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(54) Title: HUMAN INTERFACE DEVICE AND RELATED METHODS

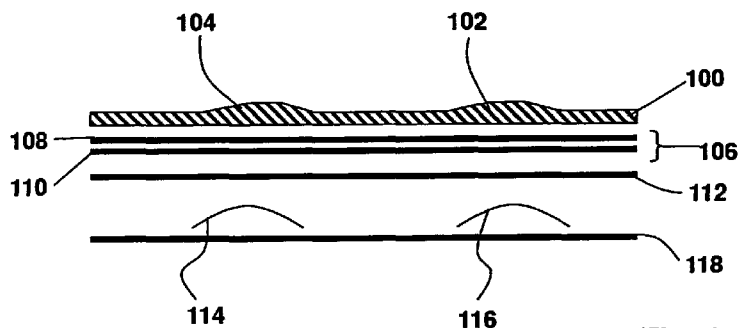


Fig. 1

(57) Abstract: A Human Interface Device (HID) including a capacitive sensing layer (106) arranged to provide at least one coordinate location where a user touches the device, a circuit layer (118) comprising a plurality of tracks each track having at least one break therein, and a plurality of user activatable domes (114,116) positioned above the breaks such that upon user activation, the dome performs one of completing the track by bridging the break and breaking the track by un-bridging the break.



HUMAN INTERFACE DEVICE AND RELATED METHODS

Field of the Invention

5

Embodiments of the invention relate to a human interface device arranged to be used with electronic devices. In particular, but not exclusively, embodiments relate to a human interface device for a hand-held electronic device, such as a cell-phone, a PDA (Portable Digital Assistant), a
10 Netbook, or the like.

Background of the Invention

Consumer electronic devices, such as cell phones (sometimes referred to as
15 mobile 'phones), are becoming more and more popular with currently over two billion such devices across the globe. With such a large market and an ever growing number of sophisticated consumers, designers and engineers must integrate more and more advanced value added features to their product offerings to maintain consumer loyalty. Even as features are added
20 to cell phones consumers still desire a small product footprint which presents a real challenge as every function added needs to be initiated by a user input command upon a button or target capable of detecting the presence of a human finger tip and to provide a tactile acknowledgement of the command in some form of haptic representation like an icon must be
25 provided. This trend of miniaturization and feature expansion is unlikely to coexist indefinitely.

Whilst it is convenient to refer to cell 'phones, as the skilled person will readily appreciate these, he / she will also appreciate that the features
30 discussed and associated problems are not limited to just cell phones. Devices such as watches, PDA's, remote controls, netbook computers,

notebook computers, or any other, typically hand held, electronic device have similar considerations.

Conventional wisdom calls for more keys and icons to be added to the cell
5 phone user interface. Currently the cell phone market is split between
graphic/video type displays and conventional key entry devices full
keypads, some sporting as many as forty to fifty keys. As stated, the
problem with this approach is that many mobile devices, including cell
10 phones, are getting smaller and thinner and user data entry real estate is
shrinking. When too many keys are clustered in a small space user
confusion and frustration with the operation of the device is inevitable.
When inter digit spacing is reduced too much to accommodate the addition
of too many keys average human sized hands and fingers can no longer
comfortably enter data on the keypad.

15 Some cell phone manufacturers like AppleTM attempt to address the
overcrowded user interface by deploying a capacitive sensing touch screen
overlay that resides atop a video display. Conventional fixed location user
keys and icons are replaced by dynamic high resolution graphics. Although
20 this approach is presently considered to be the preferred state of the art in
cell phone user interface technology, the maximum physical usable space is
a mere 2 inch by 3 inch area or that of a common business card. In an
attempt to overcome the space challenge the iPhoneTM initially only
displays Alpha keys (ie the letters of the alphabet). To utilize numerical
25 and punctuation keys the user has to manually select another screen then
return again to the first screen. The iPhoneTM and other similar
technologies that use capacitive type touch screens for user data entry
suffer from display visibility during data entry as the act of entering data
severely occludes the view of the screen; ie screen real-estate is used to
30 display the keys themselves thus reducing the available display for other
features.

