

12

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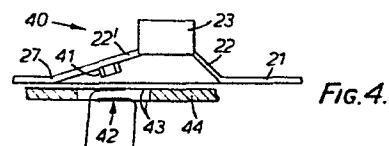
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## 54 **Keyboard Switch.**

57 A keyboard switch (40) includes a portion of a sheet (21) of moulded silicone rubber having raised sides (22, 22') supporting a key button (23). A projection (41) on one of the raised sides (22') bears on membrane switch electrical contacts (42) when the key button (23) is depressed. One raised side (22') has a greater length and thickness than the other side (22) and includes a ridge (27) at the base so as to provide a cantilever action pivoted at the ridge when the switch is operated. The cantilevered side (22') provides a positive locating movement and the more resilient side (22) provides a "snap" action to the switch.

In another embodiment (not shown) the electrical contacts are positioned above a surface having a recess with a central pip in the recess; when the key button is depressed, the electrical contacts are compressed between the pip and the bearing portion of the key button (or associated projection).



**Fig. 4.**

- 1 -

KEYBOARD SWITCH

The present invention relates to an improved keyboard switch.

One known type of electrical switch used in keyboards of, for example, data processing apparatus  
5 is a snap-effect switch which is moulded from silicone rubber into a sheet commonly providing a number of such switches. Each switch is in the form of a truncated cone which, when depressed by direct finger action or via a key button, collapses suddenly to provide the  
10 snap effect. The disadvantage of this type of switch is that the key has no lateral stability once it has been depressed and therefore reliability of operation is not assured.

The present invention provides a keyboard switch  
15 comprising a key actuating member having a key button and supporting portions on different sides of the key button, and electrical contact means arranged to change their state of conduction in response to pressure on and consequent relative movement of the key button,  
20 one of the supporting portions being relatively rigid thereby providing a cantilever effect to movement of the key button and another of the supporting portions being relatively resilient thereby providing a restoring force to the key button.

From another aspect; the present invention also provides a keyboard switch comprising a key actuating member and electrical contact means arranged to change their state of conduction in response to pressure on  
5 and consequent relative movement of the key actuating member, the electrical contact means including two contact portions separated by a membrane, the membrane having an aperture such that in an unstressed state the contact portions are held apart at the aperture,  
10 but when urged by the key actuating member the contact portions are brought together within the aperture, the membrane being located on a surface having a recess aligned with the key actuating member and a projection within the recess aligned with the membrane aperture,  
15 so that the contact portions are brought together between the key actuating member and the projection.

The latter feature of the invention, viz the projection located within the recess adjacent the membrane aperture, is advantageously but not necessarily  
20 incorporated within a keyboard switch having the cantilever effect.

Features and advantages of the present invention will become apparent from the following description of a preferred embodiment thereof, given with reference  
25 to the accompanying drawings, in which:

Figure 1 is a sectional view of one type of known key switch;

Figure 2 is a sectional view of a switch in accordance with the preferred embodiment of the present  
30 invention;

Figure 3 is a plan view of the switch shown in Figure 2;

Figure 4 is a sectional view of a modified type of switch;

35 Figure 5 is a sectional view of another modified

type of switch;

Figure 6 is a plan view of the switch shown in  
Figure 5 with a part omitted for the sake of clarity;  
and

5        Figure 7 is a plan view of the part omitted from  
Figure 6. \_\_\_\_\_

Referring to Figure 1, the known switch 10 includes a portion moulded from silicone rubber in the form of a sheet 11 having raised sides 12 in the shape of a truncated cone leading up to a key button 13 which carries a conductive member 14 on its lower surface, which member may be made of conductive rubber. The sheet 11 is disposed over a circuit board 15 which carries contacts 16, commonly in an inter-digitated array, the arrangement being that pressure on the button 13 collapses the cone and the conductive member 14 bridges the contacts 16, rendering the switch closed. However, this type of switch has the above-mentioned disadvantage, namely that, once depressed, the switch has no lateral stability and reliable operation cannot be assured; if guides are fitted to restrain lateral movement of the key, the "touch" of the switch tends to be adversely affected.

