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(54) **Keypad with Water and Dust Protection**

Tastatur mit Wasser- und Staubschutz

Clavier avec protection contre l'eau et la poussière

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## Description

[0001] The present application relates generally to keypads, and more particularly, to a keypad intended for portable or handheld communication devices.

[0002] The portability and convenience of mobile or handheld communication devices has resulted in their widespread use and popularity. The portability of handheld communication devices also makes them more susceptible to exposure to outdoor elements and hazards, such as moisture (e.g. rain, sleet, and snow), dust, and other environmental elements.

[0003] EP 1737010 A discloses a push-button switch cover member having a hard base and a keypad formed of a silicone rubber film covering the entire back surface of the hard base.

[0004] EP 1619703 A discloses a key sheet having a base sheet formed by a hard resin base plate and a holding/receiving portion formed of a rubber like elastic material extending around the periphery of the base plate.

[0005] EP 1467391 A discloses a key pad comprising a key sheet formed by a hard resin plate having a reinforcing outer frame formed of a thermoplastic elastomer extending around the periphery of the hard resin plate.

[0006] Accordingly, there remains a need for improvements in the art for keypads.

## GENERAL

[0007] The present application is directed generally to a keypad and structure that may provide protection against elements such as water, dust and/or electrostatic discharge.

[0008] Embodiments according to the present application are generally directed to a keypad assembly and structure configured to preferably provide a seal against environmental elements or agents, such as water/moisture, dust and/or ESD (Electro-Static Discharge).

[0009] According to an embodiment, there may be provided an actuator component for a keypad, said actuator component comprising: a plurality of actuators formed from silicone rubber a light guide comprising a plastic material co-molded with said plurality of actuators; and a sealing bead being formed from said silicone rubber and co-molded with said plastic light guide and said raised sealing bead being configured for compression in a channel configured in the keypad.

[0010] Preferably, said sealing bead has a height dimension in the range of 0.05 to 0.15 mm.

[0011] According to another embodiment, there may be provided a process for manufacturing a keypad insert for a keypad, said process comprising: providing a plurality of actuators formed from silicone rubber; providing a light guide formed from a plastic material; providing a raised sealing bead formed from silicone rubber and configured for compression in a gap configured in the keypad; bonding together said plurality of actuators, said light guide and said sealing bead using co-molding.

[0012] Preferably, said sealing bead extends around a perimeter line of the keypad insert.

[0013] Other aspects and features will become apparent to those ordinarily skilled in the art upon review of the following description of embodiments in conjunction with the accompanying figures.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0014] Reference will now be made to the accompanying drawings which show, by way of example, embodiments of the apparatus described herein, and how they may be carried into effect, and in which:

[0015] Fig. 1 shows in diagrammatic form a keypad according to an embodiment;

[0016] Fig. 2 shows in diagrammatic form the keypad of Fig. 1 mounted on a substrate or carrier component in a communication device;

[0017] Fig. 3 shows in diagrammatic form a bottom view of a keypad actuator according to an embodiment;

[0018] Fig. 4 is a more detailed view of a portion of the keypad actuator depicted in Fig. 3;

[0019] Fig. 5 is a bottom view of the keypad of Fig. 1;

[0020] Fig. 6 is a more detailed view of a portion of the keypad of Fig. 5;

[0021] Fig. 7 is a partial cross-sectional view of the keypad taken along line 1-1 of Fig. 1; and

[0022] Fig. 8 is a bottom view of the keypad of Fig. 5 with a dome overlay in place.

[0023] Like reference numerals indicate like or corresponding elements in the drawings.

## DESCRIPTION OF PREFERRED EMBODIMENTS

[0024] Reference is made to Fig. 1, which shows in diagrammatic form a keypad assembly according to an embodiment and indicated generally by reference 100. Fig. 2 shows the keypad assembly 100 installed, fitted or otherwise mounted or affixed to a printed circuit board (PCB) or other substrate, carrier or structural member for a communication device (e.g. a mobile or handheld), indicated generally by reference 200. The PCB 200 is configured with key-switches or contacts for the keypad and other electronic components in known manner.

[0025] In the figures, like reference numerals indicate like or corresponding elements.

[0026] As shown in Fig. 1, the keypad 100 comprises, according to an embodiment, a base-frame or member 102, a plurality of keys indicated by 110, a menu key 112, an ESC key 114, a phone call key 116 and an end phone call key 118. The base-frame or member 102 comprises a structural component which may be formed as a plastic frame (e.g. rigid or semi-rigid), and the keys or groups of keys are operatively coupled to the base frame 102. According to an embodiment the keys are configured as a QWERTY type keypad. As also shown, the keypad 100 may include one or more decoration bars or "frets" 120, indicated individually by references 120a,

120b, 120c and 120d. The frets 120 may be formed as part of the base-frame 102 or attached as separate components. According to another aspect, the keypad assembly may include a socket for a "trackball" (indicated by reference 210 in Fig. 2) or other pointer moving mechanism, indicated generally by reference 130. The keypad 100 (i.e. the base-frame 102) includes an edge structure indicated by reference 140 (Fig. 2). According to an embodiment, the edge structure 140 is configured to function in a light guide.

