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(54) Key for a keyboard.

(57) A plunger (26) is slidable in a jacket (14), preferably electrically insulating. A flange (16) is disposed on the jacket at one surface of the bezel (12). The flange receives a lip portion at one end of a boot (20) preferably made from a pliant material such as a silicone rubber. The boot and a thumbpiece (34) abut a flange on the plunger. A spring (30) may be constrained between the jacket and the flange on the plunger to bias the plunger and the boot to an unconstrained relationship of the boot. A retainer (36) such as a ring is disposed in a groove (38) in the plunger adjacent the opposite surface of the bezel from the jacket flange. The retainer cooperates with the bezel to press the jacket flange and the boot lip tightly against the bezel. This causes a seal to be produced to prevent water and humidity from passing through the bezel. An electrical contact (46) is attached to the plunger at the opposite end of the plunger from the thumbpiece. The electrical contact may be shock mounted to the plunger as by a rubber mount. The electrical contact cooperates with a contact (48) fixedly mounted in the bezel to define a switch. The plunger and the thumbpiece may be translucent. A lamp may be illuminated when the switch is closed, thereby illuminating the plunger and the thumbpiece. Under such circumstances, the contact on the plunger may bridge a pair of spaced contacts in the bezel to establish electrical continuity to the lamp. The lamp may also be illuminated independently of any operation of the key.

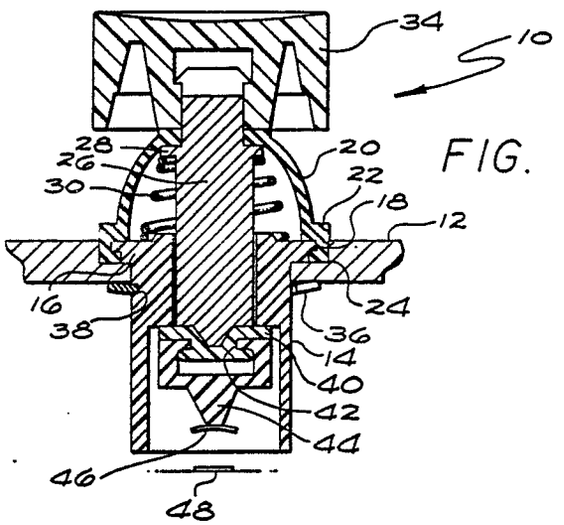

FIG. 1

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KEY FOR A KEYBOARD

This invention relates to keys for operation in keyboards or bezels to close switches. More particularly, the invention relates to keys which are disposed on a keyboard in a sealed relationship to the keyboard to prevent dust, water or humidity from leaking through the keyboard into the apparatus which includes the keyboard. The invention also particularly relates to keys which include lamps energized to illuminate the keys when the keys are depressed on the keyboard or bezel, or illuminate the key independently of the switch contact. Alternatively, the lamps may be be energized to illuminate the keys independently of any operation of the keys on the keyboards.

Keys are included on keyboards or bezels for a number of different purposes. For example, keys are included on keyboards to type information on sheets of paper. Keys are also included in keyboards to provide for the operation of data processing apparatus. In such installations, the operation of the keys controls the information which is introduced to the data processing apparatus to be processed by such apparatus.

Keyboards sometimes have to be included in apparatus which is sealed against the passage of dust, water or humidity into the apparatus. For example, keyboards have to be operated in hot and humid climates where the passage of humidity into the apparatus will affect the operation of the apparatus. As will be appreciated, if the operation of the apparatus is affected, improper information may be produced by the apparatus including the keyboard. This may be particularly serous when the information provided by the keyboard apparatus is introduced to data processing equipment for processing such information. For example, as will be appreciated, considerable amounts of money may sometimes be affected by the improper introduction of information from the keyboard apparatus to the data processing apparatus.

