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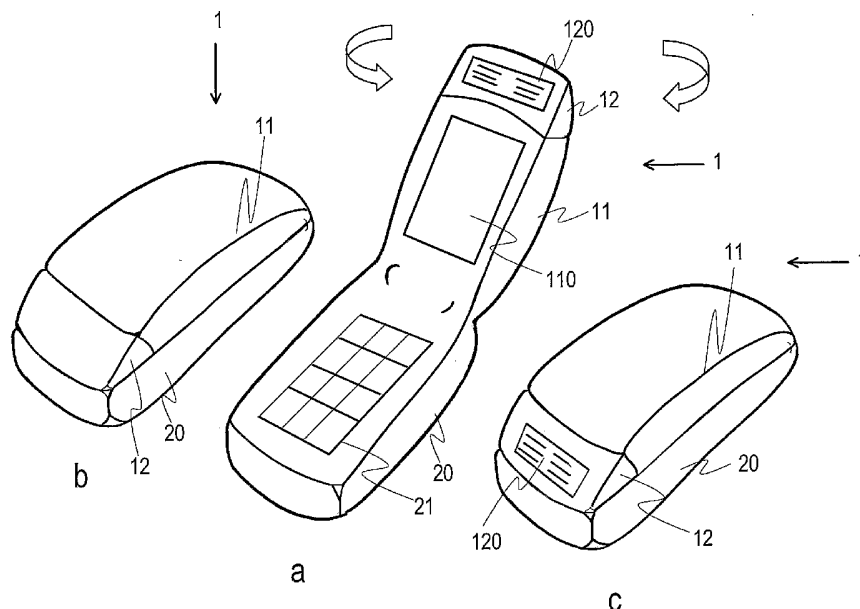
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(54) Title: FOLDABLE ELECTRONIC DEVICE



(57) **Abstract:** An electronic device comprises a first body with a first display visible in a first viewing orientation. The electronic device further comprises a second body with a second display movable relative to the first body to the first viewing orientation and to at least a second viewing orientation opposite to the first viewing orientation. The electronic device further comprises a third body with a control interface, the third body pivotably connected to the first body and functionally connected to the first and the second display.

FOLDABLE ELECTRONIC DEVICE

Field of the invention

The invention relates to electronic devices comprising at least two displays. In particular, the present invention relates to electronic devices, such as mobile communication devices, comprising a control interface in addition to the at least two displays.

Background of the invention

An electronic device may be provided with a display for displaying images or data received or stored in the device or relating to operation of the device. Such electronic devices may comprise mobile communication devices or user terminals, such as user equipment (UE), a mobile station (MS), a cellular phone, a personal digital assistant (PDA) and so on, or other electronic devices, such as a laptop computer, a digital camera or a portable television. The display may be a liquid crystal display or another appropriate display type.

It is also known to provide an electronic device, such as a mobile communication device, with two displays. In particular, a second display may provide advantages in so-called fold concept mobile communication devices. For example, a fold concept device may consist of two halves, a display half and a keyboard half. The display half may comprise a first display to be used as a major display. A second display may locate on the opposite side of the display half such that the second display is visible when the device is in folded position and the first display is hidden inside the folded device.

Patent Publication US 6,668,877 shows a dual display device with lateral withdrawal for side-by-side viewing. In US 6,668,877, a monitor housing supports a first monitor screen and a sliding assembly supports a second monitor screen. The second monitor screen may be slid in the monitor housing to a concealed position and out from the monitor housing to a viewing position next to the first screen monitor.

Summary of the invention

In accordance with an aspect of the invention, there is provided an electronic device. The electronic device comprises a first body with a first display visible in a

first viewing orientation. The electronic device further comprises a second body with a second display movable relative to the first body to the first viewing orientation and to at least a second viewing orientation opposite to the first viewing orientation. The electronic device further comprises a third body with a control interface, the third body pivotably connected to the first body and functionally connected to the first and the second display.

In an embodiment, the second may be movable relative to the first body about a single pivotable point. The second display may be rotatable 360 degrees around an axis vertical to the first and the second display. In an embodiment, the single pivotable point may be implemented by means of a hollow single axis hinge.

In an embodiment, the second may be movable relative to the first body by means of a hinge.

In an embodiment, the second display may be smaller than the first display. The first display and the second display may be configured to display different parts of data from a single source.

In an embodiment, the first body may be foldable towards the third body to a closed position. The first viewing orientation may be towards inside of a closed position and the second viewing orientation may be towards outside of the closed position.

The electronic device may be, for example, a portable electronic device or a mobile communication device. In an embodiment, the electronic device may be a fold concept mobile communication device.

