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[56]

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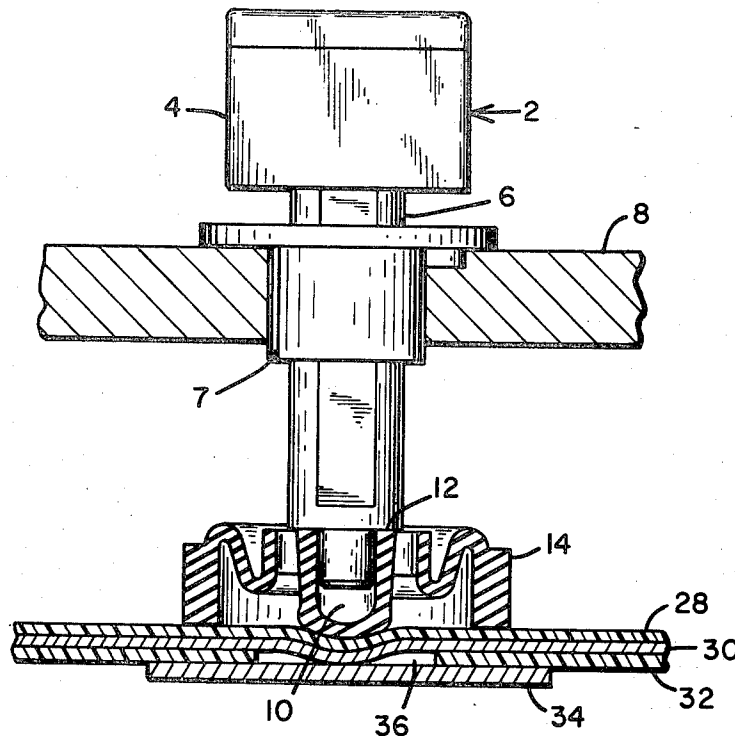
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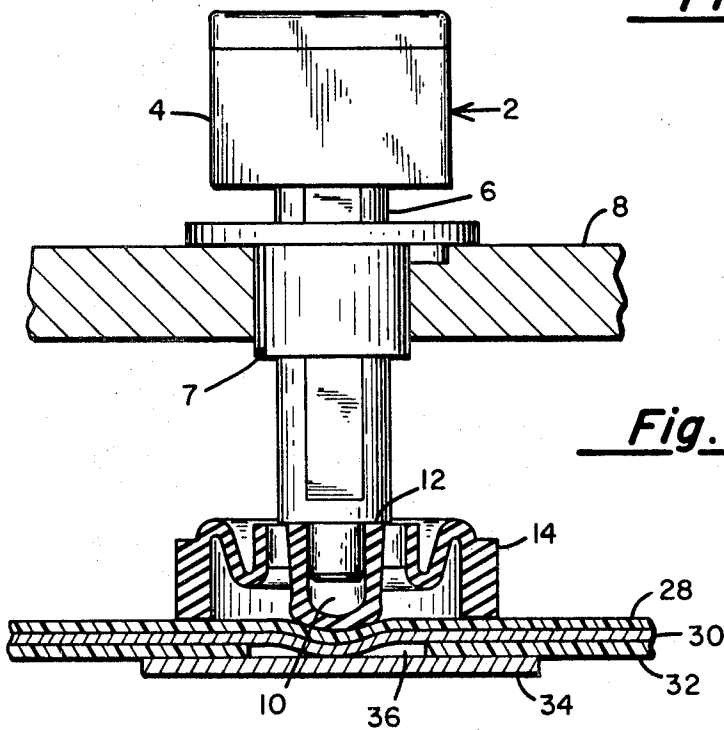
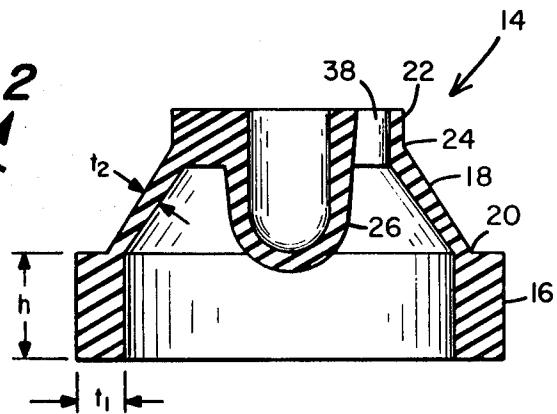
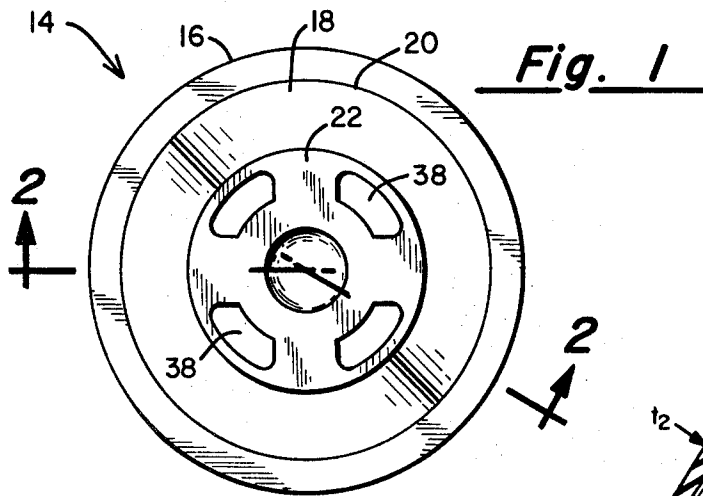
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[54] **SNAP ACTION SWITCH**
2 Claims, 3 Drawing Figs.