The present invention seeks to overcome this disadvantage by providing a key switch with a cantilever action along one edge. Referring to Figure 2, the preferred switch 20 has features in common with that shown in Figure 1 in that a sheet 21 includes raised sides 22, 22' leading up to a key button 23; a conductive member 24 is disposed over interdigitated contacts 26 provided over a circuit board 25. However, as shown in Figure 2, the raised side 22' has a greater length and thickness than side 22 and includes a ridge 27 at the base where it continues along the board 25; the effect of this is that the side 22' provides a cantilever action such that when the key is depressed, the cantilevered side 22' provides a positive locating movement with lateral stability, while the side 22 provides the vertical restoring force and hence the "snap" feel to the switch. Side edges 28, 29 to the switch, shown in Figure 3, can be arranged to contribute to the snap action, or may just act as a dust cover.

The conductive member 24 may be positioned on the key button in a similar manner to that shown in Figure 1; alternatively, since the key switch is cantilevered along

- 5 -

the ridge 27 , the member 24 may be on the cantilevered side 22' as shown in Figure 2, the contacts 26 being positioned correspondingly. This arrangement has two advantages; firstly, the switch action can occur before the key reaches its full depression so that if the finger is lifted slightly the contact is not immediately broken; secondly, the key button 23 itself may be hollowed out with consequent saving of expensive material.

Figure 4 illustrates a modified key switch 40 in which, rather than use a piece of conductive silicone rubber to selectively bridge fixed contacts, a buckling member such as the illustrated tube section 41 can be used in a membrane-type switch. In this type of switch, electrical contacts 42 are screened on to layers of plastic film 43 and are separated from making contact by a very small distance; this can be achieved by fixing the layers 43 on opposite sides of a circuit board 44 provided with an aperture where the contacts are positioned. When the key button is depressed, the buckling member 41 forces the electrical contacts 42 to close.

The key switches 20, 40 previously described with reference to Figures 2 and 4 respectively, include a cantilever side having a greater length than the opposite side. Whilst this is of advantage in providing a cantilever action, it is possible to produce a key switch in which the cantilever side is no greater in length compared to the opposite side; all that is required is that it should have greater rigidity than the opposite side e.g. by being of greater thickness as shown in the drawings. Such an arrangement will provide a cantilever effect from the stiffer side 22', whereas the opposite side 22 will act to provide a restoring force upon depression of the key switch, and hence the required snap action.

Figure 3 shows a key switch including side edges 28, 29 and this is of advantage in providing a fully-enclosed switch which is protected from adverse environmental conditions. However, if circumstances allow, the side edges can be dispensed

with and the operating part of the key switch consist solely of a relatively rigid cantilever side and a relatively more flexible side providing the restoring force.

5           The various arrangements previously described include a key button which is rectangular in shape and has approximately rectangular cantilever and restoring sides; however, a circular key button could be provided with a cantilever side which would preferably  
10           operate on no more than one half of the circumference of the key button, the remaining surrounding side providing the restoring effect.

          Although the function of the relatively rigid cantilever on the rubber moulded keyswitch described  
15           previously is to secure a form of motion in which the key top moves vertically without tipping, it is nonetheless possible that if one side of the key-top is pressed then the key will tip in that direction. If switch contacts are placed centrally under the  
20           key then it is possible that they may not be closed if the key is tipped because pressure on the key from the operator's finger may be released as soon as it is felt that one of the sides has reached the limit of its travel. It would of course be possible to have  
25           switch contacts under each side of the key but not only is this not very practicable but it is expensive in material (e.g. silver for the contacts). It is the aim of the modified embodiment to be described that no matter what angle the key is tipped through the  
30           central small switch contacts are still closed.

          Figure 5 shows a section through an improved switch 50. The key 51 is moulded in silicone rubber. When depressed, switch contacts 58 on flexible membranes 56 are pressed together sandwiched between a lower projection 55 on the key 51 and a pip 53 on the case moulding  
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52. Surrounding this pip 53 is a shallow recess 54 with a depth of the order of 0.02 inch (0.5mm) and a size larger than the key projection. If now one edge of the key is pressed, then one of the sides of the key bottom projection 55 may contact the bottom of the recess 54. However, although the key bottom projection 55 above the centre pip 53 may not be in contact with the membrane 56, the contacts 58 will still be closed by virtue of the deformation of the membrane 56 into the recess 54.

Figure 6 shows a plan view of the key switch 50 but the membrane 56 has been left out for the sake of clarity.

