

AN APPARATUS AND A METHOD FOR CONVEYING SYMBOLS TO A USER

TECHNOLOGICAL FIELD

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Embodiments of the present invention relate to an apparatus and a method for conveying symbols to a user. In particular, they relate to conveying symbols displayed on a keypad of a mobile device.

10 BACKGROUND

Some mobile devices comprise a keypad. The keypad may include various symbols that denote the functions of keys in the keypad. If a key in the keypad can be used to input different symbols in different modes of operation of the mobile device, multiple
15 symbols for those modes may be printed on the key. For example, if a key can be used to input the number two in a first mode of operation and to input the letters a, b or c in a second mode of operation, the symbols 2, a, b and c may be printed on that key.

20 BRIEF SUMMARY

According to various, but not necessarily all, embodiments of the invention there is provided an apparatus, comprising: a first layer comprising a definition of a first symbol; and a second layer comprising a definition of a second symbol, wherein the
25 definition of the first symbol at least partially overlies the definition of the second symbol.

According to various, but not necessarily all, embodiments of the invention there is provided a method, comprising: illuminating a definition of a first symbol in a first
30 layer; and illuminating a definition of a second symbol in a second layer, wherein the

definition of the first symbol in the first layer at least partially overlies the definition of the second symbol in the second layer.

According to various, but not necessarily all, embodiments of the invention there is

5 provided an apparatus, comprising: a first light guide comprising a reflective portion, forming a definition of a first symbol, configured to reflect light out of the first layer and towards a user; a layer comprising a light permeable portion, forming a definition of a second symbol, wherein the definition of the first symbol at least partially overlies the definition of the second symbol; and a second light guide comprising a reflective
10 portion configured to reflect light, such that the reflected light passes through the light permeable portion in the layer and through the first light guide.

According to various, but not necessarily all, embodiments of the invention there is provided an apparatus, comprising: means for illuminating a definition of a first
15 symbol in a first layer; and means for illuminating a definition of a second symbol in a second layer, wherein the definition of the first symbol in the first layer at least partially overlies the definition of the second symbol in the second layer.

Each apparatus described above may be for enabling a user to input symbols into an
20 electronic device. Each apparatus may form part of the electronic device.

BRIEF DESCRIPTION

For a better understanding of various examples that are useful for understanding the
25 brief description, reference will now be made by way of example only to the accompanying drawings in which:

Fig. 1 illustrates an example of an apparatus;

Fig. 2A illustrates the example of the apparatus in a first mode of operation;

Fig. 2B illustrates the example of the apparatus displaying a first symbol in the first
30 mode of operation;

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Fig. 3A illustrates the example of the apparatus in a second mode of operation;

Fig. 3B illustrates the example of the apparatus displaying a second symbol in the second mode of operation;

Fig. 4 illustrates a further example of the apparatus;

5 Fig. 5A illustrates the further example of the apparatus in a first mode of operation;

Fig. 5A illustrates the further example of the apparatus in a second mode of operation;

Fig. 6A illustrates an electronic device comprising the apparatus, where the apparatus is in a first mode of operation;

10 Fig. 6B illustrates the electronic device, where the apparatus is in a second mode of operation; and

Fig. 7 illustrates a flow chart of a method.

DETAILED DESCRIPTION

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Embodiments of the invention relates to an apparatus that may be used to display a first set of keypad symbols when an electronic device is in a first mode of operation, and a second set of keypad symbols when the electronic device is in a second mode of operation.

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In this regard, the figures illustrate an apparatus 100/100', comprising: a first layer 10 comprising a definition 12 of a first symbol 71; and a second layer 20 comprising a definition 22 of a second symbol 72, wherein the definition 12 of the first symbol 71 at least partially overlies the definition 22 of the second symbol 72.

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Fig. 1 illustrates a cross-section of the apparatus 100. The apparatus 100 may form part of a keyboard of an electronic device. The electronic device may be a hand portable electronic device such as a mobile telephone, a tablet computer, a portable music player or a dedicated games console. The keyboard may, for example, be a

30 keypad of a hand portable electronic device.

The apparatus 100 illustrated in Fig. 1 comprises three layers 10, 20, 30 in a sandwich structure. The first layer 10 overlies the second layer 20, and the second layer 20 overlies the third layer 30. The second layer 20 is therefore sandwiched
5 between the first layer 10 and the third layer 30.

The apparatus 100 also comprises a first light source 40 and a second light source 50. Each of the first and second light sources 40, 50 may be a light emitting device, such as a light emitting diode (LED). The first light source 40 is configured to direct
10 light into the first layer 10. The second light source 50 is configured to direct light into the third layer 30.

In this example, the first layer 10 is a first light guide which has an upper surface 13, a lower surface 14 and a body 11 therebetween. The first layer 10 comprises a
15 definition 12 of a first symbol. The first symbol becomes visible when the definition 12 of it is illuminated by the first light source 40. This is described in further detail below.

The first symbol may, for example, be a character such as a letter, a number or an icon. The definition 12 of the first symbol is formed in the lower surface 14 of the first
20 layer 10. In the illustrated example, the definition 12 is formed by one or more recesses (blind holes) in the lower surface 14 of the first layer 10. The recesses may, for instance, be formed using an etching process or embossed by tooling. The one or recesses constitute a reflective portion in the first layer 10.

25 In practice, the first layer 10 may include definitions for a plurality of different symbols, each of which might be formed by a reflective portion in the lower surface 14 of the first layer 10.

The second layer 20 comprises a definition 22 of a second symbol. The second symbol becomes visible when the definition 22 of it is illuminated by the second light source 50. This is described in further detail below.

5 The second symbol may, for example, be a character such as a letter, a number or an icon. The second symbol is different from the first symbol. The definition of the second symbol is formed by a light permeable portion in the second layer 20. The light permeable portion may, for instance, be formed from one or more apertures (through holes) in the second layer 20. Fig. 1 illustrates the aperture(s) labelled with
10 the reference numerals 22a, 22b and 22c.

