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(54) **Illuminated pushbutton switch**

Beleuchteter Tastschalter

Interrupteur à bouton-poussoir illuminé

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Description

[0001] The present invention relates to an illuminated pushbutton switch capable of illuminating key-tops in darkness, and which is suitable for various kinds of electronic apparatuses, such as mobile telephones.

[0002] Document US 5 577 267 discloses a device according to the preamble of claim 1.

[0003] It is required that key-tops which display numerals or characters in a mobile telephone, which has recently become widely used, and in any other apparatus are capable of being visually recognized clearly by a user even in darkness, such as at night. Therefore, pushbutton switches having light sources such as LEDs (light-emitting diodes) capable of illuminating the key-top display portions of the switch have been widely used.

[0004] As a conventional technique for the illuminated pushbutton switch, a usual configuration is that in which a switching layer such as a membrane switch having a clicking means and a key-sheet layer wherein acrylic key-tops are bonded on the surface of a silicone rubber are formed in order on a circuit board on which are placed LEDs, connectors, and so forth. Further, a display portion indicating an operation code for the key-tops is printed and formed on the bottom of the acrylic key-top. That is, in an operation panel wherein a plurality of these conventional illuminated pushbutton switches are disposed, when a user pushes a desired key-top, the silicone rubber around the key-top is deformed to push and to actuate the membrane switch underneath with a clicking feeling. And if an LED emits light, the light illuminates the silicone rubber through an opening of the switching layer so as to illuminate in turn each display portion by the light diffused from the milky-white silicone rubber. Thus the numeral or the character indicating each operation code is illuminated at the bottom surface of each colorless and clear key-top.

[0005] However, the problem with such a conventional technique described above lies in the difficulty of achieving a reduced thickness design of the apparatus which has recently been required for mobile telephones, etc., because the silicone rubber having a sufficient thickness for diffusing the light and the switching layer such as a folded membrane switch are formed between the key-tops and the circuit board. Furthermore, in this conventional technique, it is also necessary to increase the number of LEDs to sufficiently illuminate the key-tops, because the light which is emitted from the LED to the silicone rubber through the opening of the switching layer is not effectively utilized, being blocked by portions of the switching layer. That is, many LEDs are required as light sources and, further the cost of the silicone rubber is comparatively high. Because of mounting costs of the parts, the structure according to the above conventional technique has been unable to achieve a reduction in the cost of the switch.

[0006] According to the present invention, there is provided an illuminated pushbutton according to claim 1.

[0007] The first sheet layer may be formed of a light-transmissive sheet such as a PET film and light-transmissive key-tops such as an acrylic resin integrated on the surface of the light-transmissive sheet by means of a bonding or an outsert forming technique and so forth.

[0008] The display portions, indicating operation codes such as numerals or characters, may be printed and formed at the corresponding positions either on the bottom or top surfaces of the key-tops or on the front or rear surfaces of the sheet of the first sheet layer.

[0009] The second sheet layer, functioning as a light diffusing sheet, may diffuse light by using a sheet having a matte finished surface or made from a milky-white material.

[0010] The projections may be formed by swelling the sheet of the second sheet layer by embossing, etc. It is preferable, however, for maintaining the hardness and height required for the projection, to form the projection after printing an epoxy resin or the like on both surfaces of the sheet.

[0011] If the second sheet layer covers the surface of the circuit board as well as the aforementioned configuration, an exposed space of an electric circuit of the board can be enclosed so that a dust and waterproof structure may be realized cheaply.

[0012] Other objects, features, and advantages of the present invention will be made clear from the following description regarding the preferred embodiment, with reference to the accompanying drawings, by way of example only.

Fig. 1 is an assembly view of a pushbutton switch group according to an embodiment of the present invention.

Fig. 2 is a cross sectional view of an assembled pushbutton switch group shown in Fig. 1.

[0013] An embodiment of the present invention will now be described while referring to the drawings. Fig. 1 shows an assembly view of a group of the pushbutton switches in accordance with the embodiment of the present invention. Fig. 2 shows a cross-sectional view of the assembled switch group shown in Fig. 1.

[0014] The illuminated pushbutton switch group shown in Fig. 1 and 2 is used as an operating panel for a mobile telephone. This pushbutton switches group is generally formed by a first sheet layer 3 comprising a PET film 2 on which a plurality of key-tops 1 which are colorless, or clear and colored and made from an acrylic resin are bonded to form a matrix. A second sheet layer 6 comprising a PET film 4 having a matte finished surface and having, on both surfaces of the film, a plurality of projections 5 which are colorless, or clear and colored. And a circuit board 9 on which are placed a plurality of LEDs 7, a plurality of tactile switches 8, connectors (not shown) and so forth which are fixed by soldering.