[52] U.S. Cl..... **200/159 B,**
200/67 DA, 200/76
 [51] Int. Cl..... **H01h 3/12**
 [50] Field of Search..... **200/67 DA,**
168 G, 159 B; 197/98, 102-104; 233/145; 267/159

ABSTRACT: An improved electrical switching arrangement wherein a diaphragm-type switch element is operated by a plunger mechanism having a novel molded elastomer return spring operatively associated with the plunger element for providing "snap action."





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SNAP ACTION SWITCH

SUMMARY OF THE INVENTION

Many forms of diaphragm switches are known in the art. For example, in the Krakinowski patent 3,308,253, there is shown a diaphragm-type switch wherein two metallized layers are separated by an insulating sheet and formed within the insulating sheet is an aperture such that when pressure is applied to one side of the metallized layers, the layer deforms through the aperture and makes contact with the other metallized layer. It has been found convenient to utilize diaphragm-type switches in the implementation of keyboards of the type used in electric typewriters or similar data entry device. In order to adapt the diaphragm-type switch into such a keyboard, it is necessary to provide a key mechanism for deforming the diaphragm which has the "touch" or "feel" of a typewriter key when operated. Similarly, it is often a requirement that a keyboard of the type described be relatively inexpensive, but reliable over many years of service.

The present invention provides a novel return spring mechanism which cooperates with the diaphragm-type switch and the keyboard-type switch plunger to provide a "snap action" feel to the plunger as it is depressed against the metallized layer forming the diaphragm switch. The return spring of the present invention comprises a molded hollow body, preferably formed from a suitable elastomer material, which includes three integrally formed sections, namely, a lower cylindrical section having a predetermined thickness, a frustoconically shaped center section having a thickness substantially less than the thickness of the lower cylindrical member and a third solid cylindrical section forming a top to the frustoconical center section. Projecting inwardly from the top section is a hollow protrusion which is dimensioned to frictionally engage the shaft on the plunger. The design of the wall configuration provides for a breakaway point as the spring is being depressed, thereby giving a snap-action feel to the key as it is depressed. The resiliency of the material after breakaway has occurred remains sufficient to act as a return spring for the plunger thus allowing the switch to open and the key to return to its rest position. The ball-like center part of the molded spring makes contact with the metallized layer of the diaphragm and forces the metallized layer into contact with the lower conductive pad causing the switch to be closed. The compressing of the protrusion against the foil prevents or limits the tendency of the plunger to bounce, thus minimizing the disadvantageous contact bounce problem. Furthermore, air release holes are provided in the uppermost portion of the return spring to allow air to escape from the molded spring member as the key is depressed and to again enter when the key is released, thus eliminating pressure and suction effects which would otherwise be created.

Accordingly, it is the primary object of the present invention to provide an improved keyboard switch mechanism.

Another object of the invention is to provide a novel return spring for use in diaphragm-type switches.

These and other objects will become apparent from the following more particular description of the preferred embodiment of the invention as illustrated in the accompanying drawings in which:

FIG. 1 is a top view of the novel return spring utilized in the present invention,

FIG. 2 is a cross-sectional view taken along the line 2—2 in FIG. 1,

FIG. 3 illustrates the switch mechanism forming the preferred embodiment of the present invention when in an activated condition.

Referring first to FIG. 3, there is shown a typewriter keylike plunger 2 having a rectangular head 4 connected to a plunger shaft 6. The shaft 6 is slidably engaged in a collar 7 mounted in a keyboard 8 to permit reciprocating motion thereof while preventing rotation. The lower end of the plunger shaft 6 frictionally engages the sides of an aperture 10 formed in the

upper surface 12 of the return spring 14 in a manner to be described further hereinbelow.

