

[54] **TACTILE KEYCAP**
 [75] Inventor: **Albert R. Pratt**, Weston, Mass.
 [73] Assignee: **Raytheon Company**, Lexington, Mass.

2,615,547 10/1952 Grobl..... 197/102
 2,720,961 10/1955 Smith..... 235/145 X
 3,355,099 11/1967 Whippo et al. 235/145 X
 3,594,562 7/1971 Englund..... 197/98 X
 3,692,167 9/1972 Gassind..... 197/98

[22] Filed: **Jan. 26, 1973**

Primary Examiner—Robert E. Pulfrey
Assistant Examiner—R. T. Rader
Attorney, Agent, or Firm—Harold A. Murphy; Joseph D. Pannone; Edgar O. Rost

[21] Appl. No.: **326,919**

Related U.S. Application Data

[62] Division of Ser. No. 268,418, July 3, 1972, abandoned.

[52] U.S. Cl. **197/103**, 197/98

[51] Int. Cl. **B41j 5/12**

[58] Field of Search 197/98, 102, 103, 104;
 235/145, 146; 340/365

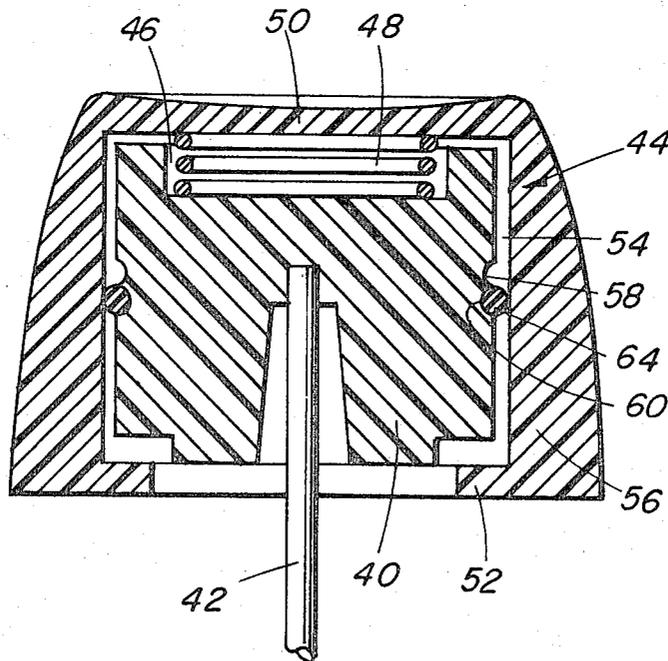
[57] **ABSTRACT**

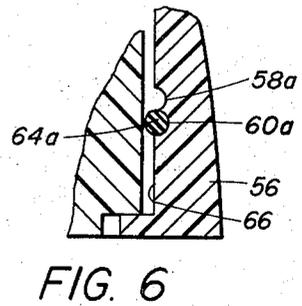
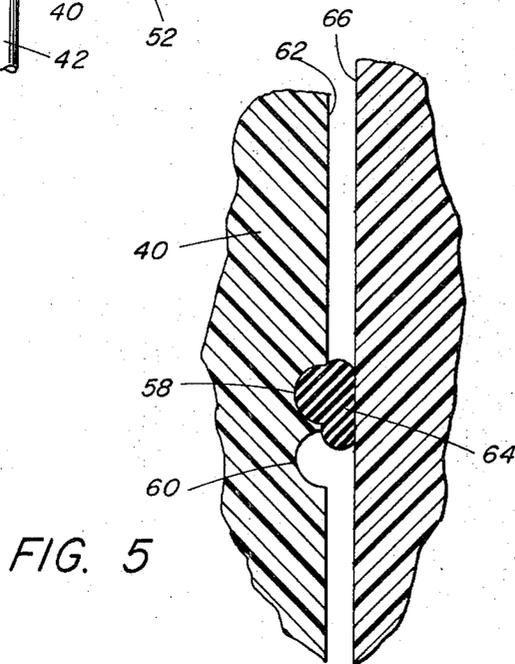
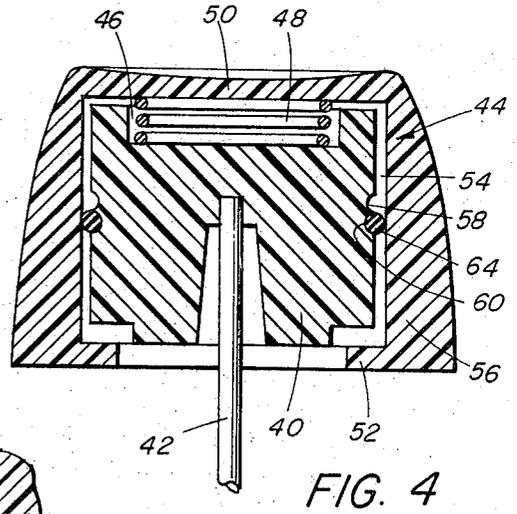
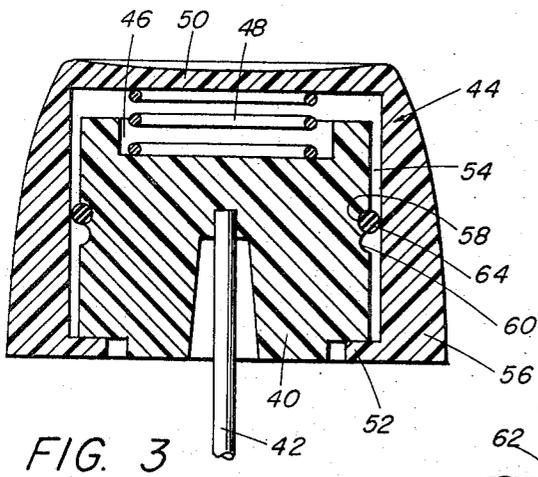
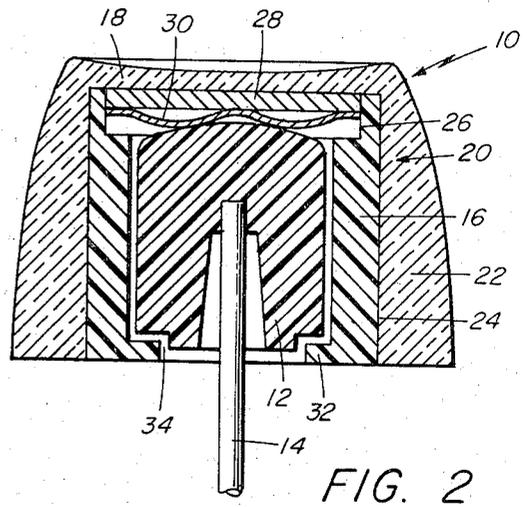
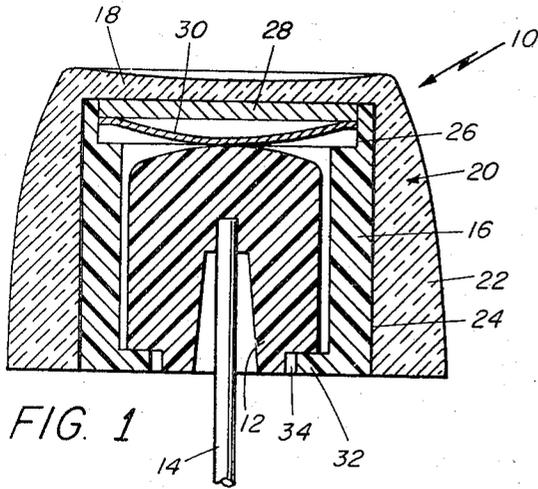
A keycap for attachment to the keys of a keyboard such as used on typewriters, computers, key punchers and the like, comprising a shell carried by a key-mounted hub, and spring means between the shell and hub for providing a sensory indication of key operation to the operator when the key is depressed, which spring means may be a click or snap to simultaneously also provide an audible signal.

[56] **References Cited**
UNITED STATES PATENTS

532,153 1/1895 Graham et al. 197/103
 2,485,213 10/1949 Niemann..... 197/102

4 Claims, 6 Drawing Figures





TACTILE KEYCAP

This is a division of application Ser. No. 268,418 filed July 3, 1972 now abandoned.

BACKGROUND OF THE INVENTION

In modern day office equipment such as electronic data processing systems, key punchers, teletypes, adding machines and electric typewriters, for example, a keyboard is provided which comprises a bank of keys adapted to be individually depressed by an operator. Each key is connected with a respective switch which is adapted to transmit an electrical signal to associated responsive equipment as is well known.