In this example, at least a region 21 of the second layer around the light permeable portion is substantially opaque. In some implementations, the entire second layer may be substantially opaque. The opaque region 21 may, for example, absorb or
15 reflect light.

The second layer 20 could be a film that is made, for example, from polycarbonate or polyethylene terephthalate (PET). The film might be adhered to the lower surface 14 of first layer 10. Alternatively, the second layer 20 could be ink, which might be
20 printed on an upper surface 33 of the third layer 30 or on the lower surface 14 of the first layer 10.

In practice, the second layer 20 may include definitions for a plurality of different symbols, each of which might be formed by a light permeable portion 22 in the
25 second layer 20.

In the example illustrated in Fig. 1, the third layer 30 is a second light guide which has an upper surface 33, a lower surface 34 and a body 31 therebetween. The lower surface 34 of the third layer 30 includes one or more recesses (blind holes). The

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recesses may, for instance, be formed using an etching process. The one or
recesses constitute a reflective portion 32 in the third layer 30.

5 The reflective portion 32 in the third layer 30 may or may not have the same shape
as the light permeable portion 22 in the second layer 20 that lies above it. For
example, the reflective portion 32 could form the shape of the second symbol, or it
could form another shape such as a square, a rectangle, a circle or an oval.

10 Fig. 2A illustrates the apparatus 100 in a first mode of operation in which the first
symbol is conveyed to a user. In this example of the first mode of operation, the first
light source 40 emits light into the first layer 10 but the second light source 50 does
not emit light into the third layer 30. The light being emitted into the first layer 10 is
represented by three light rays 61, 62, 63 in Fig. 2A.

15 The first light guide 10 is configured to guide the light emitted by the first light source
40 towards the reflective portion 12 defining the first symbol. Light may be guided
within the body 11 (for example, by means of total internal reflection) until it reaches
the reflective portion 12. When the guided light reaches the reflective portion 12, it is
reflected out of the first layer 10 and towards a user.

20 In this example, the symbol that is defined by the reflective portion 12 in the first layer
10 is the letter "A". Fig. 2B illustrates the symbol 71 that is seen by the user when the
apparatus 100 is in the first mode of operation.

25 Fig. 3A illustrates the apparatus 100 in a second mode of operation in which the
second symbol is conveyed to a user. In this example of the second mode of
operation, the second light source 50 emits light into the third layer 30 but the first
light source 40 does not emit light into the first layer 10. The light being emitted into
the third layer 30 is represented by four light rays 64, 65, 66, 67 in Fig. 3A.

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The second light guide 30 is configured to guide the light emitted by the second light source 50 towards the reflective portion 32. Light may be guided within the body 31 (for example, by means of total internal reflection) until it reaches the reflective portion 32 in the third layer 30.

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When the guided light reaches the reflective portion 32 in the third layer 30, it is reflected such that it passes through the light permeable portion 22 in the second layer 20, through the first layer 10 and towards a user. Fig. 3A illustrates the light rays 64, 65 and 66 exiting the upper surface 13 of the first layer 10. The light ray
10 labelled with the reference numeral 67 is absorbed by the opaque region 21 of the second layer 20.

In this example, the symbol that is defined by the light permeable portion 22 in the second layer 20 is the letter "B". Fig. 3B illustrates the symbol 72 that is seen by the
15 user when the apparatus 100 is in the second mode of operation.

As explained above, the definition 12 of the first symbol 71 at least partially overlies the definition 22 of the second symbol 72. In the context of the example illustrated in Figs. 2A to 3B, this means that the reflective portion 12 in the first layer 10 (which
20 defines the letter "A") at least partially overlies the light permeable portion 22 (which defines the letter "B").

Neither the first symbol 71 nor the second symbol 72 is more salient than the other when neither the first symbol 71 nor the second symbol 72 is being illuminated by the
25 light sources 40, 50. The first and second symbols 71, 72 may be substantially invisible in this instance.

When the apparatus 100 is in the first mode of operation, the first symbol 71 is illuminated and visible to the user, but the second symbol 72 is substantially invisible.

30 The second symbol 72 is substantially invisible because very little light, if any, is

passing through the light permeable portion 22 in the second layer 20 before reaching the user (or, at least, the amount of light that is doing so is much less than the amount of light that is being reflected towards the user by the reflective portion 12 in the first layer 10).

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When the apparatus 100 is in the second mode of operation, the second symbol 72 is illuminated and visible to the user, but the first symbol 71 is substantially invisible. The first symbol 71 is substantially invisible because, as illustrated in Fig. 3A, the reflective portion 12 in the first layer 10 does not redirect the light (at least, to any significant extent) that passes through the light permeable portion 22 in the second layer 20 in the direction of the user.

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From the user's perspective, when the apparatus 100 is in the first mode of operation, the position at which the first symbol 71 is displayed by the apparatus 100 is substantially the same as the position at which the second symbol 72 is displayed when the apparatus 100 is in the second mode of operation.

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In the context of the example illustrated in Figs 2A to 3B, if the first light source 40 and the second light source 50 were concurrently operational, the user would see the letter "A" and the "B" simultaneously in substantially the same position. However, the first light source 40 and the second light source 50 do not operate concurrently in this example, so the first and second symbols 71, 72 are not visible to the user at the same time.

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Fig. 4 illustrates a further example 100' of the apparatus. Fig. 4 illustrates the second light guide 30 mounted on a circuit board 6. A layer of dark print 5 is present on an upper surface of the circuit board 6.

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The example of the apparatus 100' illustrated in Fig. 4 differs from the example illustrated in Figs 1, 2A and 3A in a number of ways. Firstly, in the Fig. 4 example,

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the first light source 40 and the second light source 50 are positioned on opposite sides of the stack formed by the first, second and third layers 10, 20 and 30, rather than the same side.