A considerable effort has been made, and significant amounts of money have been expended, to develop a key which will be simple in construction and reliable in operation and which will be sealed to a keyboard so that dust, water and humidity cannot pass into the apparatus including the keyboard. In spite of such effort and such expenditure of money, a satisfactory key does not exist for a keyboard where the key is disposed on the keyboard to prevent dust, water or humidity from passing through the keyboard into the apparatus. This is particularly true when it is desired to provide a key which is simple in construction and reliable in operation and which can be easily removed from the keyboard, in instances where the key is worn or defective, and instantaneously replaced by a new key.

This invention relates to a key which is used in a bezel or keyboard and which meets the criteria discussed in the previous paragraph. The key of this invention cooperates with the bezel or keyboard to produce a sealed relationship which prevents dust, water or humidity from leaking into the keyboard. When the key becomes defective or worn, the key can be easily removed from the bezel or keyboard by the removal from the key or a retainer coupling the key to the keyboard. A new key can then be inserted into the bezel or keyboard and locked into a fixed realtionship with the bezel by reinserting the retainer on the key.

In one embdiment of the invention, a plunger is slidable in a jacket preferably made from an insulating material. A flange is disposed on the jacket at one surface of the bezel. The flange receives a lip portion at one end of a boot preferably made from a pliant material such as a silicone rubber. The boot and a thumbpiece abut the flange on the plunger. A spring may be constrained between the jacket and the flange on the plunger to bias the plunger and the boot to a position in which the boot is in an unconstrained relationship.

A retainer such as a ring is disposed in a groove in the plunger adjacent the opposite surface of a bezel from the flange on the jacket. The retainer cooperates with the bezel to press the jacket flange and the boot lip tightly against the bezel. This causes a seal to be produced to prevent water and humidity from passing through the bezel.

An electrical contact is attached to the plunger at the opposite end of the plunger from the thumbpiece. The electrical contact may be shock mounted to the plunger as by a rubber mount. The electrical contact cooperates with a contact fixedly mounted in the bezel to define a switch.

The plunger and the thumbpiece may be translucent and the plunger may be provided with a socket. A lamp may be disposed in the socket and may be illuminated when the switch is closed, thereby illuminating the plunger and the thumbpiece.

Under such circumstances, the contact on the plunger may bridge a pair of spaced contacts in the bezel to establish electrical continuity to the lamp. Alternatively, the lamp may be illuminated independently of any operation of the key.

In the drawings:

Figure 1 is a sectional view of a keyboard or bezel and one embodiment of a key, the key being disposed in the keyboard in its normal position;

Figure 2 is a sectional view similar to that shown in Figure 1 and illustrates the key in its depressed condition relative to the keyboard;

Figure 3 is a sectional view of a keyboard or bezel and a second embodiment of a key, the key being disposed in its normal position on the bezel;

Figure 4 is a sectional view similar to that shown in Figure 3 and illustrates the disposition of the key when the key has been depressed on the keyboard;

Figure 5 is a sectional view of a keyboard or bezel and a third embodiment of a key, and key being disposed on the bezel in a normal position and including a lamp illuminated upon a depression of the key;

Figure 6 is a sectional view similar to that shown in Figure 5 and illustrates the position of the key of Figure 5 on the bezel when the key has been depressed; and

Figure 7 is an enlarged schematic view - schematically illustrating electrical contacts establishing electrical continuity to the lamp which is included in the embodiment shown in Figures 5 and 6.

In one embodiment of the invention, a key generally indicated at 10 and constituting one embodiment of the invention is constructed to be disposed on a keyboard or bezel 12. The key includes a hollow jacket 14 which is preferably electrically insulating and is preferably made from a thermoplastic resin such as an acetal resin designated by the trademark "Delrin". The jacket 14 includes a shelf 16 having a flange 18 at the upper end of the shelf in Figure 1.

A boot 20 made from a pliant and electrically insulating material such as silicone rubber is disposed on the bezel 12. The boot has a configuration of a shroud and has, at its bottom end in Figure 1, a tip portion defined by an outwardly turned portion 22 and an inwardly turned portion 24. The outwardly turned portion 22 rests on the jacket 14 and the portion 24 is turned inwardly under the flange 18 of the jacket 14. The outwardly turned portion 22 and the inwardly turned portion 24 may be considered to define a lip.

