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(54) **Back-illuminated membrane key**

(57) A membrane key suitable for through illumination and having tactile enhancement is described. The key has a first polyester foil layer (1) provided with a zebra laced patterned conductor. A second flexible polycarbonate layer (4), has a zebra patterned contact on a surface facing the contact on the first layer, and an opaque shield on its opposite surface, the shield and contact on the second layer having aligned transparent graphic inscriptions. An outer dome embossed polycarbonate layer (6) has on its surface facing the second layer a white translucent coating covered by coloured pigmentation in which is defined in netgative print the graphic inscription which is aligned with the inscriptions on the second layer.

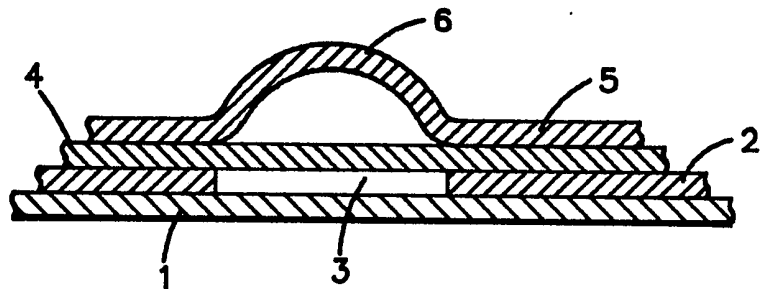


Fig. 1

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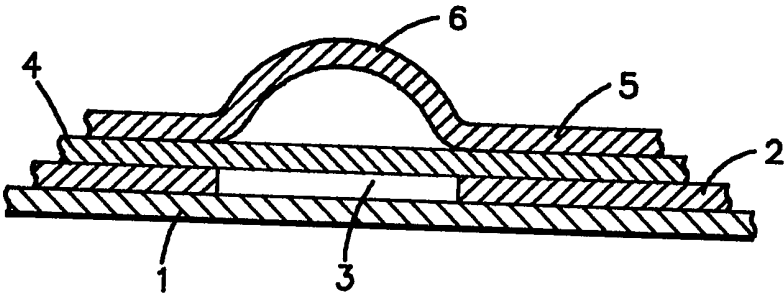