5 Secondly, the apparatus 100' comprises first, second and third shields 3, 4, 7 that prevent light from entering certain regions. The first shield 3, for example, shields the second light guide 30 from light which might (otherwise) escape from the first light guide 10 and enter the second light guide 30. This prevents the second symbol 72 from inadvertently becoming visible when the apparatus 100' is in the first mode of
10 operation in which it causes the first symbol 71 to be displayed. The second shield 4 shields the first light guide 10 from light which might (otherwise) escape from the second light guide 30 and enter the first light guide 10.

Thirdly, the apparatus 100' in Fig. 4 includes a further layer 2, positioned on/above
15 the upper surface 13 of the first layer 10. The further layer 2 may be configured to absorb or reflect light that is reflected from a blank portion of the lower surface 14 in the first layer 10 (that is, outside the reflective portion 12). The presence of the further layer 2 will have the effect of improving the visibility of the first symbol 71 when the apparatus 100 is in the first mode, but may reduce the visibility of the
20 second symbol 72 when the apparatus 100 is in the second mode. The further layer may, for example, be a non-conductive vacuum metallization film

Fig. 5A illustrates the apparatus 100' of Fig. 4 in a first mode of operation, in which a first symbol 71 (the character 'A') is displayed. Fig. 5B illustrates the apparatus 100'
25 in a second mode of operation in which a second symbol 72 (the character 'B') is displayed. The apparatus 100' illustrated in Fig. 4 operates in a similar manner to the apparatus of Fig. 1, the operation of which was explained above in relation to Figs 2A to 3B. The explanation is not repeated here for conciseness.

Embodiments of the invention advantageously enable a change in functionality of a particular input area (such as a particular key, or a particular area of a touch pad) to be clearly communicated to a user. For example, the first symbol 71 may denote a first input function designated to an input area in a first mode of operation and the second symbol 72 may denote a second input function designated to the input area in a second mode of operation. In the context of the example illustrated in Figs 2A to 3B, the first input function may be "input the letter A" and the second input function may be "input the letter B".

10 The apparatus 100/100' described above may be implemented in any type of keys, including mechanical keys that displace when actuated and capacitive keys (that might not displace when actuated).

Figs 6A and 6B illustrate an example in which the apparatus 100/100' has been implemented in a touch pad 101 of an electronic device 200. The electronic device 200/apparatus 100/100' has a first mode of operation, which is a telephone keypad mode, as illustrated in Fig. 6A. The electronic device 200/apparatus 100/100' also has a second mode of operation, which is a QWERTY keyboard mode, as illustrated in Fig. 6B.

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In the Fig 6A and 6B example, a processor of the electronic device 200 might be configured to change the mode of operation between the first and second modes, depending upon the orientation of the electronic device 200. For example, when the device 200 is in a portrait orientation, the processor may control the device 200 to operate in the first (telephone keypad) mode, and when the device 200 is in a landscape orientation, the processor may control the device 200 to operate in a second (QWERTY keyboard) mode.

Fig. 7 illustrates a flow chart of a method. Block 501 in Fig. 7 involves illuminating the definition 12 of the first symbol 71 in the first layer 10. Block 502 involves illuminating the definition 22 of the second symbol 72 in the second layer 20.

5 The illustration of a particular order to the blocks in Fig. 7 does not necessarily imply that there is a required or preferred order for the blocks and the order and arrangement of the block may be varied. Furthermore, it may be possible for some blocks to be omitted.

10 Although embodiments of the present invention have been described in the preceding paragraphs with reference to various examples, it should be appreciated that modifications to the examples given can be made without departing from the scope of the invention as claimed. For example, the apparatus 100 may comprise only a single light source that can direct light into the first layer 10 or the third layer
15 30.

The processor of the device might be configured to adjust the output of the light source(s) to control the brightness of the symbols 71, 72.

20 It is not necessary for the first mode of operation to be a telephone keypad mode, nor is it necessary for the second mode of operation to be a QWERTY keyboard mode. In another example, the different modes of operation could relate to inputting characters in different alphabets (for instance, the Latin alphabet and the Russian alphabet).

25 Features described in the preceding description may be used in combinations other than the combinations explicitly described.

Although functions have been described with reference to certain features, those
30 functions may be performable by other features whether described or not.

Although features have been described with reference to certain embodiments, those features may also be present in other embodiments whether described or not.

- 5 Whilst endeavouring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

WHAT IS CLAIMED IS:

1. An apparatus, comprising:
5 a first layer comprising a definition of a first symbol; and
a second layer comprising a definition of a second symbol, wherein the
definition of the first symbol at least partially overlies the definition of the
second symbol.
- 10 2. The apparatus as claimed in claim 1, wherein the definition of the first symbol
is a reflective portion in the first layer.
3. The apparatus as claimed in claim 2, wherein the reflective portion is
configured to reflect light out of the first layer.
- 15 4. The apparatus as claimed in claim 2 or 3, wherein the reflective portion is
formed from one or more recesses in a surface of the first layer.
5. The apparatus as claimed in any of the preceding claims, wherein the first
20 layer is a light guide configured to guide light towards the reflective portion.
6. The apparatus as claimed in any of the preceding claims, wherein the
definition of the second symbol is a light permeable portion in the second
layer.
- 25 7. The apparatus as claimed in claim 6, wherein a region of the second layer
around the light permeable portion is substantially opaque.
8. The apparatus as claimed in claim 6 or 7, wherein the light permeable portion
30 is or comprises one or more apertures in the second layer.