A plunger 26 made from a relatively light material such as a sintered aluminum is slidable within a bore 27 in the jacket 14. The plunger 26 has a flange 28 at its upper end in Figure 1. A helical spring 30 made from a suitable material such as a stainless steel is disposed within the boot 20 in a constrained relationship between the flange 28 on the plunger 26 and the jacket 14. The top of the boot 20 abuts the flange 28. A thumbpiece 34 is disposed in fixed, but removable, relationship on the plunger 26 in abutting relationship with the plunger 26. The thumbpiece 34 may be made from a suitable electrically insulating material such as a butadiene-styrene polymer or an acrylonitrile designated by the trademark "Cyclolac" or "ABS".

A retainer such as a ring 36 is disposed in a groove 38 in the jacket 14 at a position below the bezel 12 in Figure 1. The ring 36 may be made from a suitable material such as stainless steel and may be provided with a split configuration to facilitate its easy insertion in the groove 38 and its easy removal from the groove. The ring 36 is preferably slanted upwardly to engage the bottom surface of the bezel or keyboard 12. In this way, the ring 36 presses the jacket 14 downwardly in Figure 1 so thast the flange 28 on the plunger 26 presses downwardly on the inwardly turned portion 24 of the jacket 20. In this way, a fluid-tight relationship is maintained between the jacket 14, the plunger 26 and the bezel 12 to prevent dust, water or humidity from leaking through the bezel into the apparatus of which the bezel is a part.

A member 40 made from a suitable electrically insulating material such as a plastic may be attached to the plunger 26 as by sonic welding. The member 40 is shaped to define a socket 42 for receiving and detaining a shock mount 44 made from a suitable material such as rubber. An electrical contact 46 is attached to the shock mount 44. The electrical contact 46 may be made from a suitable material such as stainless steel and may be gold plated. The electrical contact 46 may be of a conventional construction to engage a stationary contact 48 fixedly disposed in the apparatus (not shown) which includes the bezel 12. For example, the contact 46 may be dish shaped and may be provided with a snap action to become flattened when it engages the contact 48. Alternatively, the contact 46 may be flat and may retain its flat configuration when it engages the contact 48.

When the thumbpiece 34 is manually depressed, it depresses the plunger 26 so that the contact 46 on the plunger engages the contact 48 in the bezel 12. At the same time, the boot 20 becomes flattened in accordance with the downward movement of the plunger 26 in Figure 1. This is shown in Figure 2. However, the boot 20 continues to provide a seal with the plunger 26 and the keyboard or bezel 12 even in its flattened condition. When the thumbpiece is released, the spring 30 acts to return the plunger 26 and the boot 20 to their original positions as shown in Figure 1.

The key 10 described above has certain important advantages. When inserted on the keyboard or bezel 12, it has a sealed relationship with the bezel so that the dust, water and humidity cannot leak through the bezel. It can be easily removed from the bezel 12 by removing the ring 36 and it can be easily inserted on the bezel by snapping the ring into position in the groove 38 in the jacket 14. The key 10 is tamper-proof when the bezel 12 is locked

into position in the apparatus with which it is associated. It does not allow electromagnetic or radio frequency energy to pass through the bezel 12 to interfere with the operation of the apparatus with which the bezel is associated.

Figures 3 and 4 illustrate a second embodiment of the invention. The embodiment shown in Figures 3 and 4 is similar to the embodiment shown in Figures 1 and 2 except that the plunger 26 has an aperture 50 for receiving one end of an arm 52. The arm 52 is pivotable on a fulcrum as at 54. When the plunger 26 is depressed, it pivots the arm 52 on the fulcrum 54. The arm 52 may be coupled in a second switch to a plunger corresponding to the plunger 26. In this way, the second switch may be closed and opened in synchronism with the closure and opening of the switch shown in Figures 1 and 2.