**[0027]** Reference is next made to Figs. 3 and 4, which shows a keypad actuator component or insert according to an embodiment and indicated generally by reference 300 in Fig. 3. The keypad actuator or insert 300 is formed from or comprises multiple materials. According to an embodiment, the keypad actuator 300 comprises a light-guide indicated by reference 310, deflection webs 320 and actuators 330. According to an embodiment, the light-guide 310 is formed from a clear or semi-clear plastic material (rigid or semi-rigid) that is co-molded with a corresponding deflection web 320 and actuator 330 for each of the keys. According to an embodiment, the actuators 330 are formed from a resilient material such as silicone material. The deflection webs 320 have enough inherent stiffness to hold the keys in their correct position when not pressed, and to yield enough when a user exerts a downward force on the key to bring the associated actuator 330 in contact with the corresponding key-switch component on the PCB 200 (Fig. 2).

**[0028]** According to an embodiment, the actuators 330 are formed from a flexible material such as silicone rubber, for example, to provide deflection for tactile feedback to a user. According to an embodiment, each of the actuators 330 comprises a contact dome structure that is configured to function with a dome overlay component, for example, as indicated by reference 800 in Fig. 8. The dome overlay component 800 provides the interface between the keypad 100 and the PCB 200. The dome overlay component 800 includes key-switches indicated by reference 810 for each of the actuators 330 (Fig. 3). The key-switches 810 are configured to generate a keypad signal on the PCB 200 in response to the depression of the associated actuator 330 and key 110 (Fig. 1) on the keypad 100. The dome overlay 800 also includes openings or cut-outs for LEDs configured to provide a backlighting source.

**[0029]** Referring back to Figs. 3 and 4, the keypad actuator or insert 300 includes a sealing structure indicated by reference 360. According to an embodiment, the sealing structure 360 comprises a continuous bead, protrusion or raised ridge which runs around the perimeter of the keypad actuator 300 as depicted in Fig. 3. According to an embodiment, the sealing structure 360 is formed from a resilient or a compressible material, such as silicone rubber. According to an embodiment, the silicone rubber for the sealing structure or ridge 360 is co-molded in the keypad actuator or insert 300, which comprises the light-guide 310, the deflection webs 320 and the ac-

tuators 330. In an implementation, the sealing structure 360 is formed from silicone rubber with a height in the range of 0.05 to 0.15 mm and a width in the range of 0.3 to 3.0 mm, although it will be appreciated that other dimensions may be utilized to suit the application. The height of the sealing structure 360 is taken as the height above the edge of the keypad, i.e. the surface of the edge structure 140, for example, as depicted in Fig. 7.

**[0030]** Reference is next made to Figs. 5 and 6, which show a bottom view of the keypad 100 with the keypad actuator or insert 300 in place. As shown, the keypad actuator 300 includes backlight pockets or sockets indicated by reference 350. The backlight pockets 350 receive a light source 352 (e.g. a light emitting diode or LED). The LEDs 352 are mounted on and powered from the PCB 200 (Fig. 2). According to an embodiment, the keys in the keypad 100 comprise transparent or semi-transparent keycaps that permit passage of light from the light sources 352 to provide a lighted keypad. To prevent light from the backlighting sources (i.e. the LEDs) from leaking outside the edges or periphery of the keypad, the base-frame 102 includes the edge structure 140 which serves to provide a backlight shielding function. According to an embodiment, the edge structure 140 comprises a dark (e.g. black) plastic edge that runs substantially around the perimeter of the keypad 100 or base-frame 102 and functions to block the transmission of light emitted by the light source(s) for backlighting the keypad. The edge structure 140 also serves to define a cavity or compartment which can assist in the positioning and/or insertion of the keypad actuator layer 300.

**[0031]** Reference is next made to Fig. 7, which shows the configuration of the sealing structure 360 in more detail. As shown in Fig. 7, the sealing structure 360 rests on the surface of the PCB 200. A sealing structure 360 formed from silicone rubber allows the seal 360 to be compressed against the surface of the PCB 200, which serves to improve the sealing properties. According to an embodiment, the keypad 100 includes a space (i.e. a channel or gap) indicated by reference 700. The space or gap 700 runs along the sealing structure 360 and is formed between the edge 140 and the dome overlay. The gap 700 provides a space to allow the sealing structure to be compressed when the keypad is assembled, i.e. a force applied during the keypad assembly procedure. According to an embodiment, the gap 700 has a height in the range of 0.05 to 0.10 mm although it will be appreciated that other dimensions may be appropriate.

**[0032]** According to an aspect, the sealing structure 360 when compressed against the surface of the PCB 200, for example, as depicted in Fig. 7, provides a seal or barrier to prevent the entry of moisture and/or dust and/or electrostatic discharge into the keypad 100.