9. The apparatus as claimed in any of the preceding claims, further comprising:
a third layer, wherein the second layer overlies the third layer.
- 5 10. The apparatus as claimed in claim 9, when dependent upon 6, wherein the
third layer comprises a reflective portion configured to reflect light such that
the reflected light passes through the light permeable portion in the second
layer and through the first layer.
- 10 11. The apparatus as claimed in claim 10, wherein the third layer is a light guide
configured to guide light towards the reflective portion.
12. The apparatus as claimed in any of the preceding claims, further comprising:
one or more light sources configured to illuminate the definition of the first
15 symbol and the definition of the second symbol.
13. The apparatus as claimed in claim 12, wherein neither the first symbol nor the
second symbol is more salient than the other when neither the first symbol
nor the second symbol is being illuminated by the one or more light sources.
- 20 14. The apparatus as claimed in any of the preceding claims, wherein the first
layer overlies the second layer.
15. The apparatus as claimed in any of the preceding claims, wherein the first
25 symbol denotes a first input function designated to an input area in a first
mode of operation, and the second symbol denotes a second input function
designated to the input area in a second mode of operation.

16. The apparatus as claimed in any of the preceding claims, wherein the apparatus is a keypad.
- 5 17. The apparatus as claimed in any of the preceding claims, wherein the first symbol is a first character, and the second symbol is a second character.
18. A method, comprising:
Illuminating, in a first mode of operation, a definition of a first symbol in a first layer; and
10 Illuminating, in a second mode of operation, a definition of a second symbol in a second layer, wherein the definition of the first symbol in the first layer at least partially overlies the definition of the second symbol in the second layer.
19. The method as claimed in claim 18, wherein the definition of the first symbol is a reflective portion in the first layer.
15
20. The method as claimed in claim 19, wherein the first layer is a light guide that guides light towards the reflective portion.
- 20 21. The method as claimed in claim 18, 19 or 20, wherein the definition of the second symbol is a light permeable portion in the second layer.
22. The method as claimed in claim 21, wherein a region of the second layer around the light permeable portion is substantially opaque.
25
23. The method as claimed in claim 21 or 22, wherein the light permeable portion is or comprises one or more apertures in the second layer.

24. The method as claimed in any of claims 18 to 23, wherein the first layer overlies the second layer.

5 25. The method as claimed in any of claims 18 to 24, wherein the first symbol denotes a first input function designated to an input area in a first mode of operation, and the second symbol denotes a second input function designated to the input area in a second mode of operation.

10 26. An apparatus, comprising:
a first light guide comprising a reflective portion, forming a definition of a first symbol, configured to reflect light out of the first layer;
a layer comprising a light permeable portion, forming a definition of a second symbol, wherein the definition of the first symbol at least partially overlies the definition of the second symbol; and
15 a second light guide comprising a reflective portion configured to reflect light such that the reflected light passes through the light permeable portion in the layer and through the first light guide.