O-ring beads 63 may be provided between the bottom surface of the inwardly turned lip portion 24 and a cut-out portion 65 on the keyboard or bezel 12. Similarly O-ring beads 67 may be provided on the upper and lower surfaces of the flange 28 of the plunger 26. The O-ring beads facilitate the production of seals between the adjacent contacting surfaces.

The embodiment shown in Figures 5, 6 and 7 includes a lamp 60 which is disposed in a socket 62 in a plunger 64. The plunger 64 may be constructed in a manner similar to that shown in Figure 1 and described in detail above except that it may be made from a translucent material such as that designated by the trademark "Lucite". A thumbpiece 66 corresponding to the thumbpiece 34 is Figures 1 and 2 may also be made from a translucent material.

A contact 68 is movable with the plunger 64 and is disposed in shock-mounted relationship to the plunger as by a resilient insert 70 which may be made from a pliant electrially insulating material such as rubber. The contact 68 may be provided with a doughnut configuration to engage and bridge contacts 72 and 74 fixedly disposed in a bezel 76. Each of the contacts 72 and 74 may be formed from a plurality of spaced radial spokes connected as by a ring. The radial spokes for the contact 72 are disposed in spaced and interleaved relationship with the radial spokes for the contact 74.

When the plunger 64 is depressed, the contact 68 engages the contacts 72 and 74 and establishes electrical continuity to the lamp 60. This causes the lamp 60 to become illuminated. The illumination is in turn transmitted through the translucent plunger 64 and the thumbpiece 66 so that it can be seen by the operator or any other interested person.

Although this invention has been disclosed and illustrated with reference to particular embodiments, the principles involved are suceptible for use in numerous other embodiments which will be apparent to persons skilled in the art. The invention is, therefore, to be limited only as indicated by the scope of the appended claims.

Claims

1. Keyboard key for disposition on a bezel (12) to establish an electrical continuity with an electrical contact (48) disposed within the bezel (12), comprising,
a plunger (26;64)
a pliant boot (20) having an unconstrained configuration and retaining at one end the plunger (26), a jacket (14) disposed on the plunger (26;64) and constructed to retain the pliant boot (20) in fixed relationship to the jacket (14) and the boot (20) at the second end of the boot (20), the plunger (26;64) being disposed in slidable relationship to the jacket (14),
biasing means (30) disposed within the boot (20) between the boot (20) and the jacket (14) for biasing the plunger (26) and the jacket (14) in a direction opposing any constraint of the boot (20),
means (36) supported by the jacket (14) for disposition against the bezel (12) to retain the jacket (14) and the boot (20) in fixed relationship to the bezel (12), and
means (46;68) movable with the plunger (26;64) and defining a switch with the contact (48;72;74) in the bezel (12), the boot (20) being constrained upon actuation of the switch.

2. Key as set forth in claim 1, wherein the jacket (14) is peripherally grooved (38),
the retaining means constituting a ring (36) disposed in the grooved periphery (38) of the jacket (14).

3. Key as set forth in claim 2, wherein the jacket (14) is provided with a flange (16) at a position adjacent the second end of the boot (20) and the boot (20) being provided with a lip portion (24) enveloping the flange (16), the flange (16) and the lip (24) being retained against the bezel (12).

4. Key as set forth in any one of the preceding claims comprising means (34) disposed on the plunger (26;64) for facilitating the depression of the plunger (26).

5. Key as set forth in claim 4, wherein said means disposed on the plunger (26;64) is a thumb piece (34) engaging said boot (20) at the one end thereof.

6. Key as set forth in any one of the preceding claims wherein the retaining means is constituted by a ring (36) and the jacket (14) is provided with a flange (38) at a position corresponding to the disposition of the jacket (14) on the rear surface of the bezel (12).

