contact 32 being separated from the fixed contact 34. When the actuating element 26 moves back into the initial position as illustrated, the snap-action system is returned to the initial position by the return spring 28. The difference can be very accurately adjusted with the aid of the set-screw 23, without any of the other aspects of the switch being altered in any way.

There are of course other possible ways of varying the operational factors of the switch, for example by altering the positions of the stops 24 and 25, by adjusting the change-over spring, by adjusting the return spring 28 and so on.

I claim:

1. A snap action electric switch assembly comprising, a frame, a lever having one end thereof pivotally mounted relative to said frame, rigid abutment means, said abutment means comprising a J-shaped bracket attached to said frame, a snap action spring between said J-shaped bracket and the other end of said lever, fixed and movable contacts with said fixed contacts being attached to said J-shaped bracket, resilient means attaching said movable contact to said frame and providing a range of movement for said movable contact, operator means for moving said lever, actuator means attached to said lever for engaging said resilient means to move said movable contact out of engagement with said fixed contact, said actuator means being spaced from said resilient means and said movable contacts when said contacts are closed, said actuator having walls defining an opening through which said J-shaped bracket extends, said walls engaging said J-shaped bracket to provide stops for said actuator in opposite directions.

2. A snap action switch assembly according to claim 1 wherein said operator means engages said lever at a point thereon spaced from said snap action spring, said lever being resilient between said point and said snap action spring.

3. A snap action switch assembly according to claim 1 wherein said frame has the form of a cup shaped member closed with an insulator block, said one end of said lever being fixedly attached to said block, said J-shaped bracket being attached to said insulator block and extending parallel to said lever, said actuator means extending transversely relative to said lever.

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