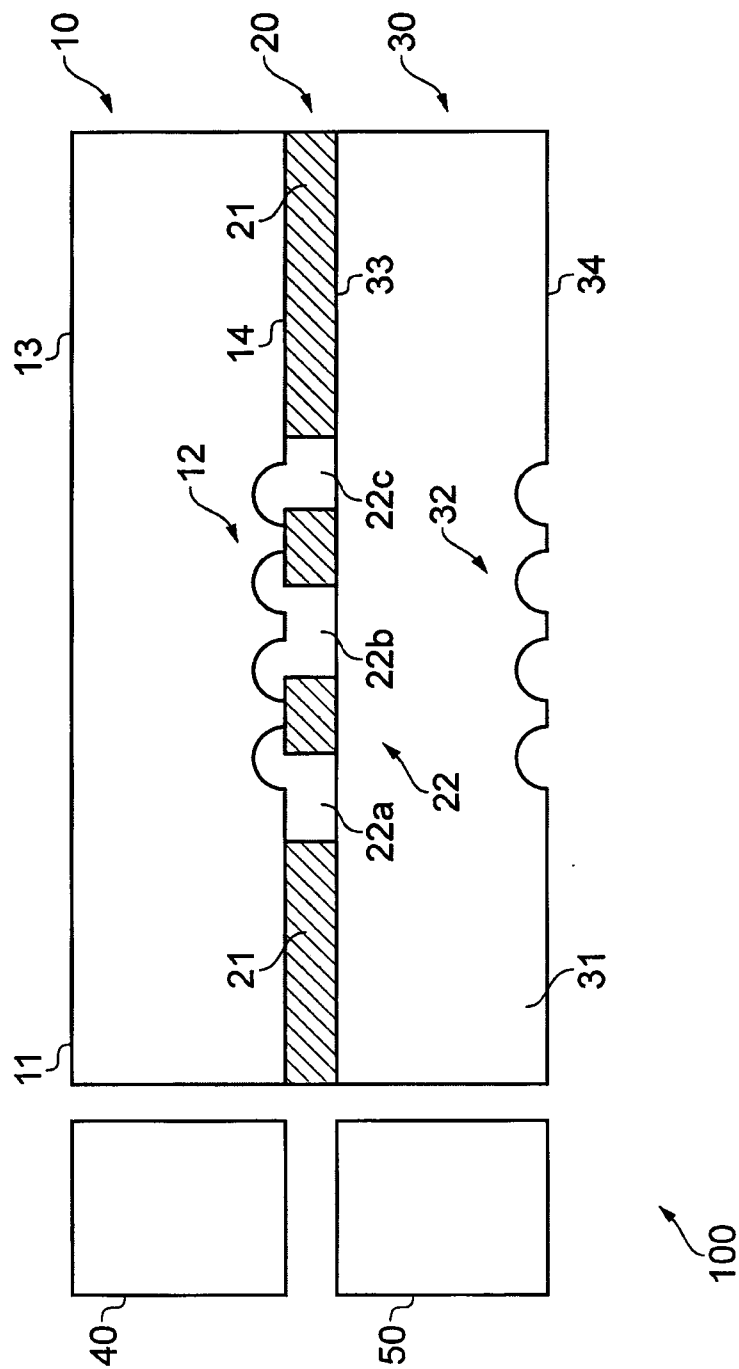


FIG. 1

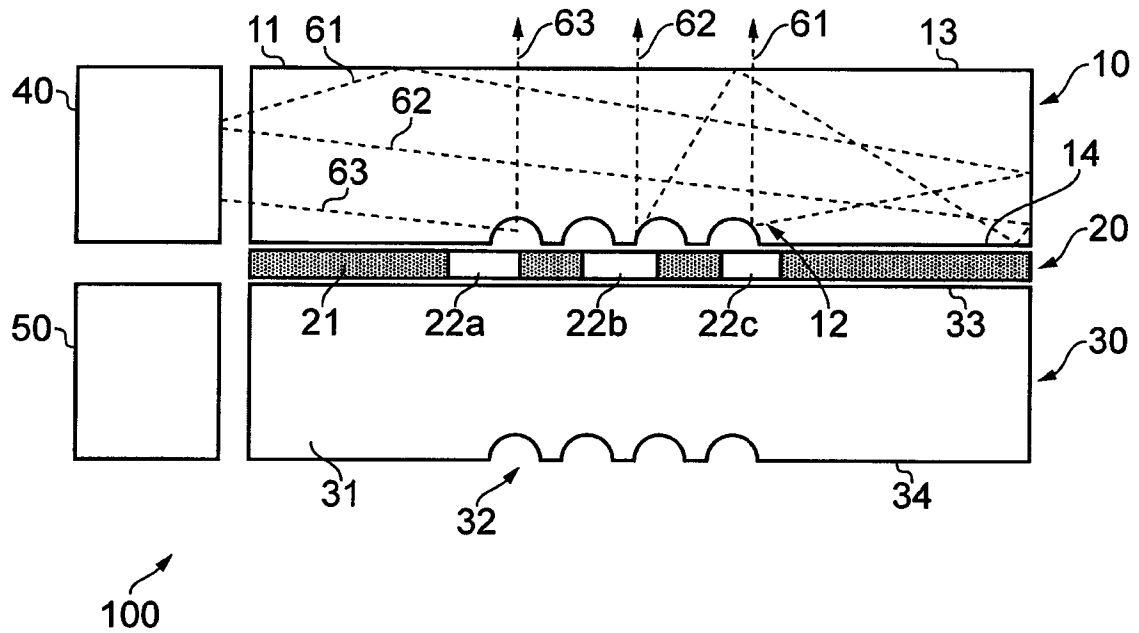


FIG. 2A

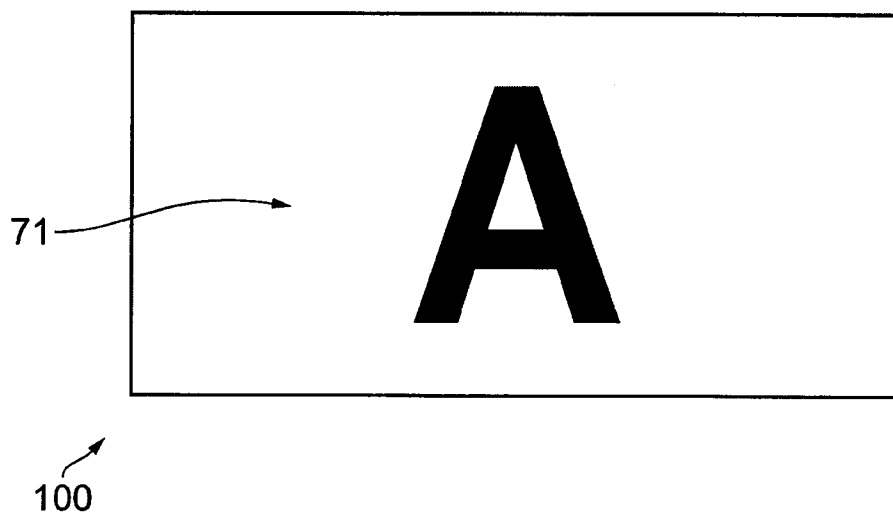


FIG. 2B