Summary of the Invention

According to a first aspect of the invention there is provided a Human Interface Device (HID) comprising:

- 5 a capacitive sensing layer arranged to provide at least one coordinate location where a user touches the device;
- a circuit layer comprising a plurality of tracks each track having a at least one break therein; and
- a plurality of user activatable domes positioned above the
- 10 breaks such that upon user activation, the dome performs one of completing the track by bridging the break and breaking the track by un-bridging the break.

Such a device is believed advantageous as it allows the HID to use inputs

15 generated by the capacitive sensing layer to modify the behaviour of buttons provided by the combination of the circuit layer and user activatable domes whilst providing the positive tactile feedback given by the domes. As such, embodiments of the HID may operate in a similar manner to a track pad or the like in which the capacitive sensing layer

20 allows a user's gestures on the HID to be used as an input.

The skilled person will appreciate that generally, the dome will bridge a gap since this is likely to be mechanically easier to fabricate. However, the mechanical inverse in which the dome is arranged to break a track, upon

25 activation thereof, is equally possible.

The HID may also comprise a display layer arranged to provide a display to a user of the HID.

30 The display layer may be arranged to provide a Graphical User Interface (GUI) which may provides keys, or other icons, that a user can manipulate through his / her touch. Such a GUI is advantageous as it can represent a

change of behaviour of a button caused by a user's interaction with the HID as sensed by the capacitive sensing layer.

In one embodiment, the HID is arranged to modify the behaviour of a button provided by a dome depending on user actions.

The HID may be arranged to modify the behaviour of a button provided by a dome according to the length of time a user hovers his/her finger over a button. For example, if a user were to hover his/her finger over the button for more than a predetermined time then the functionality of the button may change.

There may be more than one predetermined time. For example the HID may be arranged to have a base functionality for a button provided to a dome. This base functionality may be modified from the base functionality to a first modified functionality after a first predetermined time and subsequently modified to a second functionality after a second predetermined time. The first and second predetermined times need not be the same.

The first and/or the second predetermined time may be substantially any of the following: 0.5s, 1s, 2s, 3s, 4s or the like.

The direction of motion of a user's finger(s) and/or thumbs, as sensed by the capacitive sensing layer prior to a press of a button provided by a dome, may alter the functionality of that button. For example, if a user moved his/her finger from left to right before pressing a button that button may have a different functionality compared to a user moving his/her finger from right to left before pressing that same button or simply pressing the button (ie the base functionality).

Additionally, or alternatively, gestures may alter the functionality of a button. For example if a user made a pinching gesture with his / her fingers and/or thumbs then the functionality of a button may be modified.

- 5 Further, the number of fingers that a user uses on the HID may affect the functionality of a button.

The HID may comprise a cover layer which may have a contoured surface arranged to provide tactile surface for a user moving across that surface.

- 10 The contoured surface may comprise a plurality of raised portions.

Conveniently, the raised portions substantially correspond to the location of a dome.

- 15 According to a second aspect of the invention there is provided a method of providing an input to a electronic device comprising providing the device with both a capacitive sensing layer and a plurality of user activatable domes each arranged to provide a button where the functionality of the buttons is modified according to a users input to the device as sensed by the
20 capacitive sensing layer.

Such a method is believed advantageous as it provides the flexibility of a capacitive sensing layer which can for instance be used to control a GUI with the positive affirmation that a user has made an input to the device.

25

The GUI may or may not be provided as part of the electronic device that is being controlled. For example, the GUI could be provided by a screen to which the electronic device is attached.

- 30 Elements of any one of the above aspects of the invention may be applied mutatis mutandis to any other aspect of the invention.

Brief description of the drawings

There now follows by way of example only a detailed description of an embodiment the present invention with reference to the accompanying
5 drawings in which:

Figure 1 shows a cross-section through a human interface device according to an embodiment of the invention;

10 **Figure 2** shows a pattern of tracks as they appear on a circuit layer of the embodiment of Figure 1;

Figure 3 shows an example of a cell phone incorporating a Human Interface Device (HID); and

15 **Figures 4 and 5** show possible examples of the sub-layers within a display layer of the HID.