[0015] In the first sheet layer 3, a display portion 10 indicating an operation code for the key-top 1, such as a numeral or a character, is formed by printing on the bottom surface of each key-top 1 (see Fig. 2). The display portion 10, however, may be formed either on the front or rear surface of the PET film 2 or on the top surface of the key-top, as long as the display portion 10 corresponds to the location where the key-top 1 is located. This embodiment shows that each key-top 1 is bonded on the PET film 2. However, a plurality of key-tops may be injection-molded on the PET film utilizing an outsert forming technique.

[0016] The second sheet layer 6 is disposed opposing to the rear surface of the PET film 2 of the first sheet layer 3. Each projection 5 is located to correspond to the center of each key-top 1. In this embodiment, the material of the projection 5 is an epoxy resin and the adopted forming method for the PET film 2 is print-potting. Similar projections may be formed by screen printing or embossing.

[0017] The circuit board 9 is disposed opposing to the rear surface of the PET film 4 of the second sheet layer 6. Each projection 5 projected from the rear surface of the film 4 is located opposing to the center of the topside of each tactile switch 8 such that a desired tactile switch 8 can be actuated by pressing the projection 5 over the switch.

[0018] The first sheet layer 3, the second sheet layer 6 and the circuit board 9, as shown in Fig. 2, are combined in one piece utilizing a framework 11 made from a soft elastomer or a synthetic resin harder than the elastomer. With this combination, the PET film 2 of the first sheet layer 3 is bonded to the framework 11 by coating an adhesive on the periphery of only the rear surface of the PET film 2, while the PET film 4 of the second sheet layer 6 is coated with an adhesive on the entire periphery of both surfaces thereof so as to be bonded to and fixed to both the framework 11 and the circuit board 9.

[0019] In the illuminated pushbutton switch group formed as described above, when a user pushes a desired key-top, the key-top in turn pushes the projection 5 underneath. After the key-top descends as low as a predetermined stroke, the corresponding tactile switch 8 is pressed and actuated with a clicking feeling. At this time, the portions of the PET films 2, 4 deflect. However, if the pressing force is released, the PET films release the deflection with a good restoring force to return quickly the key-top 1 and projections 5 from their depressed positions to their original heights. In the illuminated pushbutton switch group, the PET film 4 for diffusing light can be illuminated from the rear surface thereof by the light emitted from a plurality of LEDs 7 which are placed in the regions on the circuit board 9 where the tactile switches 8 are not located. Therefore, if each LED 7 is turned on in the dark, the light diffused by the PET film 4 illuminates the PET film 2 almost uniformly over its entire surface. This results in uniform and high brightness illumination of the display portion 10 such as numerals and characters printed on the bottom side of each colorless, or clear and colored key-top.

Accordingly, the user can clearly visually recognize each display portion 10.

[0020] Besides, in the illuminated pushbutton switches group, since cheap and very thin PET films 2,4 are formed as sheet materials between the key-tops 1 group and the circuit board 9, a reduced thickness design and reduced cost are realized.

[0021] Further, the illuminated pushbutton switch group is combined by the framework 11 in one piece. Since the PET film 4 of the second sheet layer 6, on the entire periphery of both surfaces thereof, is bonded to and fixed to both the framework 11 and the circuit board 9, the circuit board 9 not only can be fixed to the framework 11 through the PET film 4 but also an exposed space 12 of an electric circuit on the circuit board 9 can be enclosed by the PET film 4 so that a reliable dust and water resistant structure can be realized.

[0022] In this embodiment described above, the PET films 2,4 are used as sheet materials in the first and second sheet layers. Other sheet materials, however, may be used, as long as they are cheap, thin, and with a good restoring force in the normal direction. Further, any material other than an acrylic resin may form the key-top 1 as long as it is light-transmissive, corresponding to being colorless, or clear and colored.

[0023] The present invention is embodied as described above and has effects as will be described.

[0024] If an illuminated pushbutton switch comprises a first sheet layer having a light-transmissive sheet and light-transmissive key-tops integrated with one surface of the light-transmissive sheet, the first sheet layer further having display portions provided at locations where the key-tops are located; a second sheet layer including a diffusing and light-transmissive sheet having projections on both surfaces, the second sheet layer further being disposed opposing to the other surface of the light-transmissive sheet of the first sheet layer; and a circuit board on which are placed light sources which emit light to the second sheet layer from the opposite surface of the first sheet layer and switching devices which are actuated by pushing forces from the key-tops, wherein the projections are located corresponding to the locations of the key-tops and the switching devices, then cheap and thin films such as a PET film can be used for sheet materials of the first and second sheet layers to provide a less expensive illuminated pushbutton switch suitable for reducing its thickness.