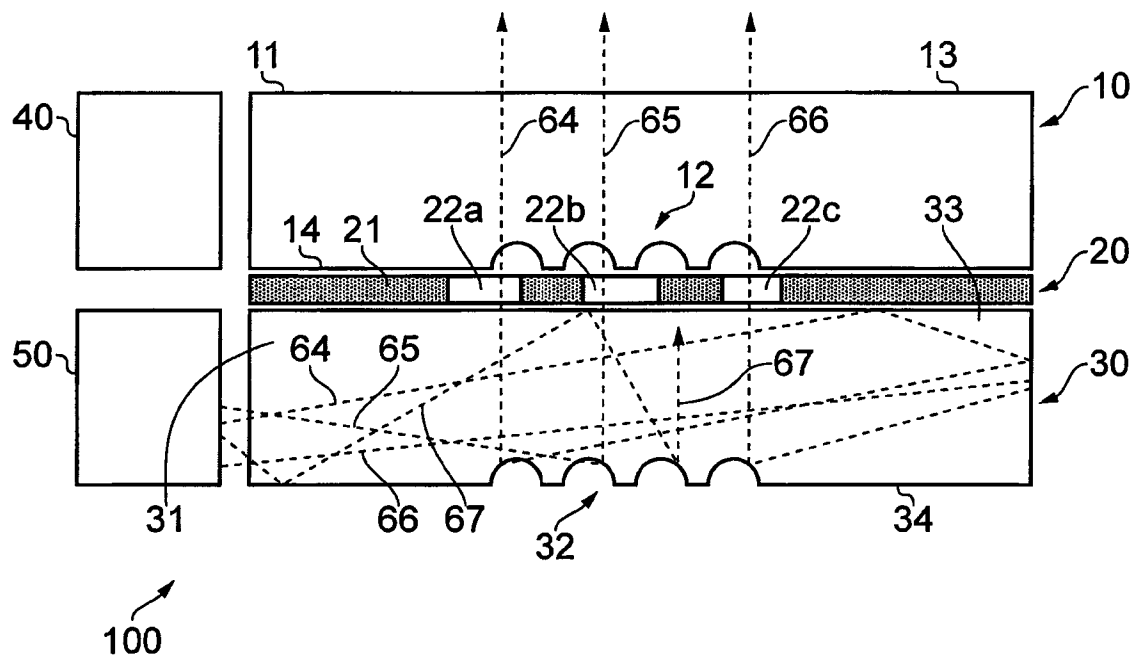


FIG. 3A

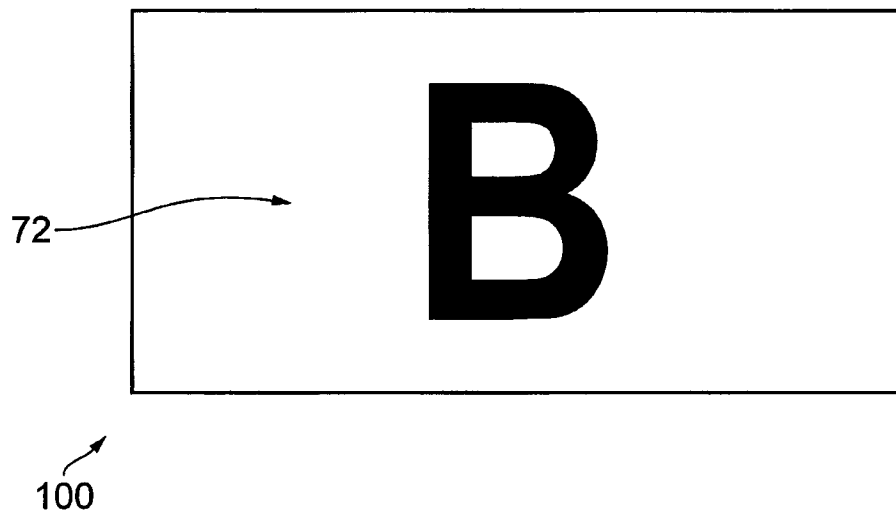


FIG. 3B

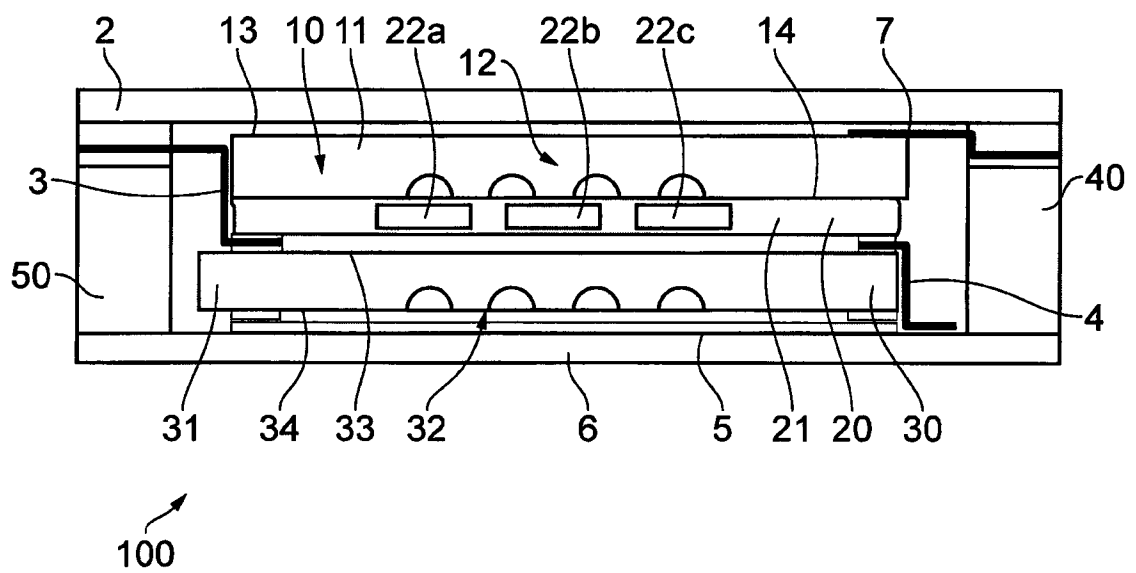