**[0033]** In accordance with an embodiment, the keypad actuator 300 is formed from multiple materials using a co-molding process. For example, the deflection webs 320, the actuators 330 and the sealing bead or protrusion 360 are formed from a first resilient or a compressible

material such as silicone rubber, and the light guide 310 is formed from a second material such as a rigid or semi-rigid plastic material. According to an embodiment, this allows the sealing bead or protrusion to be formed at the same time as the actuators 330 and an integral element of the keypad actuator 300.

**[0034]** The keypad 100 may be installed or implemented with a mobile communication device. The mobile communication device comprises electronic circuitry and components configured and/or assembled on the PCB 200. The electronic circuitry includes a central processing unit or CPU, which operates under the control of a program (i.e. firmware or software) stored in program memory. The CPU is also provided with data memory. The CPU is operatively coupled to the keypad 100 and the trackball 210 (Fig. 2), i.e. input devices, a display module and an audio transducer or speaker. In addition to the program executable code provided for performing the functions associated with the operation of the mobile communication device, the program memory may include other applications, such as a browser program. The mobile communication device also includes circuitry for wireless communication with a wireless network. The particular implementation details of the mobile communication device will be within the understanding of those skilled in the art, and are therefore not described in further detail.

**[0035]** While the embodiments according to the present application have been described in the context of mobile communication devices, the embodiments may be extended or find application in other types devices having a keypad or keys.

**[0036]** The keypad according to the present application may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. Certain adaptations and modifications of the keypad will be obvious to those skilled in the art. Therefore, the presently discussed embodiments are considered to be illustrative and not restrictive, and the scope being indicated by the appended claims.

## Claims

1. An actuator component (300) for a keypad (100), said actuator component (300) comprising:

a plurality of actuators (330) formed from silicone rubber;

a light guide (310) comprising a plastic material co-molded with said plurality of actuators (330); **characterized in that** it further comprises :

a sealing bead (360) being formed from said silicone rubber and co-molded with said plastic light guide (310) and said raised sealing bead (360) being configured for compression in a channel configured in the

keypad.

2. The actuator component as claimed in claim 1, wherein said sealing bead has a height dimension in the range of 0.05 to 0.15 mm.

3. A process for manufacturing a keypad insert (300) for a keypad, said process comprising:

providing a plurality of actuators (330) formed from silicone rubber;  
providing a light guide (310) formed from a plastic material; **characterized in that** it further comprises :

providing a raised sealing bead (360) formed from silicone rubber and configured for compression in a gap configured in the keypad;

bonding together said plurality of actuators (330), said light guide (310) and said sealing bead (360) using co-molding.

4. The process as claimed in claim 3, wherein said sealing bead extends around a perimeter line of the keypad insert.

## Patentansprüche

1. Eine Aktuatorkomponente (300) für eine Tastatur (100), bestehend aus:

einer Vielzahl von aus Silikongummi geformten Aktuatoren (330),  
einem Lichtleiter (310) bestehend aus einem mit der Vielzahl von Aktuatoren (330) im Verbund gegossenen Kunststoffmaterial,

**dadurch gekennzeichnet, dass** die Aktuatorkomponente weiter einen aus dem besagten Silikongummi geformten und mit dem besagten Kunststofflichtleiter (310) im Verbund gegossenen Dichtwulst (360) umfasst, wobei der besagte erhöhte Dichtwulst (360) so ausgeführt ist, dass er in einem auf der Tastatur vorgesehenen Spalt zusammengepresst werden kann.

2. Die Aktuatorkomponente nach Anspruch 1, **dadurch gekennzeichnet, dass** der besagte Dichtwulst eine Höhe von 0,05 mm bis 0,15 mm aufweist.

3. Ein Fertigungsverfahren für einen Tastatureinsatz (300) für eine Tastatur, bestehend aus:

der Bereitstellung einer Vielzahl von aus Silikongummi geformten Aktuatoren (330),  
der Bereitstellung eines aus einem Kunststoffmaterial geformten Lichtleiters (310),

**dadurch gekennzeichnet, dass** das Fertigungsverfahren weiter die Bereitstellung eines aus Silikongummi geformten erhöhten Dichtwulsts (360) umfasst, wobei der Dichtwulst so ausgeführt ist, dass er in einem auf der Tastatur vorgesehenen Spalt zusammengepresst werden kann, wobei die besagte Vielzahl von Aktuatoren (330), der besagte Lichtleiter (310) und der besagte Dichtwulst (360) im Verbund gegossen sind.

4. Das Verfahren nach Anspruch 3, **dadurch gekennzeichnet, dass** der besagte Dichtwulst außen um den Tastatureinsatz herumführt.

et de ladite moulure d'étanchéité (360) par co-moulage.

4. Le procédé revendiqué dans la revendication 3, dans lequel ladite moulure d'étanchéité s'étend sur le pourtour de l'insert du clavier.