Detailed description of the drawings

20 For the sake of brevity and clarity, it is convenient to describe the Human Interface Device (HID) in relation to a cell (ie a mobile) telephone. However, the skilled person will appreciate that such a human-interface device has much wider applicability and can be used on a wide range of
25 electronic devices such as watches, PDA's, netbook computers, notebook computers, remote controls, or the like.

Figure 1 shows a plurality of layers that will not be explained in detail.

30 The top most layer 100 is a key cap layer can may incorporate decals or other graphics. However, other embodiments, may be absent any such decals / graphics. Typically, the key cap layer comprises raised

portions 102, 104 which are arranged to provide a user of the device with feedback as to the location of his/her digit (ie a finger or thumb) on the device. However, again, other embodiments of the device need not comprise such raised portions. Typically, the key-cap layer is fabricated
5 from a plastics material which may be in particular Polyethylene Terephthalate (PET) or the like.

Beneath the key cap layer 100 is provided a capacitive sensing layer 106 which in this embodiment comprise two sub-layers 108, 110. Each of the
10 sub-layers comprises a plurality of conductors each parallel to one another. The direction of the conductors in each sub-layer lie substantially orthogonal to one another in order that the combination of the two sub-layers provides a grid of intersecting points. The two sub layers are spaced apart from one another so that there is no direct electrical contact between
15 the conductors in one sub-layer (eg 108) to the other (eg 110). However, a capacitance does exist between the sub-layers which is modified by a user touching the HID. Thereby, in a know manner, control circuitry 212 connected to the capacitive sensing layer 106 can determine that a user has touched the screen by detecting the change in capacitance and also the
20 location of the touch by determining which of the pairs of conductors from the sub-layers (108, 110) are associated with this capacitance change.

The capacitive sensing layer 106 will generally provide the co-ordinate (typically as an XY position) of where the user touches the HID. Some
25 embodiments of the invention provide more than one coordinate as to where a user touches the HID. For example, if a user were to touch the HID in two places (eg with two fingers / thumbs) then two coordinates may be returned. Likewise, three coordinates may be returned for three fingers/thumbs and four coordinates may be returned for four
30 fingers/thumbs. The control circuitry 212 may also provide data as to movement of a digit on the HID.

The capacitive sensing layer 106 is provided as the top most layer in which there are electrical conductors are provided in order that the electrical field can be influenced by a user.

- 5 The next layer 112 comprises a display layer, which itself may comprise a number of sub-layers. Indeed, the display layer 112 is an optional layer and need not be provided in some embodiments.

The display layer 112 may allow information to be presented to a user of the HID 300 or alternatively, it may provide a backlight or a combination
10 of the two. In some embodiments, the display layer may comprise a display as described in PCT/GB2005/002298 in the name of Pelikon Ltd. This teaching is incorporated herein by reference.

- 15 Possible sub-layers of the display layer 106 are shown in Figures 4 and 5. From front to back (ie bottom to top in the drawing):

a relatively thick protective electrically-insulating transparent front layer (11; the substrate (this may be omitted if the display is incorporated into a HID);

- 20 over the rear face of the substrate 11, a relatively thin transparent electrically-conductive film (12) forming the front electrode of the display; covering the rear face of the front electrode 12, a relatively thin layer (13) of LC material (14) physically-stabilised by being dispersed within a supporting matrix (15);

- 25 formed directly on, and covering the rear face of, the liquid crystal layer 13, a relatively thin layer (16) of electroluminescent/phosphor material (17) dispersed within a supporting matrix (18);

- over the rear face of the phosphor layer 16, a relatively thin optically-reflective electrically-insulating layer (19) of a relatively high
30 dielectric constant material (in the Figure this layer is shown as a seamless extension of the phosphor layer 16); and

disposed over the rear face of the reflective electrically-insulating

layer 19, an electrically-conductive film (20) forming the rear electrode(s) of the display.

The front and rear electrodes together define which areas of both the liquid
5 crystal layer and the electroluminescent layer can be selected to be switched "on" or "off".

In addition, the back electrode layer may be covered with a protective film (not shown here). Again, this may be omitted when combined within a HID.
10

In an alternative embodiment shown in Figure 5 of the accompanying drawings, the EL and LC materials are not directly formed on one another, but are instead separated by an insulating interlayer. In all other aspects, Figures 4 and 5 are the same and common reference numerals have been
15 used.