[0025] If the second sheet layer is formed so as to cover the surface of the circuit board, an exposed space of an electric circuit on the circuit board can be enclosed so that a dust and water resistant structure can be realized cheaply.

Claims

1. An illuminated pushbutton switch, comprising:

a first sheet layer (3) having a light-transmissive sheet (2), and light-transmissive key-tops (1) integrated with one surface of said light-transmissive sheet, said first sheet layer further having display portions provided thereon at locations where said key-tops are located; a circuit board (9) bearing light sources (7) which emit light and switching devices (8) which are actuated by pushing forces from said key-tops; **characterised by**;
a second sheet layer (6) is provided between the circuit board and the first sheet layer, and includes a diffusing and light-transmissive sheet (4) having projections (5), said second sheet layer further being disposed

opposite to the other surface of said light-transmissive sheet of said first sheet layer and receiving light from the light source and wherein said projections are located corresponding to the locations of said key-tops and said switching devices, said projections being printed and formed on both surfaces of said diffusing and light-transmissive sheet of said second sheet layer.

2. An illuminated pushbutton switch according to Claim 1 wherein said second sheet layer covers a surface of said circuit board.

Patentansprüche

1. Leuchtdruckknopfschalter, aufweisend:

eine erste Flächengebilde-Schicht (3) mit einem lichtdurchlässigen Flächengebilde (2) und lichtdurchlässigen Tasten-Oberteilen (1), welche in einer Oberfläche des lichtdurchlässigen Flächengebildes integriert sind, wobei die erste Flächengebilde-Schicht außerdem darauf vorgesehene Anzeigebereiche an den Stellen hat, an denen die Tasten-Oberteile lokalisiert sind; eine Platine (9), welche Licht ausstrahlende Lichtquellen (7) und Schaltvorrichtungen (8) trägt, welche durch drükkende Kräfte von den Tasten-Oberteilen betätigt werden, **gekennzeichnet durch**

eine zweite Flächengebilde-Schicht (6), welche zwischen der Platine und der ersten Flächengebilde-Schicht vorgesehen ist und welche ein streuendes, lichtdurchlässiges Flächengebilde (4) mit Vorsprüngen aufweist, wobei die zweite Flächengebilde-Schicht außerdem gegenüber der anderen Oberfläche des lichtdurchlässigen Flächengebildes der ersten Flächengebilde-Schicht angeordnet ist und Licht von der Lichtquelle aufnimmt und wobei die Vorsprünge mit den Stellen der Tasten-Oberteile und den Schaltvorrichtungen korrespondierend angeordnet sind, wobei die Vorsprünge auf beiden Oberflächen des streuenden, lichtdurchlässigen Flächengebildes der zweiten Flächengebilde-Schicht gedruckt und gebildet sind.

2. Leuchtdruckknopfschalter nach Anspruch 1 , wobei die zweite Flächengebilde-Schicht eine Oberfläche der Platine bedeckt.

Revendications

1. Interrupteur éclairé à boutons-poussoirs, comprenant:

une première couche (3) en feuille qui inclut une feuille translucide (2), et des têtes (1) de touches intégrées avec l'une des surfaces de la feuille translucide, ladite première couche en feuille comportant de plus des parties d'affichage qui y sont disposées à des emplacements où lesdites têtes de touches sont situées; une carte (9) de circuit portant des sources lumineuses (7) qui émettent une lumière et des dispositifs interrupteurs (8) qui sont actionnés par des forces de poussée venant desdites têtes de touches; **caractérisé en ce que**:
une deuxième couche (6) en feuille est disposée entre la carte de circuit et la première couche en feuille, et inclut une feuille (4) diffuseuse de lumière et translucide et présentant des saillies (5), ladite deuxième couche en feuille étant en outre disposée face à l'autre surface de ladite feuille translucide de ladite première couche en feuille et recevant la lumière venant des sources lumineuses, et dans lequel lesdites saillies sont situées en correspondance avec les emplacements desdites têtes de touches et desdits dispositifs interrupteurs, lesdits saillies étant imprimées et formées sur les deux surfaces de ladite feuille diffuseuse de lumière et translucide de ladite deuxième couche en feuille.

2. Interrupteur éclairé à boutons-poussoirs selon la revendication 1, dans lequel ladite deuxième couche en feuille couvre la surface de ladite carte de circuit.