### Revendications

1. Un composant actionneur (300) pour un clavier (100), ledit composant actionneur (300) comprenant :

Une série d'actionneurs (330) réalisés en caoutchouc de silicone ;

Un conduit de lumière (310) composé d'un matériau en matière plastique et de ladite série d'actionneurs (330) ; **caractérisé par le fait qu'il** comprend en outre :

Une moulure d'étanchéité (360) réalisée avec ledit caoutchouc de silicone, et co-moulée avec ledit conduit de lumière en matière plastique (310), ladite moulure d'étanchéité (360) étant configurée pour être comprimée dans une rainure configurée dans le clavier.

2. Le composant actionneur selon la revendication 1, dans lequel la hauteur de ladite moulure d'étanchéité est comprise entre 0,05 et 0,15 mm de haut.

3. Un procédé pour la fabrication d'un insert de clavier (300) pour un clavier, ledit procédé comprenant :

l'installation d'une série d'actionneurs (330) réalisés en caoutchouc de silicone ;

l'installation d'un conduit de lumière (310) réalisé en matière plastique, **caractérisé par le fait qu'il** comprend également :

l'installation d'une moulure d'étanchéité (360) réalisée avec ledit caoutchouc de silicone, et configurée pour être comprimée dans une rainure configurée dans le clavier ;

la fixation ensemble de ladite série d'actionneurs (330), dudit conduit de lumière (310)