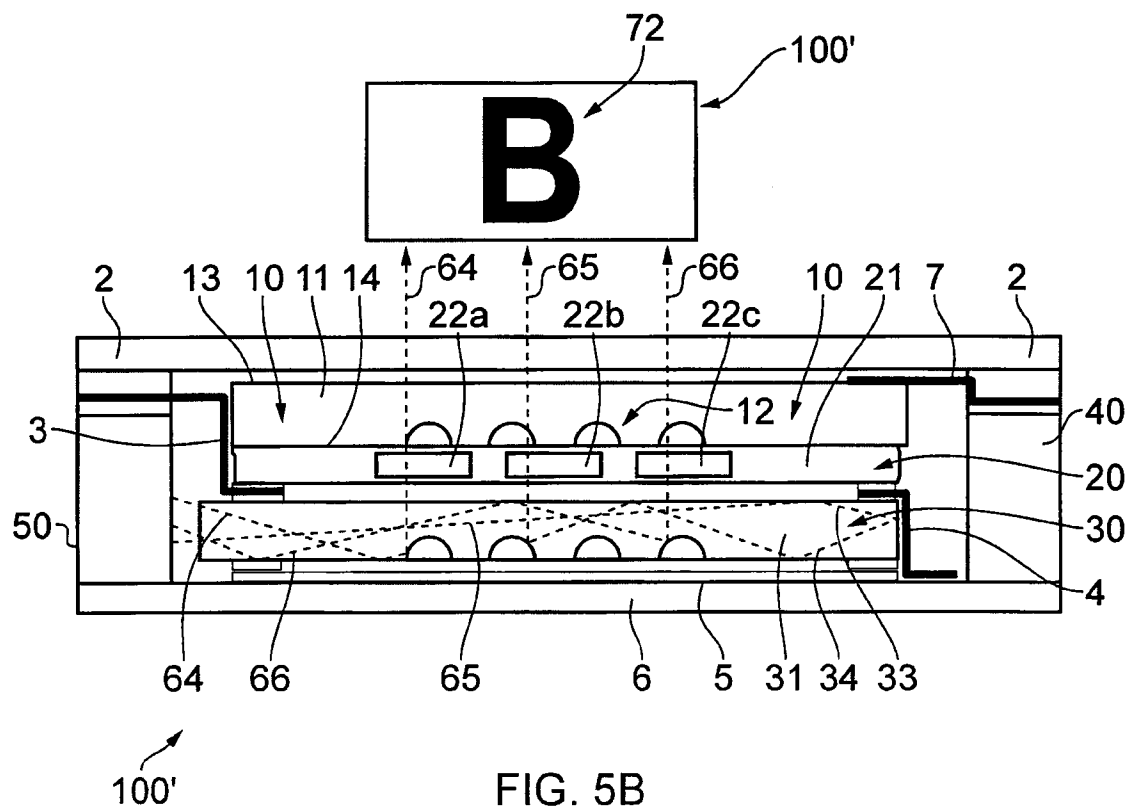
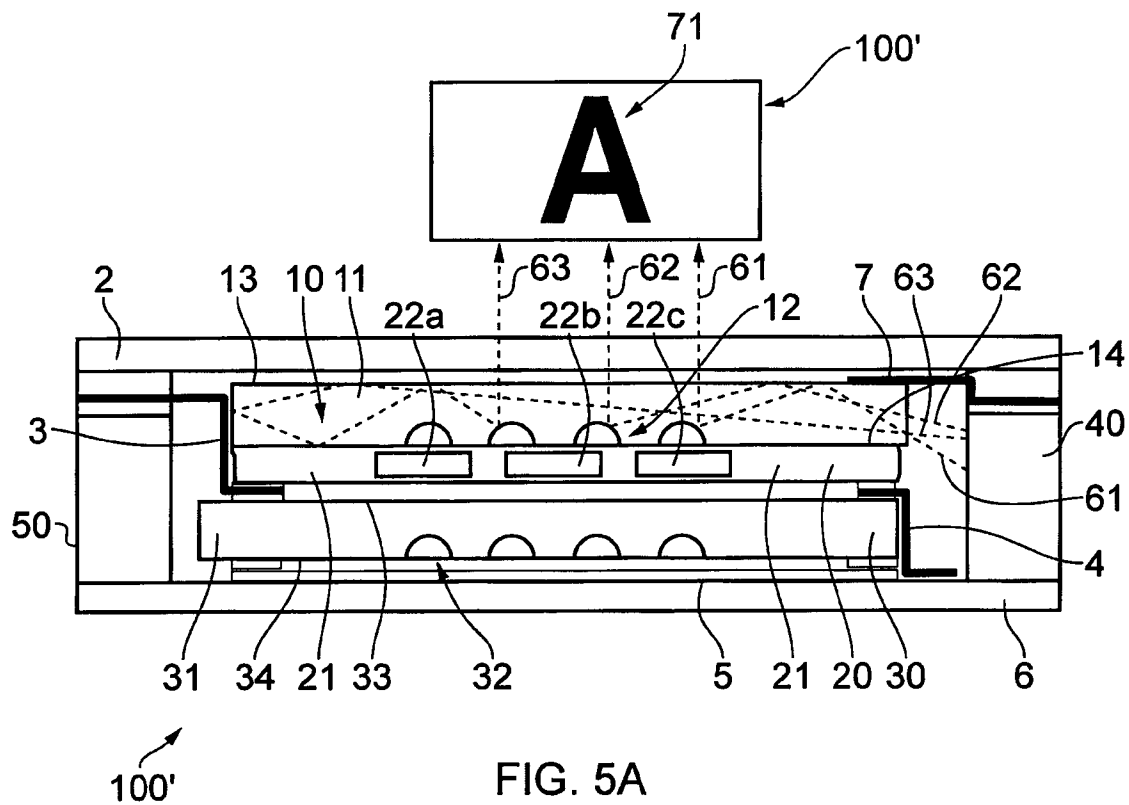
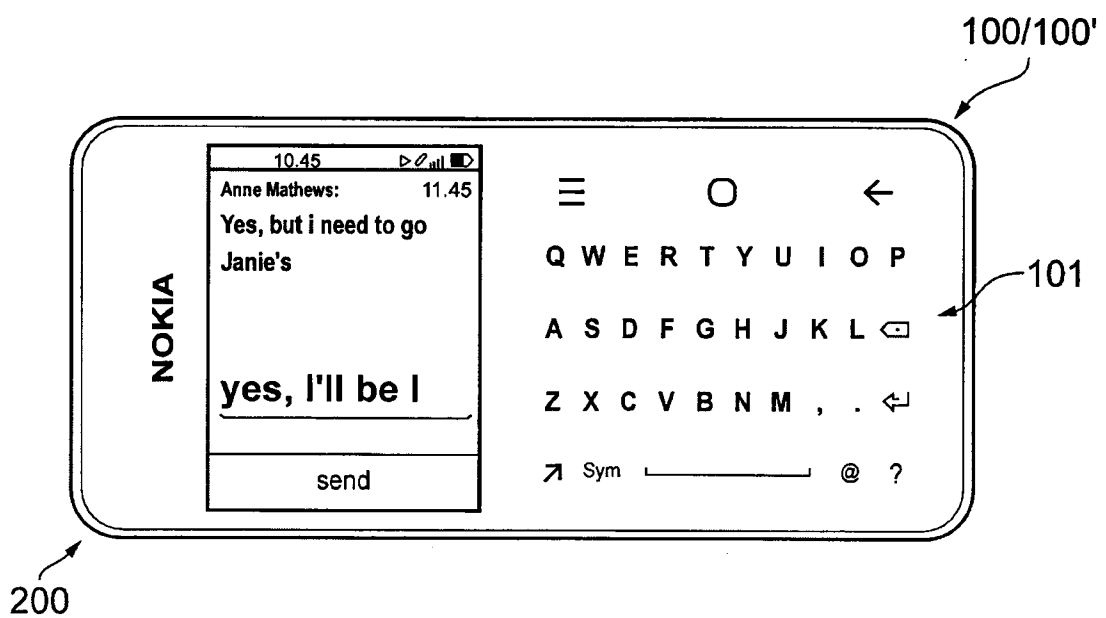
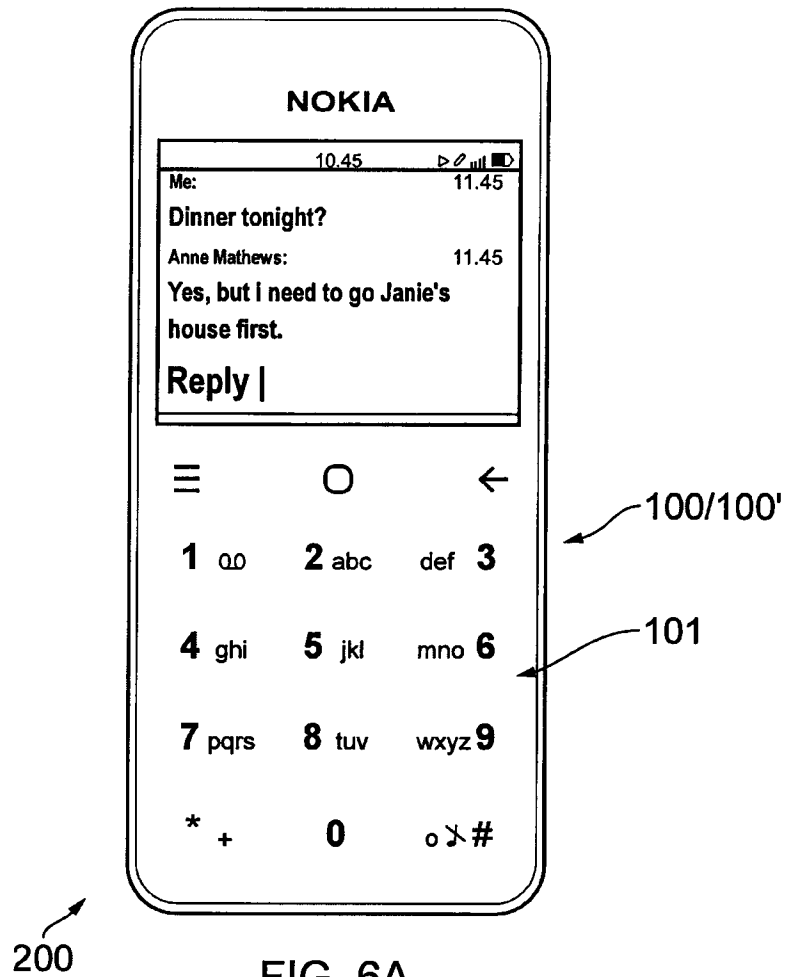