Figure 7 shows a plan view of the membrane 56. It consists of a sandwich of three plastics sheets, typically polycarbonate or polyester. The central sheet is typically 0.01 inch (0.25mm) thick, has an adhesive coating on both surfaces and is punched with a relatively large diameter hole 57. The upper and lower sheets (again typically polycarbonate or polyester) are printed on their inside faces using a silver loaded ink so that the contacts 58 formed thereby are held a very small distance apart and deflection of either top or bottom surface of the membrane will result in their closing.

Although the bottom portion 55 of the key button 51 is shown as being uniformly flat, it can have many other forms in the interests of saving material. For example, the key could be hollow, circular or rectangular. Alternatively, it may be cross or diagonally ribbed.

CLAIMS:

1. A keyboard switch comprising a key actuating member having a key button and supporting portions on different sides of the key button, and electrical contact means arranged to change their state of  
5 conduction in response to pressure on and consequent relative movement of the key button, one of the supporting portions being relatively rigid thereby providing a cantilever effect to movement of the key button and another of the supporting portions being  
10 relatively resilient thereby providing a restoring force to the key button.
2. A keyboard switch according to claim 1, wherein the rigid supporting portion comprises a side of the  
15 key actuating member which is longer than the side forming the resilient supporting portion.
3. A keyboard switch according to claim 1 or 2, wherein the rigid supporting portion has a greater  
20 thickness than the resilient supporting portion.
4. A keyboard switch according to claim 1, 2 or 3 wherein the rigid supporting portion includes a ridge of lesser thickness so as to provide a pivoting  
25 point for the cantilever effect.
5. A keyboard switch according to any one of the preceding claims, wherein the key button and supporting portions are integral and made of a resilient  
30 material.
6. A keyboard switch according to claim 5, wherein the integral key actuating member is part of a sheet of resilient material forming a keyboard with a  
35 plurality of similar key actuating members.

7. A keyboard switch according to any one of the preceding claims, wherein the key button includes a conductive portion and the electrical contact means comprises electrical contacts positioned so that pressure  
5 on the key button brings the conductive portion to bear on the electrical contacts.

8. A keyboard switch according to any one of claims 1 to 6, wherein the electrical contact means  
10 includes two contact portions separated by a membrane having an aperture therein, such that in an unstressed state the contact portions are held apart at the aperture but when urged by pressure on the key actuating member the contact portions are brought  
15 together within the aperture.

9. A keyboard switch according to claim 8, wherein the membrane of the electrical contact means is located on a surface having a recess aligned with the key  
20 actuating member and a projection in the recess aligned with the membrane aperture, so that when urged by pressure on the key actuating member the contact portions are brought together between the key actuating member and the projection.

25  
10. A keyboard switch comprising a key actuating member and electrical contact means arranged to change their state of conduction in response to pressure on and consequent relative movement of the key actuating  
30 member, the electrical contact means including two contact portions separated by a membrane, the membrane having an aperture such that in an unstressed state the contact portions are held apart at the aperture, but when urged by the key actuating member the contact  
35 portions are brought together within the aperture, the

membrane being located on a surface having a recess aligned with the key actuating member and a projection within the recess aligned with the membrane aperture, so that the contact portions are brought together between the key actuating member and the projection.

1/2

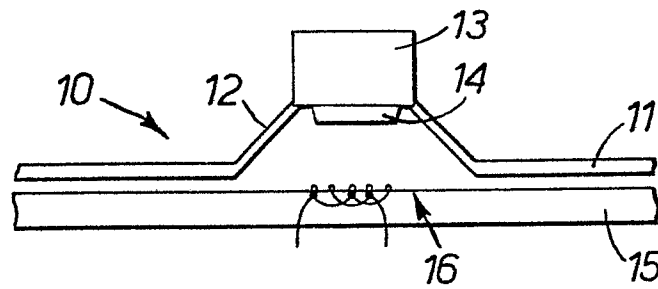


FIG. 1.

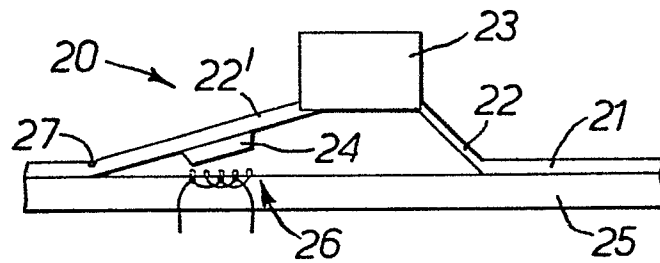


FIG. 2.