7. Key as set forth in claim 12, wherein the contact in the bezel (12) comprises a pair of contacts (72;74) disposed in fixed and spaced relationship to each other in the bezel (12) and
the contact (68) on the plunger (64) being disposed to establish continuity between the spaced contacts (72;74)

8. Key as set forth in claim 7, wherein the first (72) of the spaced contacts is shaped in the form of a plurality of spokes and
the second (74) of the spaced contacts is formed in a plurality of spokes disposed in spaced relationship to one another and to the spokes defining the first of the spaced contacts (72;74) and
a pliant insert (70) is disposed between the plunger (26) and the contact (68) on the plunger (64).

9. Key as set forth in any one of the preceding claims wherein said boot (20) is formed as a means for sealing the plunger (26) and the jacket (14) against the leakage of water, dust and humidity into the bezel (12).

10. Key as set forlth in any one of the preceding claims wherein the plunger (64) is made from a transparent or translucent material and
means (60) being associated with the plunger (64) and connected in a circuit with the switch (68;72;74) to provide for the passage of light through the plunger (64) in accordance with the closure of the siwtch (68;72;74).

11. Key as set forth in claim 10 comprising a lamp (60) disposed in contiguous relationship to the plunger (26) to become energized.

12. Key as set forth in claim 11, wherein the plunger (64) is provided with a socket (62) and the lamp (60) is disposed within the socket (62) in the plunger (64) to become energized upon the engagement of the contact (68) on the plunger (64) with the contact (72;74) in the bezel (12).

13. Key as set forth in any one of the preceding claims comprising a pivotable arm (52) associated with the plunger (26) and pivotable in accordance with the depression of the plunger (26) and a second key corresponding to the key specified in any one of the preceding claims and coupled to the pivotable arm (52) for operation in accordance with the pivotal movement of the pivotable arm (52).

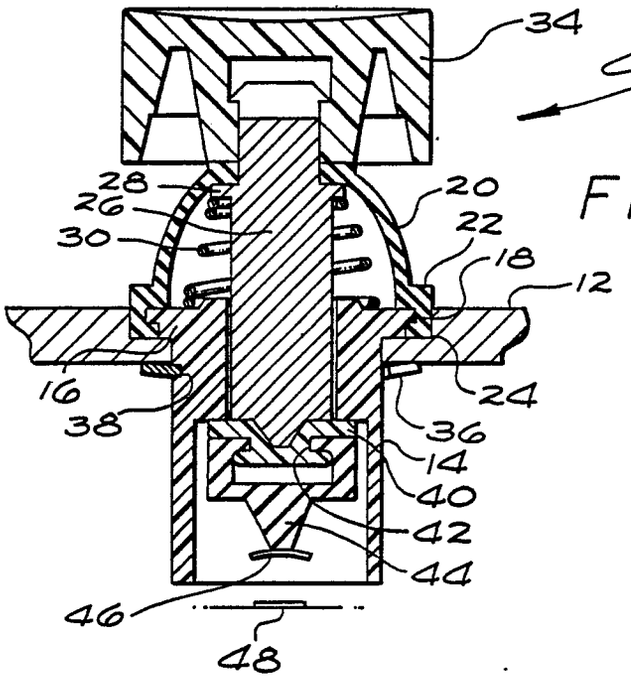
34
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FIG. 1

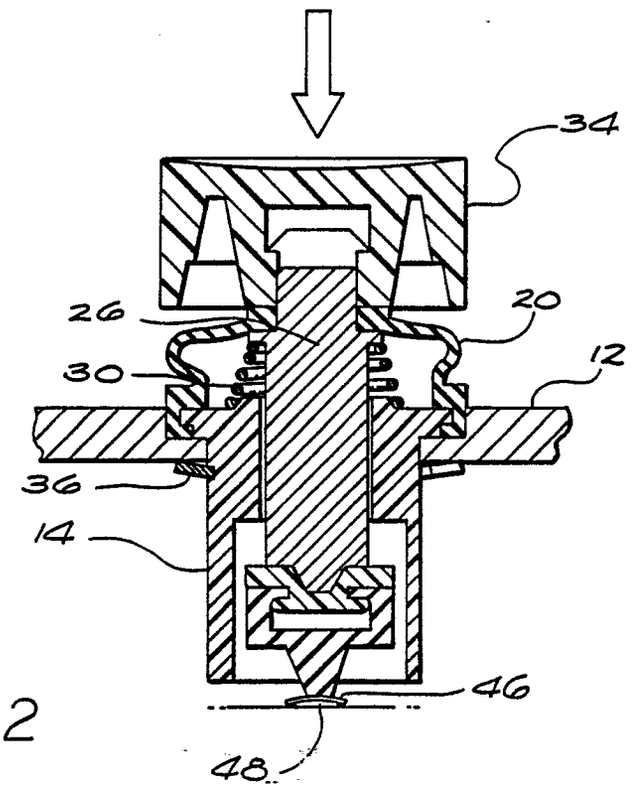
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FIG. 2