In either case with or without the interlayer 10, the EL and LC materials can share the common pair of electrodes 12, 20 for common activation of the EL and LC materials. Thus, a common front electrode 12 and substrate
20 can support multiple indicia 21a, 21b. Each indicium 21a, 21b comprises the remaining layers of the structure shown in Figure 4 or Figure 5 of the accompanying drawings, namely the LC layer 13, optionally the interlayer 10, the EL layer 17, the reflective insulating layer 18 and the rear electrode 20. These layers are shaped to provide selectively illuminatable elements
25 that can be illuminated to provide indications to a user; in the present example these are the numbers "5" and "6" but could be extended to any indicia.

Underneath the display layer 106 there is provided a plurality of domes,
30 eg 114, 116. For the sake of clarity on two such domes are shown but there would generally be more. Such domes 114, 116 are exemplified by US6844508.

For example, to provide a typical numeric keypad requires roughly between 9 and 12 buttons. As such, there may be provided substantially 9 to 12 buttons. If the HID provides more than a numeric keypad then there might
5 be further buttons provided. For example there may be roughly any of the following number of buttons: 15, 20, 25, 30, 35, 40.

Each dome 114, 116 corresponds to the location of a switch / button provided by the HID. As can be seen in Figure 1 the location of each
10 dome 114, 116 corresponds with the location of the raised portions 102, 104 in the key cap layer 100. That is the dome 114 is substantially directly underneath the raised portion 104 and the dome 116 is substantially directly underneath the raised portion 102.

15 Thus, the raised portions 102, 104 provide tactile feedback to a user of the HID as to the location of a button. The skilled person will appreciate that an advantage of such domes 114, 116 is that they provide tactile feedback that a button has been pressed; the user is given a direct feel that an activation has been made.

20

Typically, the domes are fabricated from a metal but other conducting materials are suitable. It would also be possible to fabricate the domes from a plastics material and cover them in a conductor such as metal.

25 In some embodiments, there is provided underneath the domes a circuit layer 118 which contains a plurality of tracks each having at least one break therein. The domes 114, 116 positioned thereabove are arranged, upon user activation, to complete the track by bridging the gap therein.

30 Figure 2 shows a possible layout of the tracks in the circuit layer 118.

The track are presented as a grid, with a portion 200 thereof running in a horizontal direction as shown in the figure and a further portion 202 running in a vertical direction as shown in the figure. The horizontal portion 200 of the track is connected to an outer ring 204 of a contact area 206 and the vertical portion 202 of the track is connected to an inner region 208 of the contact area 206. A gap 210, which provides a break, exists between the outer ring 204 and the inner region 208 such that a gap exists between the portions of the tracks 200 and 202; ie there is a break in the tracks 200, 202.

10

A dome 114, 116 is positioned above a contact area 206 such that the outer circumferential region of the dome rests on the outer ring 204 of the contact area 206. When a user activates a dome 114, 116 it collapses and a central region thereof comes into contact with the inner region 208 of the contact area 206 thereby bridging the horizontal portion 200 and the vertical portion 202 of the tracks.

In use, a device, such as a cell phone 300, can accept inputs from the capacitive sensing layer 106 as a user touches the screen in that area. Should the embodiment be provided with a circuit layer 118 then the cell phone 300 may also take inputs from the circuit layer 118 as the user collapses the dome 114, 116 to complete the circuit in the circuit layer 118.

An advantage of a HID having the capacitive layer is that it can function as mouse pad (sometimes called a track pad, etc.) in which a users input is tracked as he/she moves his/her finger around the HID. The presence of the metal domes 114, 116 give positive confirmation that a press has been made which is generally confirmed by completing the circuit in the circuit layer 118.

30

However, it is possible for the cell phone 300 to modify the behaviour of a button provided by a dome 114,116 depending on user actions. For

example, if a user were to hover his/her finger over a button for more than a predetermined time then the functionality of the button may change. For example, the predetermined time may be substantially any of the following: 0.5s, 1s, 2s, 3s, 4s or the like.