Before continuing with the description of the switch assembly of FIG. 3, reference will first be made to the configuration of the return spring as it is illustrated in FIGS. 1 and 2. In FIGS. 1 and 2, the return spring 14 is shown in its relaxed state, i.e., when no pressure is applied to the plunger element. As can best be seen from the cross-sectional view of FIG. 2, the return spring of this invention can be considered as comprising three sections which are integrally formed with one another as by molding. The first section, which may be conveniently termed the base, comprises a hollow cylinder or toroid 16. The section 16 has a predetermined thickness t_1 and a height h . Integrally formed with the bottom section 16 is a center section 18 which can best be described as a hollow frustum of a cone. The thickness of the wall of this center section varies from a minimum at the junction point 20 to a maximum at the upper end of the frustum of the cone but can be considered to have an average thickness t_2 . The thickness of the wall t_2 is substantially less than the thickness of the wall t_1 to thus provide a breakpoint at the junction 20.

The third section of the return spring 14 comprises a solid cylindrical top section 22 which is formed integrally with the upper end of the center section 18. The thickness of this upper section 22 is substantially greater than that of the wall of the middle section 18 such that a breakpoint is also formed at the junction 24 between the center section 18 and the upper section 22.

Formed within the hollow confines defined by the sections 16, 18 and 22 is an inwardly extending hollow protrusion 26 depending from the upper section 22. As can be seen from FIG. 2, the protrusion 26 extends downwardly beyond the breakpoint 20 such that when the spring member 14 is depressed, the protrusion 26 firmly abuts the surface of the diaphragm switchplate with which it cooperates.

Referring again to FIG. 3, the return spring 14 is illustrated in its depressed state. It is to be especially noted that the center section 18 folds at the breakpoints 20 and 24 so that the upper section 22 is telescoped within the lower section 16. The walls 16 of the lower section rest against an upper metallized layer 28 consisting of a sheet of Mylar having a metallic strip 30 affixed thereto. An insulating layer 32 normally maintains the metallization layer 30 out of contact with the lower conductive pad 34. However, the insulating layer 32 is provided with a plurality of apertures 36 at predetermined locations. Associated with each one of these locations is a key member 2 and a return spring 14.

As the key is pressed downward, a breakpoint is reached and the plunger 6 moves downward rapidly to force the protrusion 26 against the metallized layer 28 such that contact is made between the conductive strip 30 and the conductive plate 34. The compression of the protrusion 26 against the Mylar covered copper foil minimizes the bounce tendency present when two rigid or semirigid materials are brought together, thus providing the antibounce feature of the switch. The compression of the protrusion 26 also provides an over-travel feature, allowing the key to be depressed some distance beyond the point of switch closing. This is desirable for the reason that human factors engineers have determined that switches which "make" before reaching the end of travel permit higher typing rates.

Referring again to FIG. 1, there are shown a plurality of air relief holes 38 which as mentioned earlier, permit air to escape from the return spring as the key is depressed and to again enter the return spring when the key is released to thereby eliminate any suction effects or pressures that would otherwise be created upon actuation and release of the plunger.

While I have described a preferred embodiment of my invention, those skilled in the art will readily appreciate that the principles of this invention can be embodied in other forms of springs in accordance with the language and spirit of the claims which follow.

What is claimed is:

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1. An electrical switch assembly comprising in combination:
first and second conductive surfaces;
an insulating surface having an aperture therein disposed
between said first and second conductive surfaces to nor-
mally maintain said conductive surface out of contact
with one another;
a switch actuating plunger mounted in a guide means for
reciprocating motion therein, and
a return spring adapted to be mounted on said plunger and
placed in a juxtaposed position with respect to said aper-
ture, said return spring comprising a hollow body of
elastomeric material having a cylindrical wall portion of a
thickness, t , a frustoconical-shaped portion integrally
formed on top of said cylindrical portion having a
thickness $t_2 < t_1$, and a top surface extending perpendicu-
lar to the common axis of said cylindrical portion and said

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frustoconical portion, said top surface having formed
therein an inwardly extending hollow protrusion aligned
with said common axis for frictionally engaging said
plunger, wherein pressure applied to said plunger causes
said frustoconical portion to telescope within said cylin-
drical portion.

2. An article of manufacture comprising a molded
elastomeric material having three concentric portions includ-
ing a first hollow cylindrical portion of thickness, t_1 , a second
hollow frustoconically shaped portion integrally formed on
the upper end of said first portion of a thickness $t_2 < t_1$ and a
third solid cylindrical portion integrally formed on top of said
second portion, said third solid cylindrical portion having an
inwardly extending hollow protrusion integrally formed
therein.

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