In accordance with a further aspect of the invention, there is provided a method for displaying data in an electronic device. The method comprises displaying data in a first display visible in a first viewing orientation. The method further comprises displaying data in a second display movable relative to the first body from the first viewing orientation to at least a second viewing orientation opposite to the first viewing orientation. The method further comprises controlling the steps of displaying the data in the first display and displaying the data in the second display by means of a control interface in a third body, the third body pivotably connected to the first body and functionally connected to the first and the second display.

Various embodiments and variations of the invention shall become clear from the following description and the accompanying drawings.

Brief description of the drawings

5 The invention will now be described in further detail, by way of example only, with reference to the following examples and accompanying drawings, in which:

Figure 1 shows a first embodiment of the invention;

Figure 2 shows an example of a component that may be used to implement the first embodiment of the invention;

Figure 3 shows a schematic diagram of an embodiment of the invention;

10 Figure 4 shows a second embodiment of the invention; and

Figure 5 shows a third embodiment of the invention.

Detailed description of preferred embodiments

15 The present invention provides an electronic device. The electronic device comprises a first display in a first body and a second display in a second body, the first and the second body being movable relative to each other such that the second display may be viewed at least in two viewing orientations relative to the first display. In a first viewing orientation, the first and the second display may be viewed from the same direction. In a second viewing orientation, the first display may be viewed from a direction opposite to the direction from where the second
20 display may be viewed. The two displays may additionally have further viewing orientations. Furthermore, the electronic device comprises a third body with a user interface. The third body is pivotably connected to the first body and functionally connected to the first and the second display.

25 Figures 1a-1c show an example of an electronic device 1 according to an embodiment of the invention. The electronic device 1 of Figures 1a-1c has a form of a fold design mobile station having a display half comprising a first body 11 and a second body 12 and a keyboard half 20. The first body 11 is provided with a first display 110 and the second body 12 is provided with a second display 120 as shown in Figure 1a. Furthermore, control buttons 21 are shown in the keyboard
30 half 20 of the electronic device 1 in Figure 1a.

The keyboard half 20 may be referred to, more broadly, as a third body with a control interface. The control interface may comprise, instead of control buttons, a rotating key, a control stick or another control means for controlling function of the electronic device comprising the function of the first and the second display.

- 5 Figure 1b illustrates the electronic device 1 in a first closed position. The first display 110 and the second display 120 (shown in Figure 1a) are both hidden inside the electronic device 1 in a closed position when the display half comprising the first body 11 and the second body 12 is folded towards the keyboard half 20.

- 10 Figure 1c illustrates the electronic device 1 in a second closed position. The first display 110 (shown in Figure 1a) is hidden inside the electronic device 1 in a closed position when the display half comprising the first body 11 and the second body 12 is folded towards the keyboard half 20. The second body 12 provided with the second display 120 has been turned around a single pivotable point compared to Figure 1b. The second display 120 is facing to an opposite position than the first display. The viewing orientation is as well opposite compared to the position of the
15 second display shown in Figure 1b.

- Figure 1 shows only one exemplifying electronic device according to an embodiment of the invention. It shall be appreciated that the type of the electronic device may differ substantially from what is shown in Figure 1. Furthermore, a
20 typical electronic device may further comprise a processor entity, electrical memory means, possibly an antenna element and other elements, which are not shown in Figure 1, as they are not relevant for understanding the inventive idea. Other electronic devices according to embodiments of the invention may comprise, but are not limited to, for example devices described above in the
25 background section and any other electronic devices where two or more displays may be implemented.

- Figure 2 shows an example of a hinge component 30 that may be used to implement the single pivotable point to enable movement of the first body 11 and the second body 12 about each other. The hinge component 30 comprises a
30 rotating sleeve 31 allowing a pivotable movement of the two bodies 11, 12 about each other. The rotating sleeve 31 is preferably hollow to allow wires from the first body 11 to be routed to the second body 12 such that the wires do not disturb or are not harmed by rotating the first body 11 and the second body 12 about each other.

Figure 3 shows a plan view of the rotating hinge component 30 mounted in an electronic device according to an embodiment of the invention. As shown in Figure 3, the second body 12 comprising the second display may be connected to the first body 11 comprising the first display by the rotating hinge component 30 comprising the rotating sleeve 31. The rotating sleeve 31 allows a rotating movement of the second body 12 about the first body 11 around a single pivotable axis perpendicular to each body 11, 12. Furthermore, there may be optionally a hinge 32 allowing movement between a "closed" position and an "open" position also between the first body 11 and the second body 12, for example, in a similar manner as between the display half and the keyboard half in known fold concept devices.