5

The direction of motion of a user's finger(s), as sensed by the capacitive sensing layer 106 prior to a press may alter the functionality of a button provided by a dome 114, 116. For example, if a user moved his/her finger from left to right before pressing a button that button may have a different
10 functionality compared to a user moving his/her finger from right to left before pressing that same button.

Additionally, or alternatively, gestures may alter the functionality of a button. For example if a user made a pinching gesture with his / her fingers
15 then the functionality of a button may be modified.

Further, the number of fingers that a user uses on the HID may affect the functionality of a button.

5

CLAIMS

1. A human interface device comprising:

a capacitive sensing layer arranged to provide at least one coordinate location where a user touches the human interface device;

10

a circuit layer including a plurality of tracks, each of the plurality of tracks including at least one break; and

a plurality of user-activatable domes, each of the plurality of user-activatable domes being positioned above a corresponding one of the at least one break; wherein

15

upon user activation of one of the plurality of user-activatable domes, the activated one of the plurality of user-activatable domes performs one of:

completing one of the plurality of tracks by bridging one of the at least one break; and

breaking one of the plurality of tracks by un-bridging one of the at least one break.

20

2. The human interface device of claim 1, further comprising a display layer arranged to provide a display.

25

3. The human interface device of claim 2, wherein the display layer is arranged to provide a graphical user interface that a user can manipulate through touch.

30

4. The human interface device of claim 3, wherein the human interface device is arranged to modify the behavior of a button defined by a corresponding one of the plurality of user-activatable domes based on user actions detected by the capacitive sensing layer.

5. The human interface device of claim 1, further comprising a cover layer that includes a contoured surface arranged to provide a tactile surface.

5 6. The human interface device of claim 5, wherein the contoured surface includes a plurality of raised portions arranged such that each of the plurality of raised portions substantially corresponds to a location of a corresponding one of the plurality of user-activatable domes.

10 7. A method of providing an input to an electronic device comprising:
providing a capacitive sensing layer; and
providing a plurality of user-activatable domes such that each of the plurality of user-activatable domes is arranged to define a button having a functionality that is modified based on user input sensed by the capacitive sensing layer.

15 8. The method of claim 7, wherein the electronic device modifies the behavior of the button when a user hovers over the button for more than a predetermined time.

20 9. The method of claim 7, wherein the electronic device modifies the behavior of the button based on a direction of motion of a user digit as sensed by the capacitive sensing layer prior to a press of the button.

25 10. The method of claim 7, wherein the electronic device modifies the behavior of the button according to a user gesture.

 11. The method of claim 10, wherein the functionality of the button is changed when a user makes a pinching gesture.

30 12. The method of claim 7, wherein the functionality of the button is altered according to a number of user digits touching the electronic device.