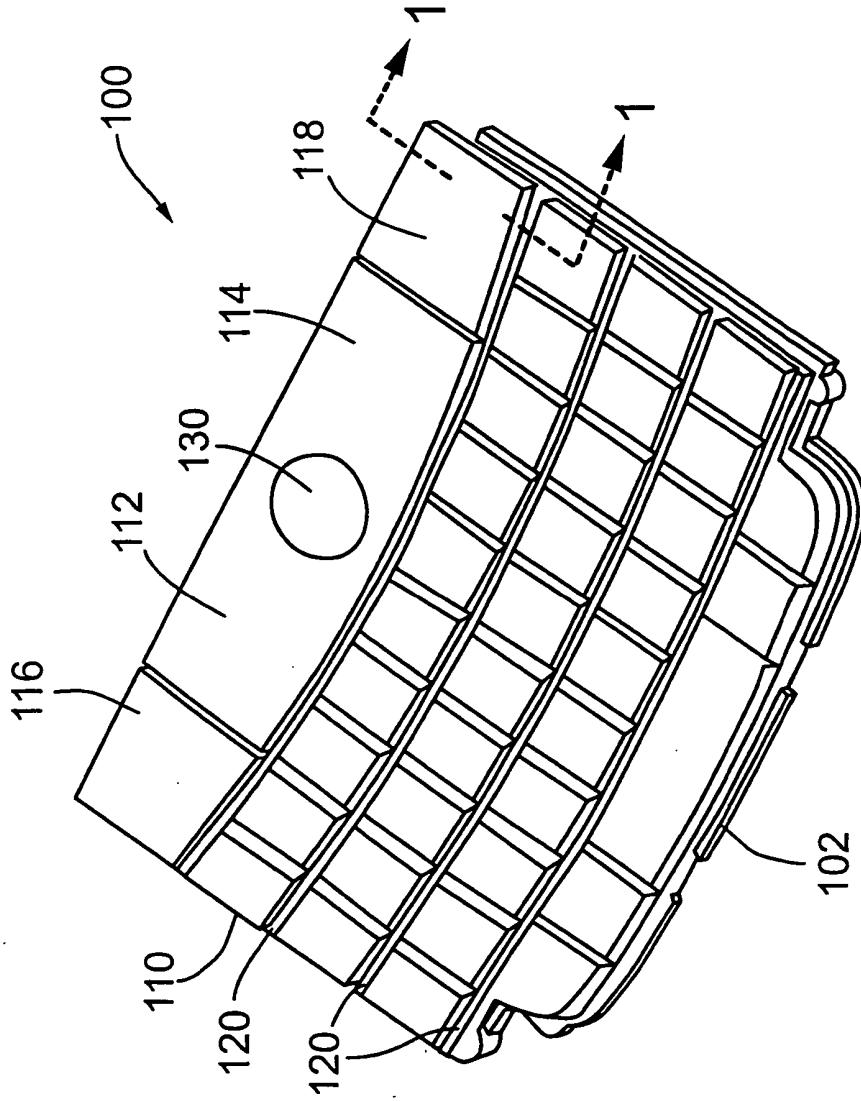


FIG. 1

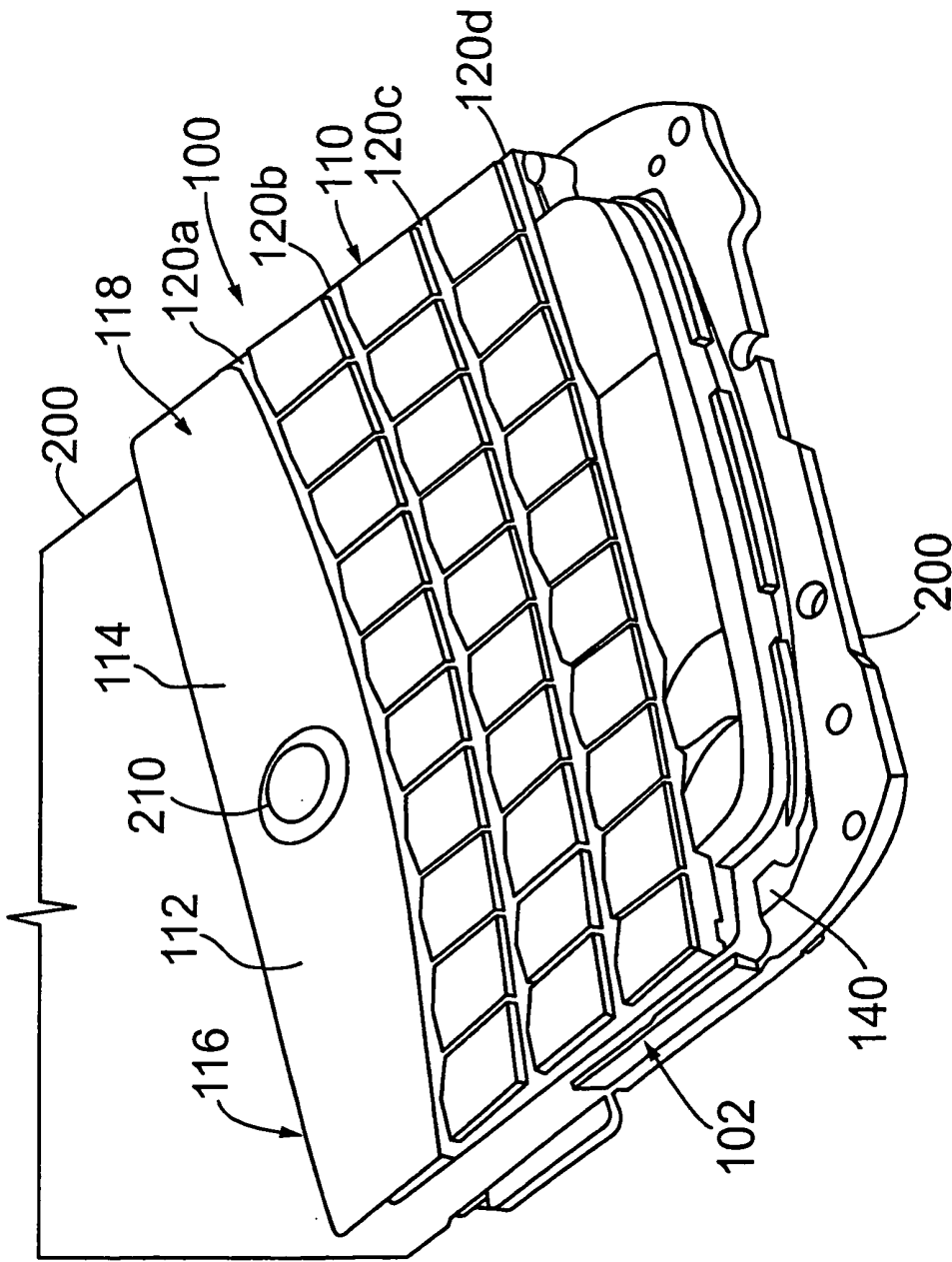


FIG. 2