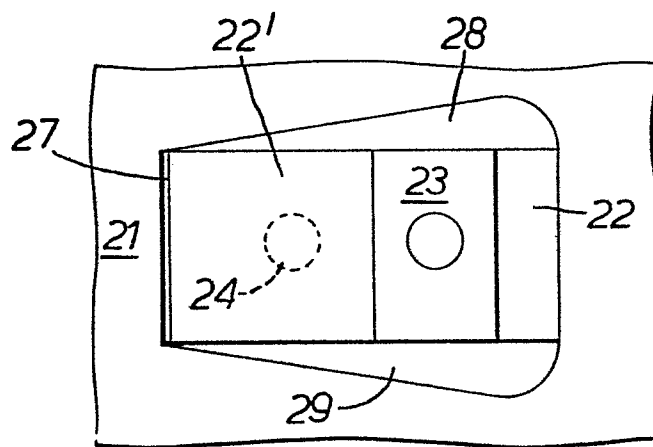


FIG. 3.

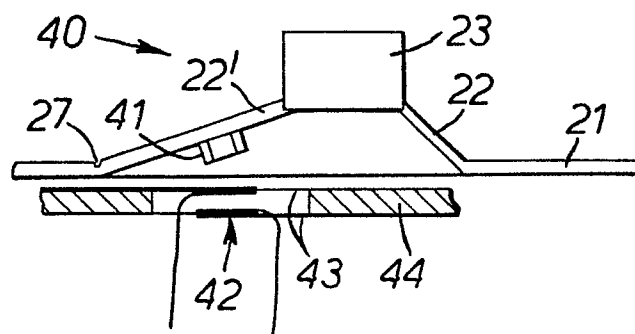
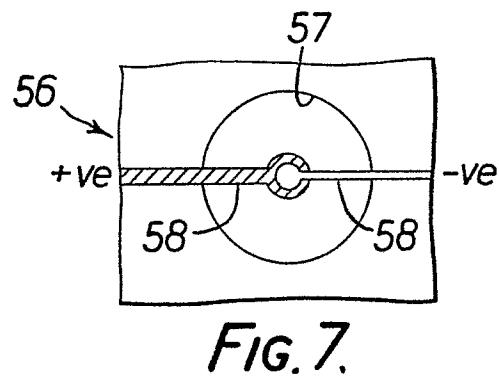
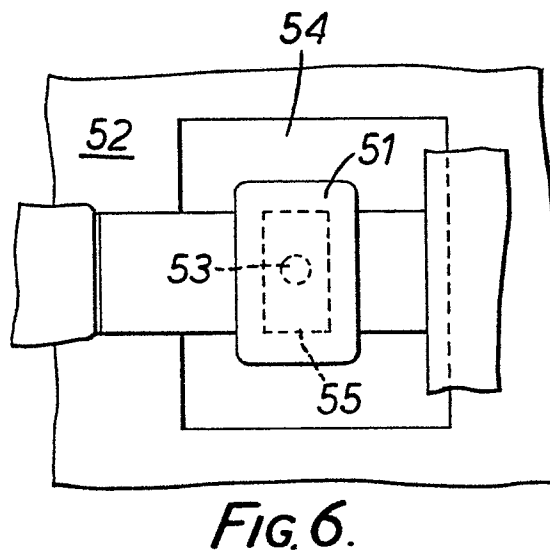
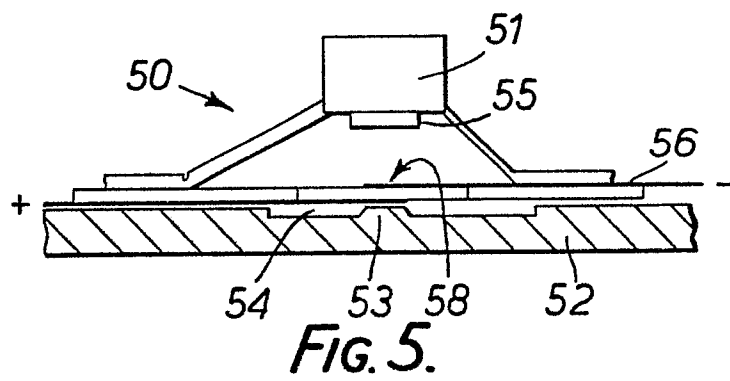


FIG. 4.