1/3

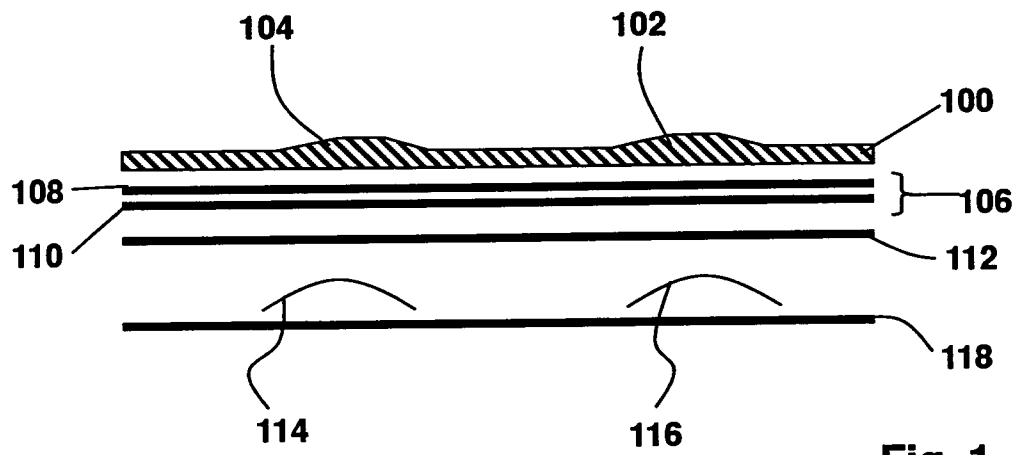


Fig. 1

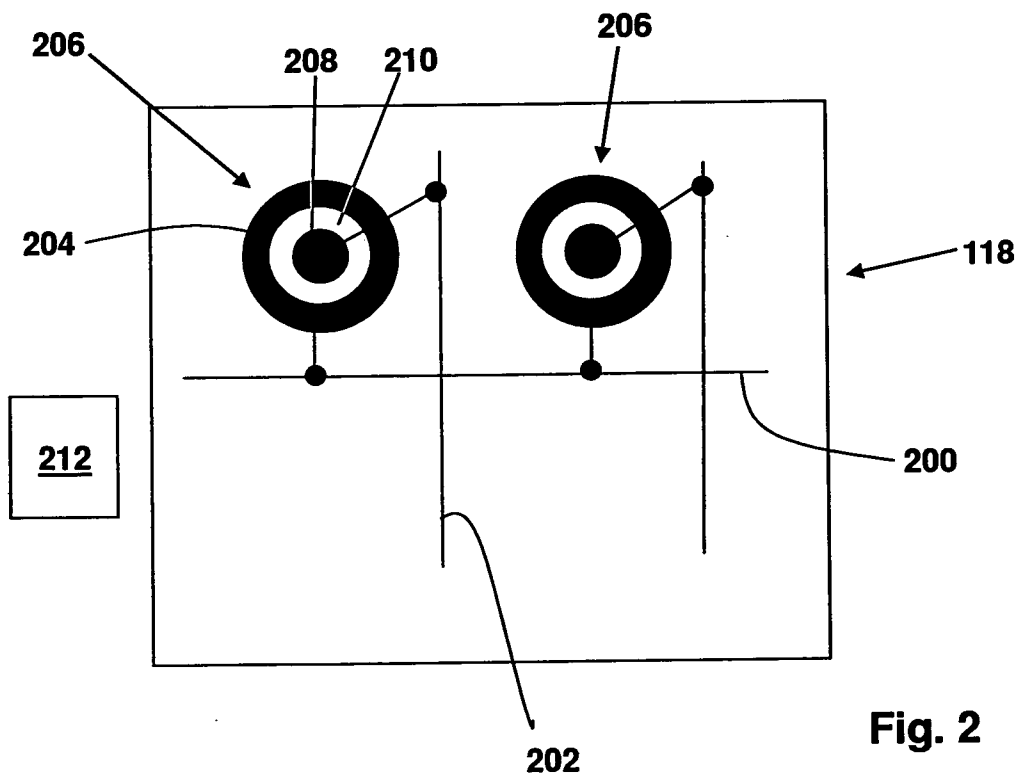


Fig. 2

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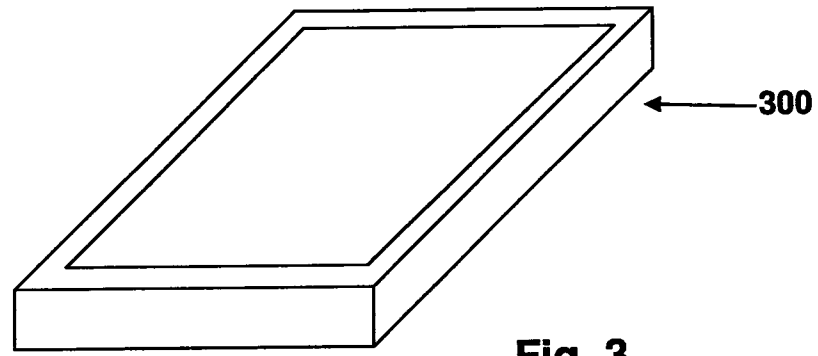