In such devices, key movement is often very small and, in fact, in some cases the switches are of a non-contacting type of a capacitive nature which may require little or no movement whatsoever of the key. It will be apparent that such devices present problems to an operator who is unable to determine whether a key has actually been operated, or operated sufficiently to accomplish the desired resultant actuation of the associated switch.

Attempts to overcome this problem have been made by providing a tactile response in or adjacent the switch or built into the key mechanism. However, while these attempts may have had some measure of success, they were of an expensive and usually somewhat complicated nature, requiring maintenance and other attention. Attempts to provide tactility in the keycaps have usually produced a structure wherein the keycap is merely made movable with respect to the key by means of rubber cylinders, springs or the like.

SUMMARY OF THE INVENTION

In accordance with the present invention, the above and other disadvantages of the prior art are improved upon or overcome by the provision of a novel keycap which includes built in tactility and, if desired, audibility. This is achieved by novel spring means which allows limited movement of the keycap with respect to the key. Such spring means, in an audible tactile keycap according to this invention, comprises a click type or snap action metal spring which is disposed within the keycap between the keycap shell and the adjacent end portion of the key or, more specifically, the head or hub thereon. The spring is concave so that when the keycap is depressed the spring will quickly snap downwardly with an audible sound and with definite sensory teactility.

In an inaudible embodiment of this invention, a coil spring is inserted between the top of the shell and the top of the hub. Also, a rubber O-ring is positioned between the inner side wall of the shell and the outer adjacent surface of the hub. This surface of the hub is provided with a pair of contiguous, circumferential, parallel grooves, in the upper of which the rubber ring normally reposes. When the keycap is depressed against the resistance of the coil spring, the shell will move downwardly with respect to the hub and in doing so will, by friction, cause the ring to roll downwardly into the lower groove. Thus, tactility is provided. Upon release of pressure from the keycap, the coil spring will raise the keycap and consequently cause the ring to return to the upper groove.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objectives and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings, wherein:

FIG. 1 is a vertical sectional view of a key having thereon a keycap embodying one form of the invention;

FIG. 2 is a view similar to FIG. 1 showing the keycap in depressed position;

FIG. 3 is a vertical sectional view similar to FIG. 1 illustrating a second embodiment of this invention;

FIG. 4 is a view similar to FIG. 3 showing the keycap thereof in depressed position;

FIG. 5 is an enlarged sectional view of the rubber ring and associated parts of device shown in FIG. 3; and

FIG. 6 is a fragmentary sectional view similar to a portion of FIG. 3 showing the grooves disposed in the skirt.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring more particularly to the drawings, an audible tactile keycap 10 is shown in FIGS. 1 and 2 mounted on the head or hub 12 of a key 14. The hub 12 may be a plastic block having cylindrical side walls and a flat or convex upper end surface. The hub is force fit or otherwise fixedly secured to the key 14 which is preferably of metal.

Encircling the hub 12 in close-fitting relation is a housing or cylinder 16, preferably of rigid plastic, which has an inside diameter which allows it to readily slide upon the outer surface of the hub. The upper end of the cylinder 16 abuts the inner end wall 18 of a shell 20 which is provided with a skirtlike portion 22 enclosing the cylinder 16. The inner diameter 24 of the skirt 22 will preferably be of a size to relatively snugly interfit around the cylinder 16 so that movement of the two parts will occur as a unit. However, the upper end of the cylinder 16 may be suitably adhered to the end wall 18 when it is not desired to make these parts separable.

The upper end of the cylinder 16 is provided with a bore 26 which is of a diameter slightly larger than the inner bore 24 and within which is disposed a wafer 28 on which is printed an indicia, legend or other selected character (not shown) which may be viewed through the end wall 18 of the shell which is made transparent for this purpose. The wafer 28 extends transversely within the cavity formed by bore 26 and rests upon the upper side of the peripheral portion of a concave metal snap spring 30, the concave portion of the spring 30 resting upon the upper surface of the hub 12.

The snap spring 30 will preferably be relatively thin, such as about .003 inch, for example, so that light pressure upon the shell 20 will cause it to suddenly snap out of its normal unstressed concave shape as shown in FIG. 1 to the irregular stressed configuration shown in FIG. 2. Such snap action will be very definitely felt by the finger of the operator.