Fig. 1

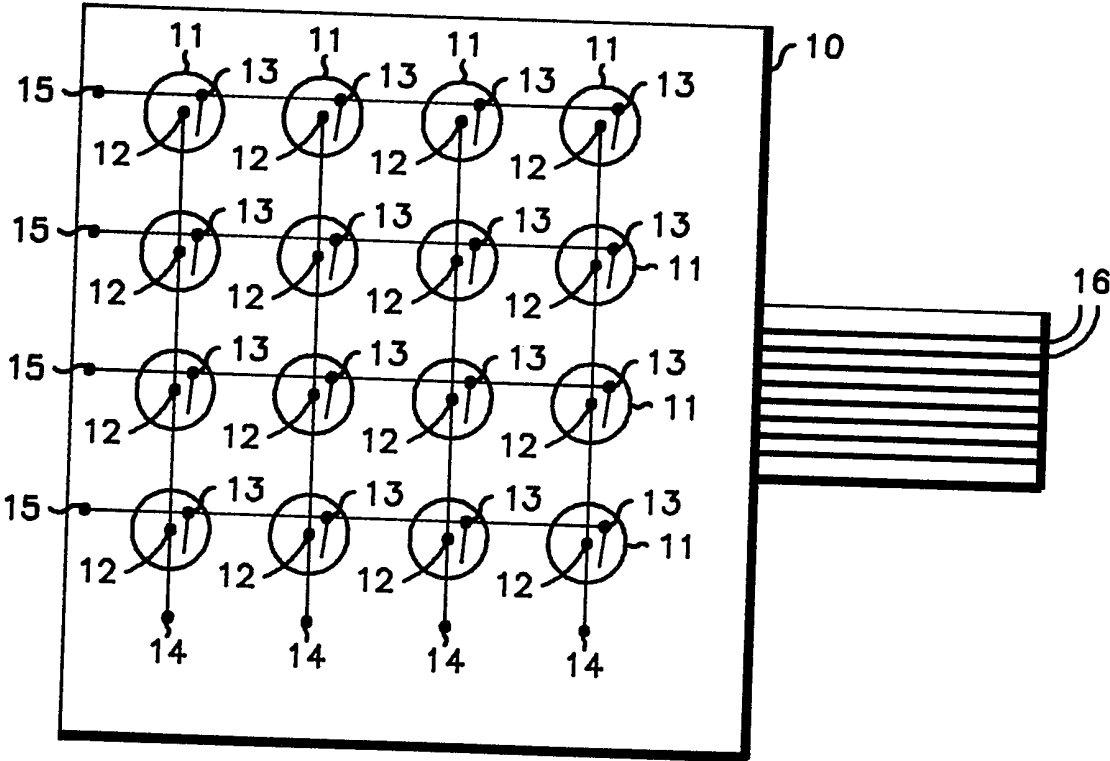


Fig. 2

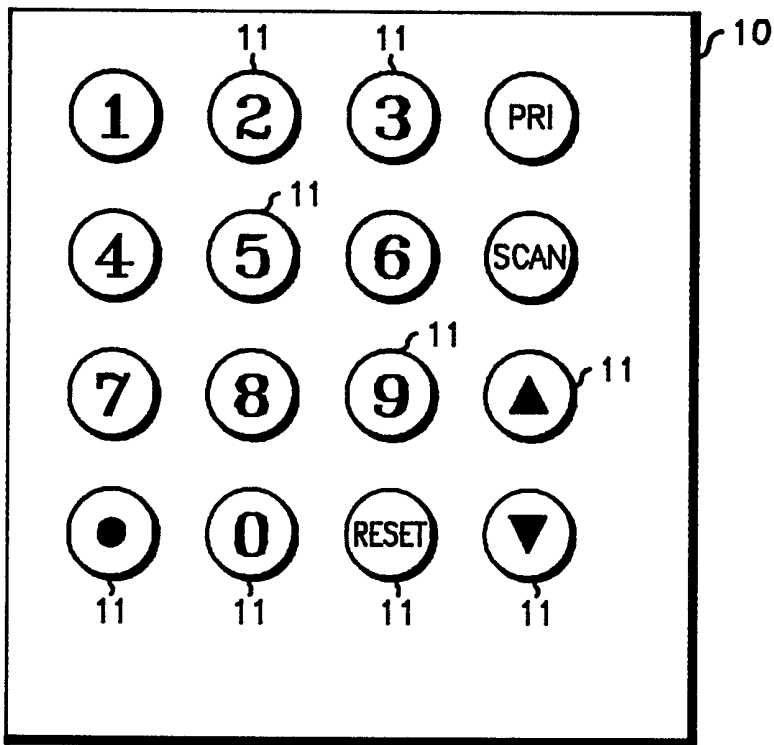


Fig. 3

SPECIFICATION

Flat membrane key and keyboard

5 FIELD OF INVENTION

This invention relates to a flat membrane key and keyboard.

BACKGROUND ART

10 Flat membrane keys and keyboards are known but such keys and keyboards have not had satisfactory tactile performance nor have known keyboards been suitable for back illumination through the keys themselves.

15 BRIEF DESCRIPTION OF THE INVENTION

This invention seeks to provide, at least in a preferred embodiment, a membrane key and keyboard in which the above mentioned disadvantages of known keys are mitigated.

20 In accordance with the invention there is provided a flat membrane key suitable for through illumination comprising, a first layer having a light transmissive portion provided with an electrical contact; a second and flexible layer spaced from the first layer and having a light transmissive portion provided with a second electrical contact which faces the contact on the first layer and which carries a light transmissive graphic inscription and an outer flexible layer carrying the same graphic inscription, the graphic inscriptions on the second and outer layers being substantially aligned with one another and such that light passing through the key illuminates the graphic inscription.

BRIEF DESCRIPTION OF DRAWINGS

40 An exemplary embodiment of the invention will now be described with reference to the drawings in which;

Figure 1 illustrates a preferred embodiment of a flat membrane key in accordance with the present invention,

45 *Figure 2* is an electrical schematic diagram of a flat membrane keyboard formed from the keys of Fig. 1, and

50 *Figure 3* shows a membrane keyboard in accordance with the invention as viewed by a user.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to Fig. 1 the illustrated flat membrane key comprises a thin foil 1 typically polyester, which has a conductive contact printed in opaque conductive ink on its upper surface as viewed in the drawing. The conductive ink forms a zebra laced pattern i.e. is cross-hatched to facilitate light transmission.

60 In a complete keyboard a conductive pattern interconnects rows and columns of such contacts to form a matrix arrangement of individual keys.

65 Overlying the foil 1 is a spacer layer 2, typically of polyester, which has a punched hole 3

in front of each contact area of the foil 1. A further contact layer 4, typically formed of poly carbonate, overlays the spacer 2 and has an electrical contact printed on its surface which faces the layer 1.

70 As with the contact layer 1, the electrical contact provided on the layer 4 is printed in zebra laced artwork and a conductive pattern interconnects contacts in several keys forming part of a keyboard.

75 The centre area of the contact on the layer 4 is free of conductive ink in an area directly underneath a graphic inscription which is to be presented on the key to a user, the area which is free of ink being in the exact shape of the contours of the inscription but slightly larger so as to avoid layer registration problems.

80 Light passing through the thin layer 1 and through the spacer layer 2, passes through the contact area on the layer 4 without causing shade on the front layer of the key.