FIG. 1

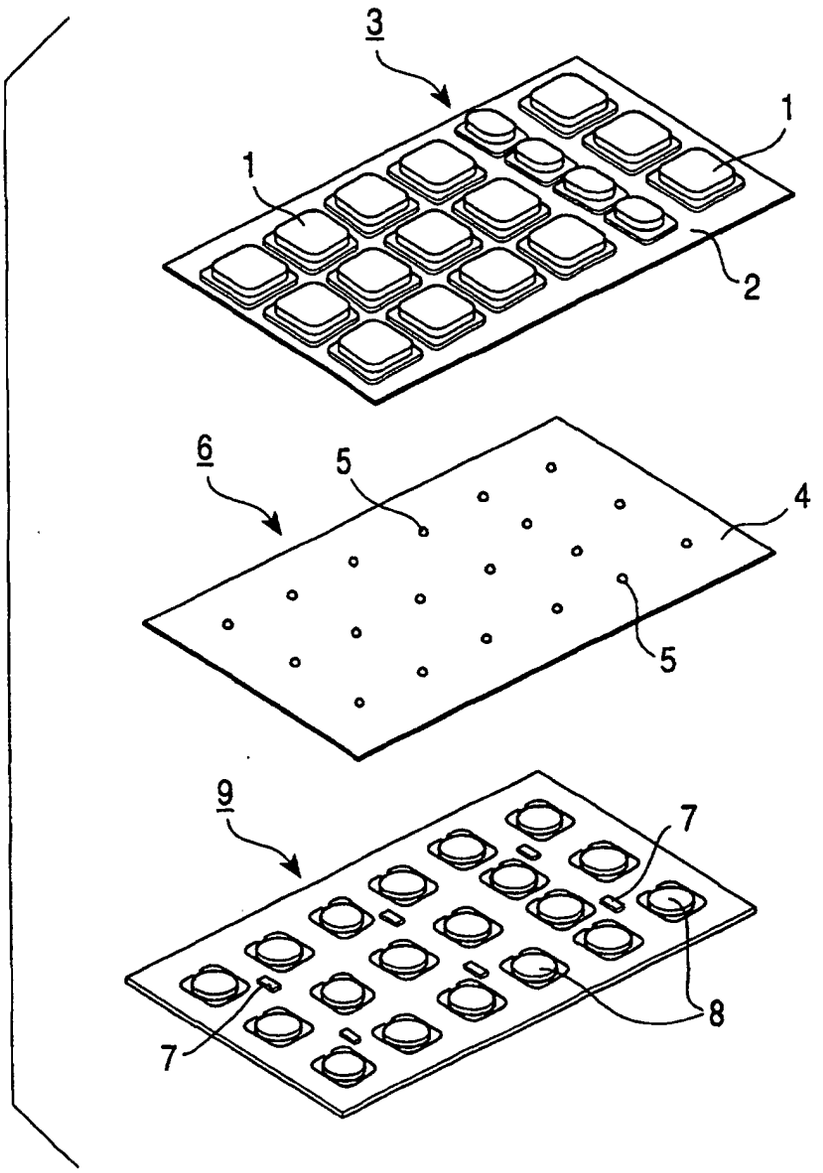
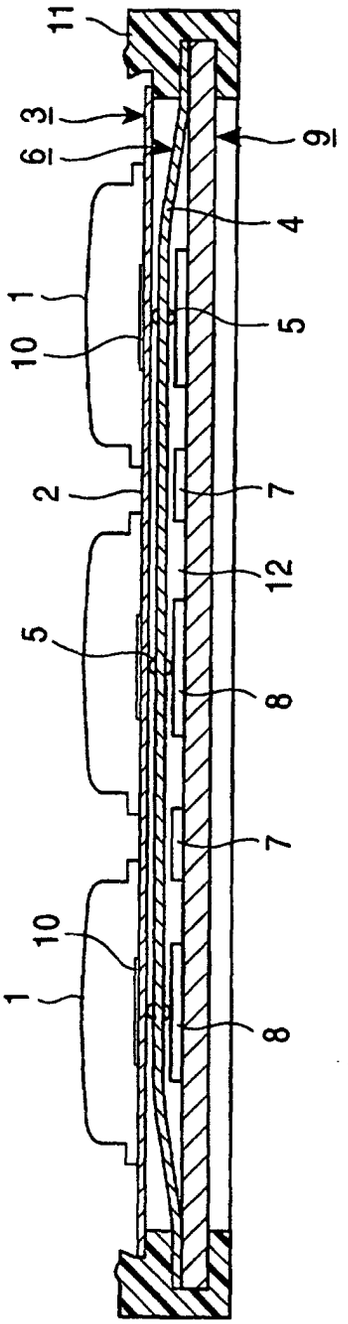
FIG. 2