The lower end of the cylinder 16 is provided with means for preventing accidental removal of the keycap from the key, which means takes the form of an inwardly directed flange or tab 32 which may extend around the entire inner periphery of the lower end of the cylinder or only a part thereof. The flange 32 overlies

the adjacent lower end of the hub 12, or a peripheral groove 34 therein as shown in FIG. 1. As shown in FIG. 2, the relatively small spacing between the flange 32 and the end of the hub 12 graphically illustrates the small amount of actual movement which is required of the shell 20 and cylinder 16 to operate the spring 30. The spring 30 will, of course, reassume its normal shape when pressure is lifted from the shell.

In the inaudible version of this invention illustrated in FIG. 3, the hub 40 is fixed to key 42 and is enclosed within a shell 44 similar to shell 20 in the FIG. 1 structure. The upper end of the hub 40 is hollowed out to form a cavity 46 therein within which rests one end of a coil spring 48. The other end of the spring 48 abuts the adjacent end wall 50 of the shell and thereby normally urges the shell upwardly. Upward movement of the shell 44 with respect to the hub 40 is limited by a flange 52 which engages the lower end surface of the hub 40.

A space 54 is provided between the outer circumferential surface of the hub 40 and the inner surface of the encircling skirt 56 which forms a portion of the shell 44.

A pair of circumferential grooves 58-60 are provided in the outer surface 62 of the hub 40, as shown best in FIG. 5, and are arranged in contiguous, parallel, side-by-side relation as shown. In the upper groove 58 is disposed a rubber O-ring 64 which is of a thickness to fill the groove and abut the adjacent inner surface 66 of the skirt 56. The grooves 58-60 are preferably similar in size.

It will be understood that downward pressure upon the shell 44 will be exerted against the coil spring 48 and will cause the shell skirt 56 to move relative to the hub 40. During such movement friction of the wall surface 66 upon the rubber ring 64 will cause the ring to abruptly roll into the lower groove 60 with a suddenness which can be readily sensed by the touch of the operator's finger. Such tactile operation is, however, completely silent. Such downward motion is illustrated clearly in FIG. 4.

Release of pressure from the shell 44 will allow the coil spring 48 to raise the shell 44 to its initial normal position relative to the hub 40. Such return motion of the shell will consequently cause rubber ring 64 to return to the upper groove 58.

It will be understood that although the foregoing de-

scription and the drawings disclose the grooves 58-60 as being located in the outer circumferential surface 62 of the hub 40, they can alternatively be located as grooves 58a-60a in the inner surface 66 of the skirt 56, in which case the ring 64a will be normally positioned in the lower groove 60a and will move into the upper groove 58a when the shell is depressed.

From the foregoing it will be apparent that a novel tactile keycap has been provided in accordance with the objectives of this invention. It will be understood, however, that various changes and modifications in the structures shown and described may be made by those skilled in the art without departing from the spirit of the invention as expressed in the accompanying claims. Therefore, all matter shown and described is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. A tactile keycap and key combination comprising a key shaft, a hub on said shaft, a shell encasing said hub and having an end portion overlying an adjacent end portion of said hub, a spring between said adjacent end portions of the shell and hub for normally maintaining said portions in spaced relation, said shell having a skirt overlying a longitudinally extending circumferential side wall of the hub, and separate resilient means disposed between said skirt and said wall and movable longitudinally of the hub for creating an abrupt mechanical shock capable of being sensorily detected by an operator's finger on said shell.

2. The combination set forth in claim 1 wherein said shell and wall have adjacent spaced parallel surfaces, one of said surfaces is provided with a pair of adjacent parallel circumferential grooves, a rubber ring is disposed in one of said grooves, and the opposite of said surfaces frictionally engages the ring whereby relative movement of the shell and hub causes rolling movement of the ring between grooves.

3. The combination set forth in claim 2 wherein said grooves are located in the surface of the hub wall, and the ring is normally disposed in the groove nearest said end portion of the hub.

4. The combination set forth in claim 2 wherein said grooves are located in said surface of the skirt, and the ring is normally disposed in the groove farthest from said end portion of the hub.

* * * * *

50

55

60

65