2/2





| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                              |                                                |                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|------------------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Citation of document with indication, where appropriate, of relevant passages                                                                                                | Relevant to claim                              | CLASSIFICATION OF THE APPLICATION (Int. Cl. 3) |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | FR-A-2 442 502 (OREGA)<br>* Page 4, lines 19-35 *                                                                                                                            | 1,7                                            | H 01 H 13/70                                   |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ---<br>US-A-3 932 722 (NIPPO<br>COMMUNICATION INDUSTRIAL)<br>* Column 2, line 11 - column 3,<br>line 20 *                                                                    | 1,3                                            |                                                |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ---<br>FR-A-2 457 006 (ROGERS CORP.)<br>* Figures 3,4; page 7 *                                                                                                              | 1,2                                            |                                                |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ---<br>GB-A-2 077 464 (CITIZEN WATCH<br>CY.)<br>* Page 1, lines 72-129; figures<br>1,2 *                                                                                     | 1,2                                            |                                                |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ---<br>US-A-4 129 758 (TELARIS)<br>* Figure 1 *                                                                                                                              | 8                                              | TECHNICAL FIELDS<br>SEARCHED (Int. Cl. 3)      |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ---<br>IBM TECHNICAL DISCLOSURE<br>BULLETIN, vol. 23, no. 9,<br>February 1981, pages 4172-4178,<br>New York, USA<br>H.K. SEIBOLD: "Sandwich keyboard"<br>* Pages 4177-4178 * | 1,2                                            | H 01 H 13/00                                   |
| X,P                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | ---<br>DE-A-3 044 414 (LICENTIA)<br>* Figures 4,5; page 5, paragraph<br>2 *                                                                                                  | 1,3                                            |                                                |
| --- -/-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                              |                                                |                                                |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                              |                                                |                                                |
| Place of search<br>THE HAGUE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                              | Date of completion of the search<br>08-06-1983 | Examiner<br>JANSSENS DE VROOM P.               |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone<br/>Y : particularly relevant if combined with another document of the same category<br/>A : technological background<br/>O : non-written disclosure<br/>P : intermediate document</p> <p>T : theory or principle underlying the invention<br/>E : earlier patent document, but published on, or after the filing date<br/>D : document cited in the application<br/>L : document cited for other reasons<br/>&amp; : member of the same patent family, corresponding document</p> |                                                                                                                                                                              |                                                |                                                |



| DOCUMENTS CONSIDERED TO BE RELEVANT                                              |                                                                               |                                                |                                                            |
|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------|------------------------------------------------------------|
| Category                                                                         | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim                              | CLASSIFICATION OF THE APPLICATION (Int. Cl. <sup>3</sup> ) |
| A                                                                                | GB-A-2 039 417 (GUMMI MAAG AG.)<br>* Figure 3 *<br><br>-----                  | 1                                              |                                                            |
|                                                                                  |                                                                               |                                                | TECHNICAL FIELDS<br>SEARCHED (Int. Cl. <sup>3</sup> )      |
|                                                                                  |                                                                               |                                                |                                                            |
| The present search report has been drawn up for all claims                       |                                                                               |                                                |                                                            |
| Place of search<br>THE HAGUE                                                     |                                                                               | Date of completion of the search<br>08-06-1983 | Examiner<br>JANSSENS DE VROOM P.                           |
| <b>CATEGORY OF CITED DOCUMENTS</b>                                               |                                                                               |                                                |                                                            |
| X : particularly relevant if taken alone                                         |                                                                               |                                                |                                                            |
| Y : particularly relevant if combined with another document of the same category |                                                                               |                                                |                                                            |
| A : technological background                                                     |                                                                               |                                                |                                                            |
| O : non-written disclosure                                                       |                                                                               |                                                |                                                            |
| P : intermediate document                                                        |                                                                               |                                                |                                                            |
| T : theory or principle underlying the invention                                 |                                                                               |                                                |                                                            |
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| L : document cited for other reasons                                             |                                                                               |                                                |                                                            |
| & : member of the same patent family, corresponding document                     |                                                                               |                                                |                                                            |