Fig. 3

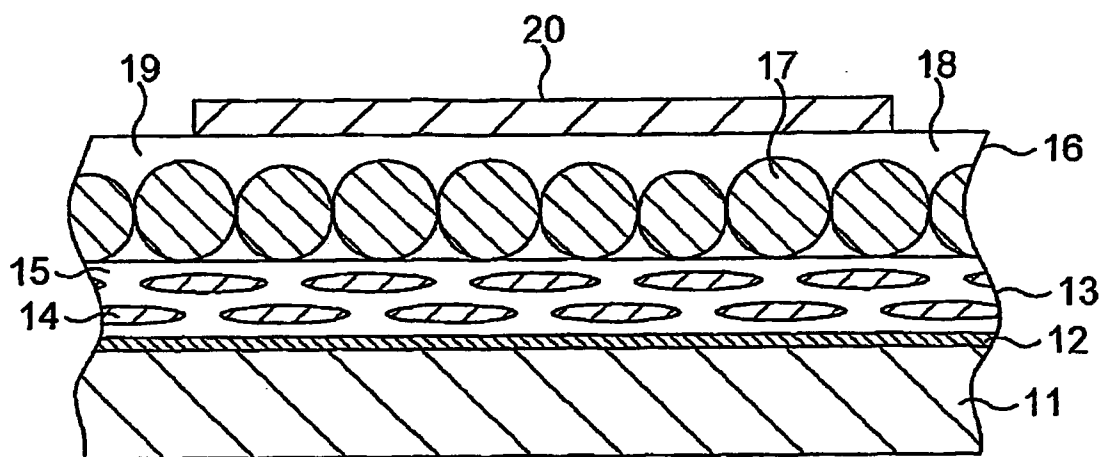


Fig. 4

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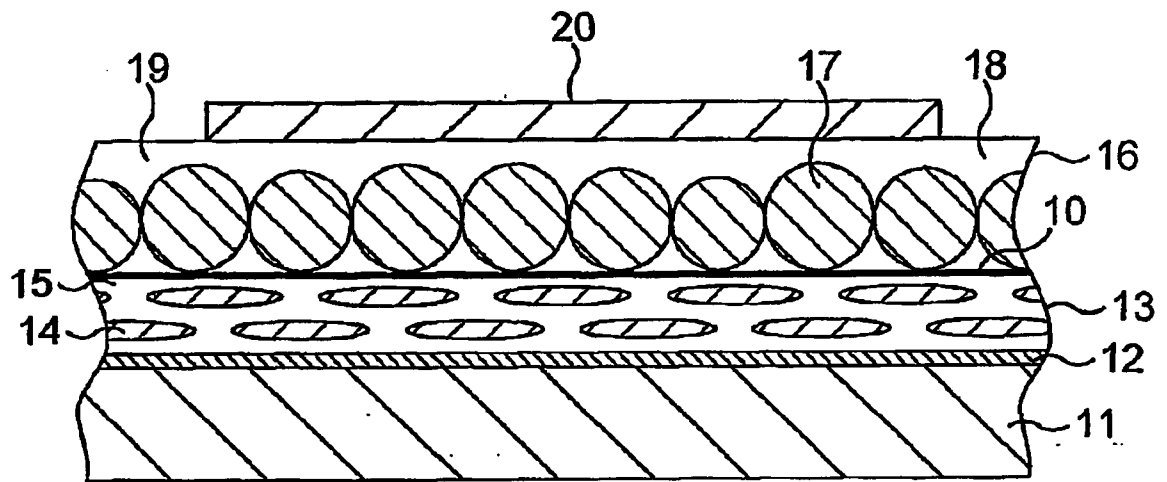


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2010/003297

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F3/02 G06F3/033
ADD. G06F3/044 G06F3/048

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)
G06F H04M

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 practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/195418 A1 (OH EUI-JIN [KR]) 6 August 2009 (2009-08-06) paragraphs [0003] - [0006] paragraphs [0083] - [0250]; figures 1-9b -----	1-12
X	US 2004/077373 A1 (CHOI JAE-GOO [KR] ET AL) 22 April 2004 (2004-04-22) paragraphs [0030] - [0036], [0043]; figures 1-4 ----- -/-	1,2,5-7