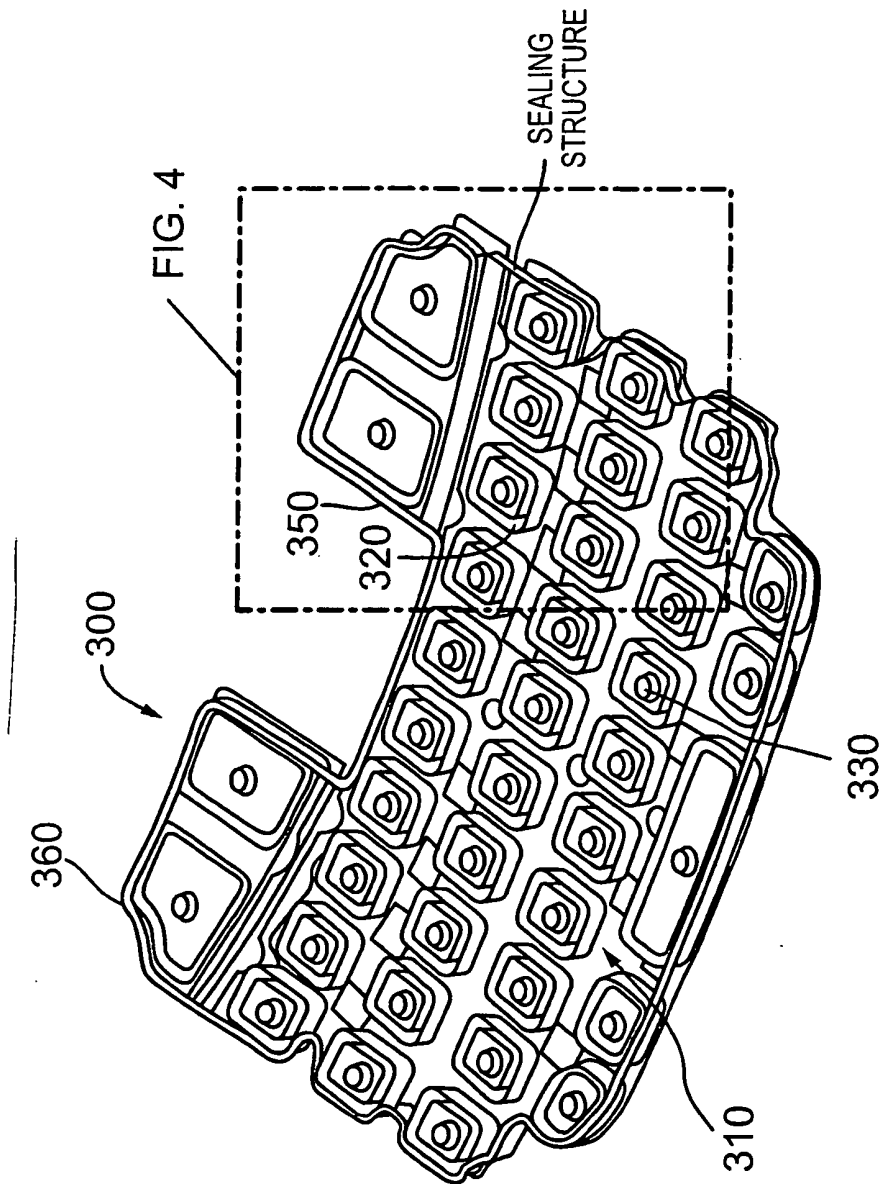


FIG. 3

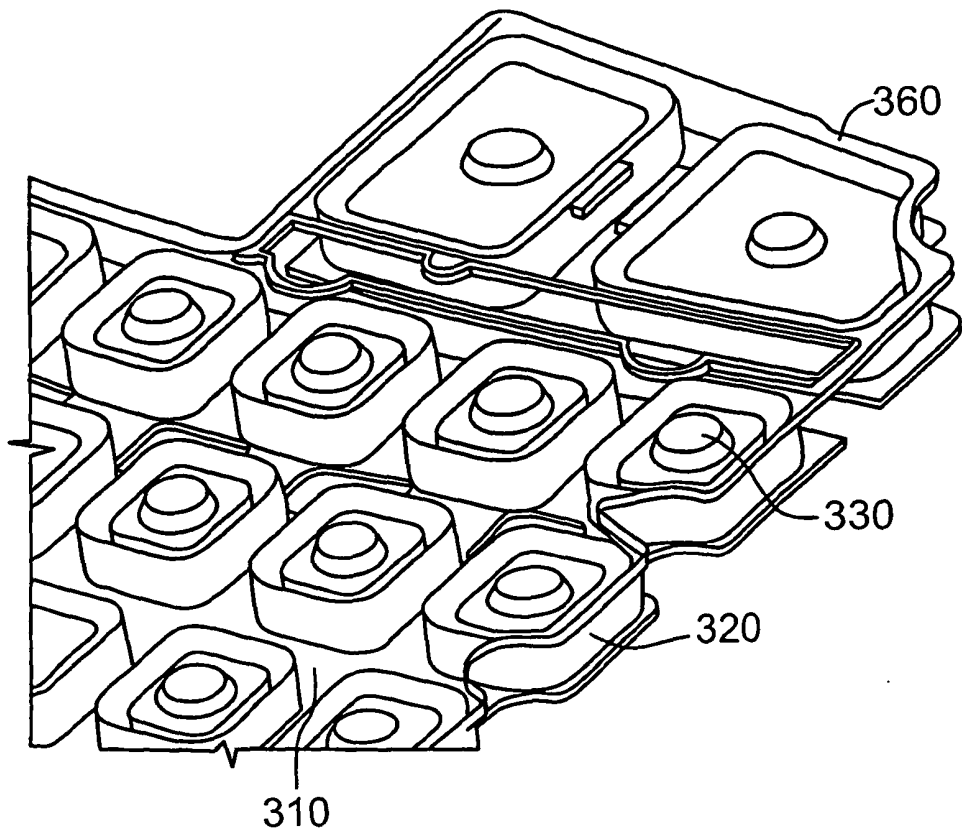


FIG. 4