FIG. 4





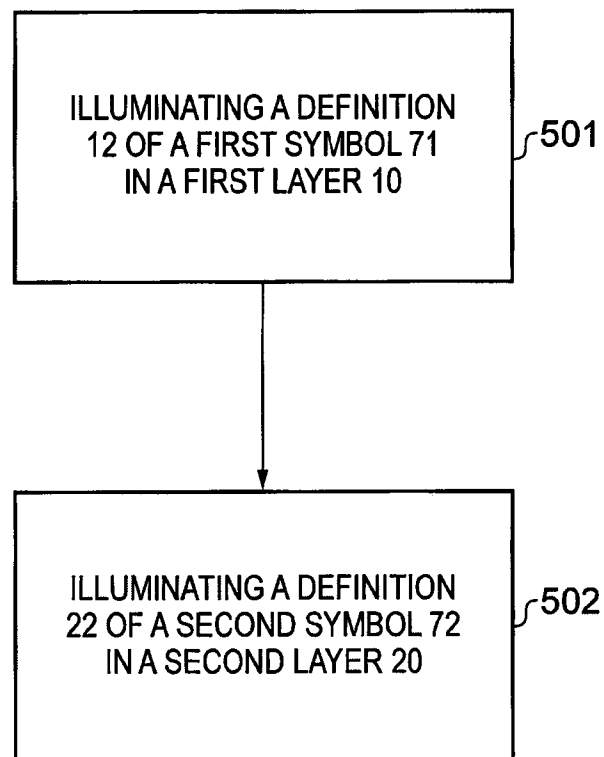


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2012/086434

A. CLASSIFICATION OF SUBJECT MATTER		
G06F 3/02 (2006.01) i		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC: G06F/-; H04M/-; H01H/-		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
WPI;EPODOC;CNKI;IEEE;CNPAT keypad, keyboard, symbol, layer, overl+, light w guide, reflect+, aperture?, recess, permeable, opaque, illuminat+, character, number		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US2009/0284397A1 (Hsin-Chin Lee, Hsien-Kuo Kao) 19 November 2009 (19.11.2009)	1-7,9-22,24, 25
Y	description, pages 2-3 and figures 1-3	8,23,26
Y	CN2938613Y (ZHONGXING COMM CO., LTD.) 22 August 2007 (22.08.2007)	8,23,26
	description, pages 2-4 and figure 1	
A	US2010/0060491A1 (SAMSUNG ELECTRONICS CO., LTD.) 11 March 2010 (11.03.2010)	1-26
	see the whole document	
A	CN101170019A (ICHIA TECHNOLOGIES INC.) 30 April 2008 (30.04.2008)	1-26
	see the whole document	
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Date of the actual completion of the international search 04 September 2013 (04.09.2013)	Date of mailing of the international search report 19 Sep. 2013 (19.09.2013)	
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer LI, Le Telephone No. (86-10)62411827	

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