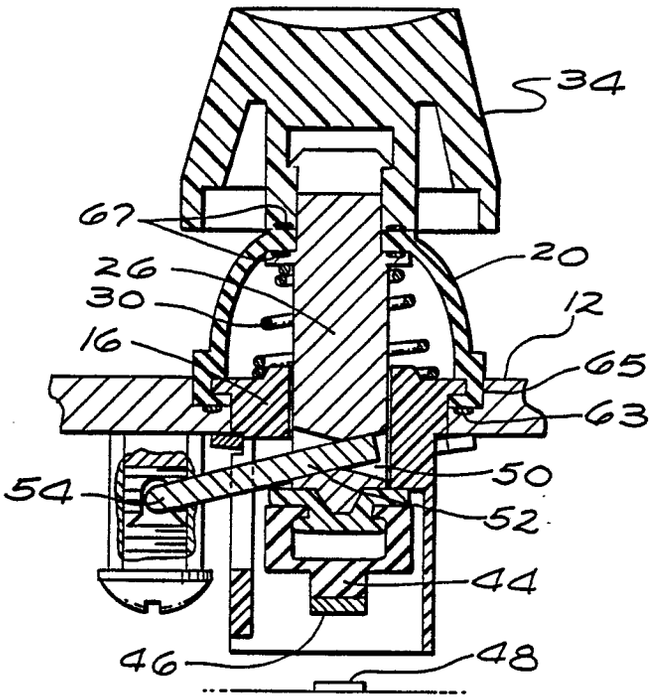
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FIG. 3

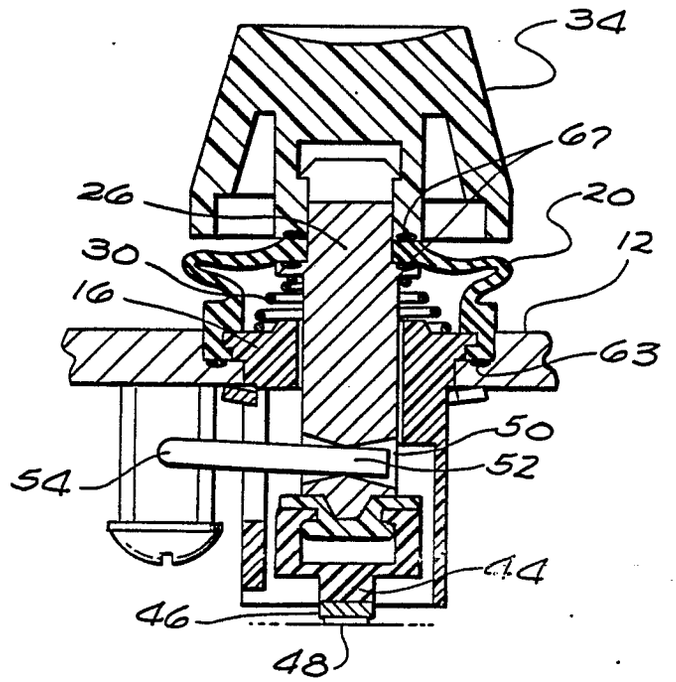
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FIG. 4