85 On the surface of the layer 4 opposite to that which carries the electrical contact, is printed in the same conductive ink an opaque shield cover, which is also free of ink under the graphic inscription and in the exact shape of but slightly larger than the inscription contour i.e. the inscription is negatively printed on the shield. This opaque printing serves both as a electrostatic shield and as a light masking layer and renders each key completely opaque except for the area of the graphic inscription.

90 Finally a layer 5, formed from polycarbonate, provides a tactile graphic layer and has a dome embossing 6 to provide tactile enhancement.

95 The side of the layer 5 which faces the layer 4 is printed first with a semitransparent i.e. translucent white layer, and then with a pigmentation layer having any desired colour. Graphic inscriptions are provided on the pigmentation layer formed on the layer 5 in negativeprint. In other words, the graphic inscription itself is provided without colour whilst a surrounding frame is coloured as desired by the layer of pigmentation. The outer surface of the layer 5, intended to be pressed by a user, may be textured in a fine grain design.

100 Referring now to Fig. 2, there is shown an electrical schematic of a typical membrane keyboard in accordance with the invention.

105 The keyboard 10 comprises rows and columns of membrane key switches each as described with reference to Fig. 1 of the drawings. Each key switch 11 has electrical contacts 12, 13 formed by the contacts on the layers 1 and 4 respectively, of the keys of Fig. 1. The contacts 12 and 13 are zebra laced contacts the contacts 12 being connected together by means of the column conductors 14, whilst the contacts 13 are connected together by means of row conductors 15. The row and column conductors 14 and 15, exit the keyboard by means of conductive

tracks 16.

Depressing the dome 6 of each key causes the appropriate contacts 11, 12 to make electrical contact and to provide an appropriate
5 electrical signal onto the respective one of the tracks 16.

Referring now to Fig. 3, there is shown a view of a typical keyboard of the invention as viewed by an operator. The figure is generally
10 self explanatory and as can be seen each key displays a graphic inscription which may be illuminated through the keyboard.

In this example the keyboard is of a form suitable for use as an input device to a programmable radio in which certain of the keys
15 carry numbers for entering frequency values and other keys are function keys for such functions as 'frequency scan', 'up', 'down', 'reset', etc.

It will be apparent that there has been described a membrane key and keyboard which has a tactile touch and which includes the option of illumination of the keys by means of light transmitted through each key.
20

The invention has been described by way of example and modifications may be made without departing from the scope of the invention. For example the materials described for the various layers of the keyboard, are particularly
25 advantageous but they could be replaced by other suitable alternatives. The graphic inscription on the outer layer 5 is defined in negative print but could equally well be positively printed as a coloured symbol on a transparent or translucent background.
30

The keys of a complete keyboard have been shown arranged in a matrix array but any convenient layout could be used.
35

40 CLAIMS

1. A flat membrane key suitable for through illumination comprising, a first layer having a light transmissive portion provided with an electrical contact; a second and flexible layer spaced from the first layer and having a light transmissive portion provided with a second electrical contact, which faces the contact on the first layer and which carries a light transmissive graphic inscription, and an
45 outer flexible layer carrying the same graphic inscription, the graphic inscriptions on the second and outer layers being substantially aligned with one another and such that light passing through the key illuminates the graphic
50 inscription.
55

2. The key of claim 1 wherein the first layer is a light transmissive polyester foil.

3. The key of claim 1 or 2 wherein the second layer is a light transmissive polycarbonate layer.
60

4. The key of any preceding claim wherein the electrical contact provided on the first layer has a zebra-laced pattern.

5. The key of any preceding claim wherein
65 the electrical contact provided on the second

layer has a zebra-laced pattern.

6. The key of any preceding claim wherein the surface of the second layer, opposite to that which carries the second electrical contact, is provided with an opaque covering having a light transmissive portion in the shape of said graphic inscription and substantially aligned with the graphic inscriptions on the outer layer and in the second electrical contact.
70

7. The key of claim 6 wherein the opaque covering is electrically conductive to provide an electrostatic shield.
75

8. The key of any preceding claim wherein the outer layer is a light transmissive polycarbonate layer.
80

9. The key of any preceding claim wherein the graphic inscription provided on the outer layer is formed in negative print.
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10. The key of any preceding claim wherein the graphic inscription provided on the outer layer is provided in a translucent portion of the outer layer.
90

11. The key of claim 10 wherein the translucent portion is formed by providing a surface portion of the outer layer which overlies the electrical contacts of the first and second layers with a translucent coating.
95

12. The key of claim 11 wherein the graphic inscription is defined on the translucent coating by means of a selectably coloured pigmentation.
100

13. The key of any one of claims 9 to 12 wherein the graphic inscription is formed on a surface of the outer layer which faces the second layer.
105

14. The key of an preceding claim wherein the outer layer has tactile enhancement.

15. The key of claim 14 wherein the tactile enhancement is provided by dome embossing the outer layer.
110

16. A membrane keyboard including a plurality of keys each as claimed in any preceding claim the first and second electrical contacts of each key being interconnected by respective conductive patterns.