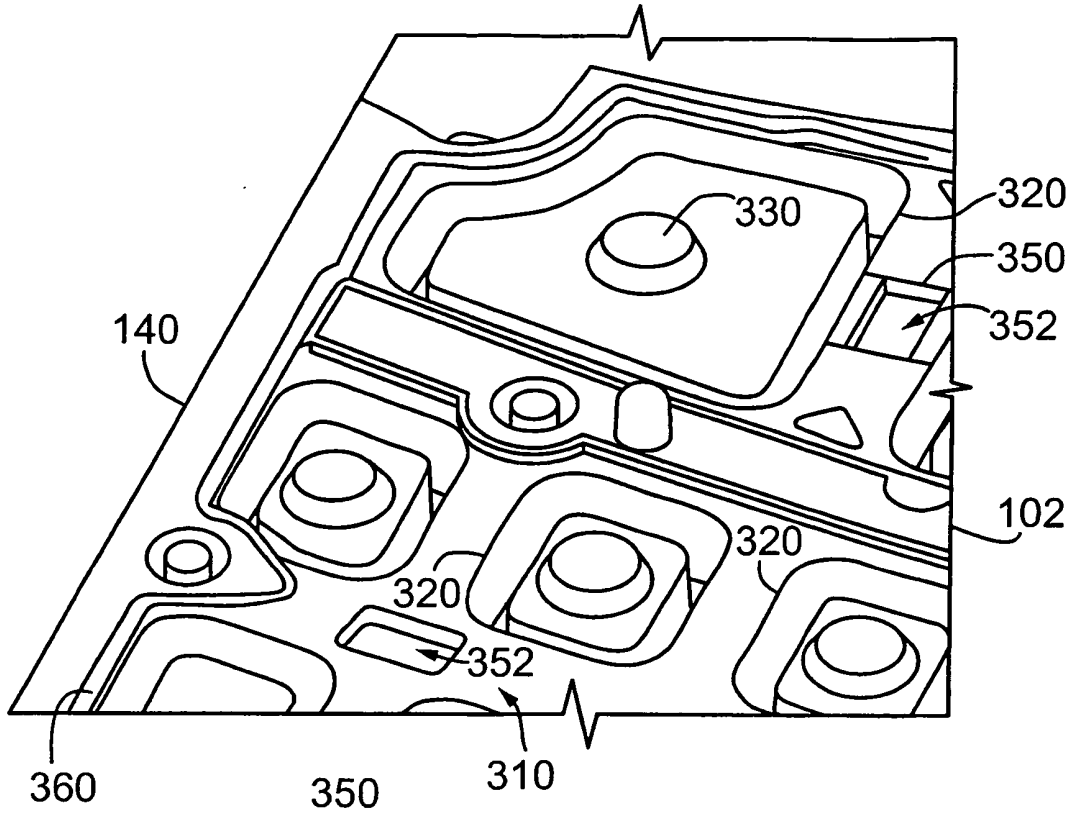


FIG. 6

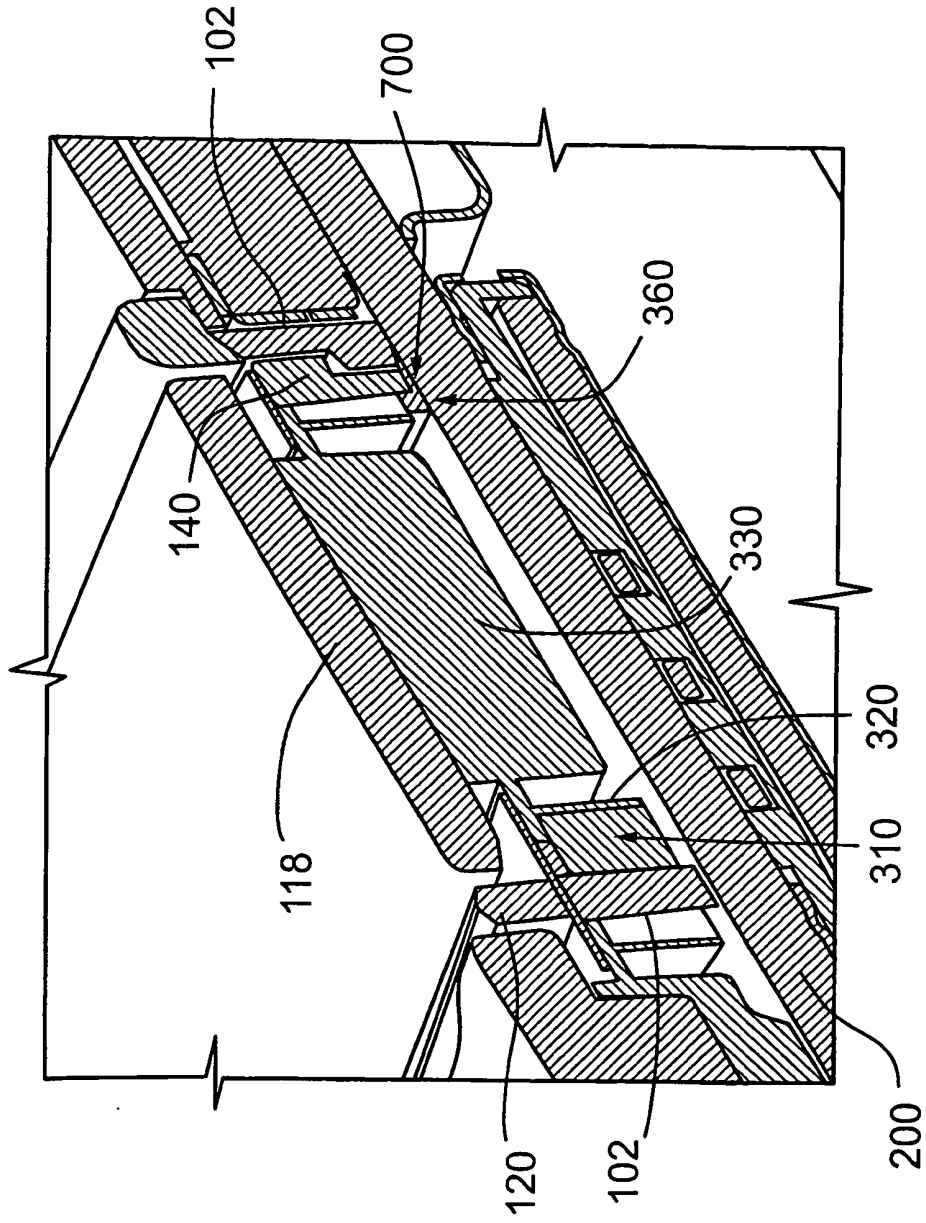


FIG. 7

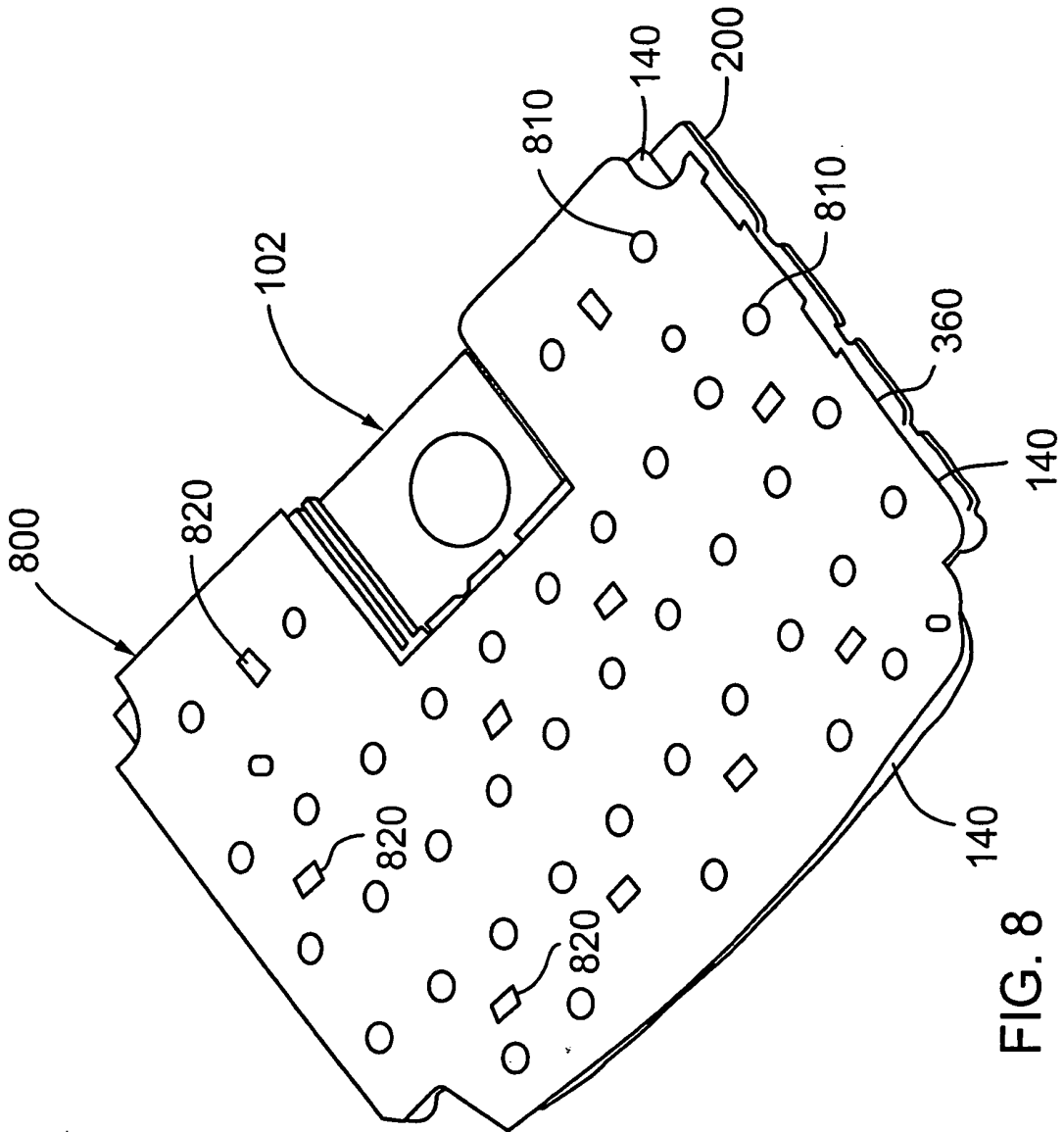


FIG. 8

**REFERENCES CITED IN THE DESCRIPTION**

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