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search

31 March 2011

Date of mailing of the international search report

06/04/2011

Name and mailing address of the ISA/

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Fax: (+31-70) 340-3016

Authorized officer

Chéron, Laurent

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2010/003297

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/161871 A1 (HOTELLING STEVE P [US] ET AL HOTELLING STEVE P [US] ET AL) 20 July 2006 (2006-07-20) paragraphs [0003] - [0004] paragraphs [0038] - [0048], [0052]; figure 1 paragraphs [0058] - [0068]; figure 3 paragraphs [0086] - [0090]; figures 6-7 paragraphs [0120] - [0126]; figure 12 paragraphs [0137] - [0141]; figure 18 paragraphs [0149], [0163] - [0164], [0166]	7-10
A	EP 1 942 401 A1 (APPLE INC [US]) 9 July 2008 (2008-07-09) paragraphs [0057], [0059]; figure 2 paragraphs [0072] - [0073]; figure 7F paragraphs [0076], [0078], [0080], [0086]; figure 7h paragraph [0086]; figures 7i-7j paragraphs [0088] - [0091]; figure 7k paragraphs [0095] - [0097]; figures 8e-8g paragraphs [0105] - [0123]; figures 11-18e	7-12
A	US 6 094 197 A (BUXTON WILLIAM A S [CA] ET AL) 25 July 2000 (2000-07-25) column 4, line 35 - column 7, line 21; figures 1-10	9
X	US 2007/152975 A1 (OGIHARA TAKUYA [JP] ET AL) 5 July 2007 (2007-07-05) paragraphs [0023] - [0034], [0 44] - [0046]; figures 1-7b	1-7
X	US 2003/025679 A1 (TAYLOR BRIAN [US] ET AL) 6 February 2003 (2003-02-06) paragraphs [0002] - [0003] paragraphs [0038] - [0052], [0 60]; figures 1-3 paragraphs [0081] - [0082]; figure 11	1-3,5-8
A	US 2009/254855 A1 (KRETZ MARTIN [SE] ET AL) 8 October 2009 (2009-10-08) paragraph [0048]; figure 1a paragraph [0065]; figure 4a paragraph [0073]; figure 7	10-12
A	WO 2005/121878 A1 (PELIKON LTD [GB]; BLAKESLEY RICHARD GUY [GB]; TYLDESLEY WILLIAM FRANK) 22 December 2005 (2005-12-22) cited in the application the whole document	2
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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2010/003297

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 844 508 B2 (LIM HEUI-DO [KR]) 18 January 2005 (2005-01-18) cited in the application the whole document -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2010/003297

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009195418 A1	06-08-2009	AU 2007279515 A1 CA 2659954 A1 EP 2054790 A1 JP 2009545830 T WO 2008016286 A1 KR 20080012808 A	07-02-2008 07-02-2008 06-05-2009 24-12-2009 07-02-2008 12-02-2008
US 2004077373 A1	22-04-2004	KR 20040035058 A	29-04-2004
US 2006161871 A1	20-07-2006	NONE	
EP 1942401 A1	09-07-2008	AU 2007100826 A4 AU 2007101053 A4 AU 2007341930 A1 DE 202007018368 U1 EP 2207086 A2 HK 1105768 A2 HK 1108275 A2 US 2008165141 A1 WO 2008083360 A1	27-09-2007 13-12-2007 10-07-2008 19-06-2008 14-07-2010 22-02-2008 02-05-2008 10-07-2008 10-07-2008
US 6094197 A	25-07-2000	DE 69429237 D1 DE 69429237 T2 EP 0660218 A1 JP 3546337 B2 JP 7200126 A JP 3886975 B2 JP 2004206731 A JP 3886976 B2 JP 2004206732 A	10-01-2002 13-06-2002 28-06-1995 28-07-2004 04-08-1995 28-02-2007 22-07-2004 28-02-2007 22-07-2004
US 2007152975 A1	05-07-2007	WO 2005076117 A1	18-08-2005
US 2003025679 A1	06-02-2003	NONE	
US 2009254855 A1	08-10-2009	EP 2263134 A1 WO 2009125258 A1	22-12-2010 15-10-2009
WO 2005121878 A1	22-12-2005	AT 492832 T CN 101002136 A EP 1756657 A1 JP 4314302 B2 JP 2008502019 T US 2008303981 A1	15-01-2011 18-07-2007 28-02-2007 12-08-2009 24-01-2008 11-12-2008
US 6844508 B2	18-01-2005	KR 20040068700 A	02-08-2004
US 6844508 B2		US 2004144636 A1	29-07-2004