FIG. 5

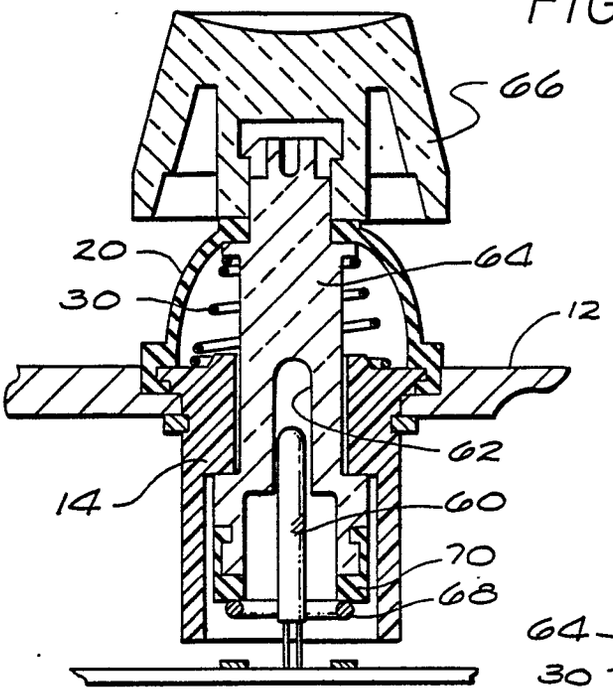
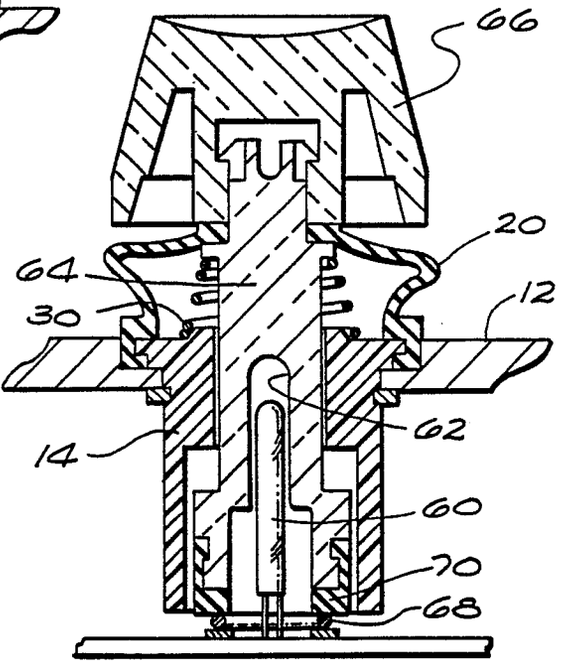


FIG. 6



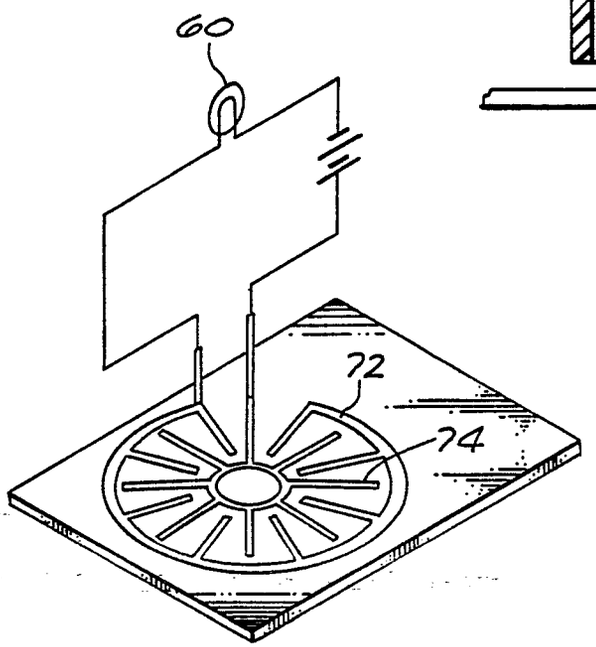


FIG. 7