Figures 4 and 5 show further embodiments of the electronic device 1 having a form of a fold design mobile station. In Figures 4 and 5 same numerals as in Figure 1 are used for denoting similar parts of the electronic device. It shall be appreciated that these parts may have various other forms as well.

The electronic device 1 of Figures 4a-4b has a display half comprising a first body 11 and a second body 12 and further a third body 20 with a control interface 21. The first body 11 is provided with a first display 110 and the second body 12 is provided with a second display 120 as shown in Figure 4a.

Figure 4b illustrates the electronic device 1 in a closed position. The first display 110 (shown in Figure 4a) is hidden inside the electronic device 1 in a closed position when the display half comprising the first body 11 and the second body 12 is folded towards the keyboard half 20. The second body 12 provided with the second display 120 has been turned or folded to an opposite position compared to Figure 4a. The second display 120 is facing to an opposite position than the first display. The second body 12 may be turned around about a single pivotable point in between the first body 11 and the second body 12. In an alternative, the second body 12 may be folded relative to the first body 11 by means of a hinge, such as a pivot hinge, in between the first body 11 and the second body 12.

The electronic device 1 of Figures 5a-5b has a display half comprising a first body 11 and a second body 12 and further a third body 20 with a control interface 21. The first body 11 is provided with a first display 110 and the second body 12 is provided with a second display 120 as shown in Figure 5a.

Figure 5b illustrates the electronic device 1 in a closed position. The first display 110 (shown in Figure 5a) is hidden inside the electronic device 1 in a closed

position when the display half comprising the first body 11 and the second body 12 is folded towards the keyboard half 20. The second body 12 has been folded on the first body 11 such that the second display 120 faces towards an opposite position compared to Figure 5a. The second display 120 is facing to an opposite position than the first display. The second body 12 may be folded relative to the first body 11 by means of a hinge, such as a pivot hinge, in between the first body 11 and the second body 12. The hinge may situate in any of the three free sides of the first body 11. The fourth side of the first body 11 is connected to the third body 20, for example, by means of a hinge.

- 10 Data may be displayed by means of an electronic device according to embodiment of the invention. In an embodiment, data may be displayed in a first display visible in a first viewing orientation. Furthermore, data may be displayed in a second display movable relative to the first body from the first viewing orientation to at least a second viewing orientation opposite to the first viewing orientation.
- 15 Furthermore, displaying the data in the first display and displaying the data in the second display may be controlled by means of a control interface in a third body. The third body is pivotably connected to the first body and functionally connected to the first and the second display. In an embodiment, data displayed in the first display and data displayed in the second display may comprise different parts of
- 20 data from a single source.

Implementing in an electronic device a second display in addition to a first display and allowing the second display to be turned, such as rotated, or folded to the opposite direction compared to the first display may provide various advantages. The second display may be useful both in a closed and in an open position of a fold concept electronic device. A rotating or foldable second display may provide various different viewing orientations. This may be advantageous also in non-fold concept devices, such as non-fold mobile telephones or digital cameras, and so on. In the following, some non-limiting examples illustrating the use of a rotating or foldable second display are given. Furthermore, the amount of displays is not

25 limited to two, but further displays may be provided using the same mechanism.

A second display may be used for showing caller identification, such as a caller number, when a fold concept communication device is in closed position and the second display is facing outwards as shown in Figures 1c, 4b and 5b. When the second display is rotated or folded to the same viewing orientation than the first display as shown in Figure 1b, 4a and 5a, the second display can be used for

35

other applications alongside the first display. It may be advantageous in some implementations that the second display is smaller than the first display.

5 The first display and the second display may be configured to display different parts of data from a single source. A rotating or foldable second display may be used as an additional screen for two-way video calls and may allow improved visual communication. A rotating or foldable second display may allow different view to be seen at the same time on the two displays, for example displaying snapshots of a video while the video is streaming on the first display or displaying different zoom or magnification of a single image on each display. Furthermore, a
10 rotating second display may provide improved gaming possibilities.

The above examples are by no means exhaustive, but just illustrating some embodiments and advantages of the invention. Various other uses of a rotating or foldable second display may be found.

15 Although the invention has been described in the context of particular embodiments, various modifications are possible without departing from the scope and spirit of the invention as defined by the appended claims. It should be appreciated that whilst embodiments of the present invention have mainly been described in relation to mobile communication devices, embodiments of the present invention may be applicable to other types of electronic devices
20 comprising two or more displays.

Claims

1. An electronic device comprising:
a first body with a first display visible in a first viewing orientation; and
a second body with a second display movable relative to the first body to
5 the first viewing orientation and to at least a second viewing orientation opposite to
the first viewing orientation; and
a third body with a control interface, the third body pivotably connected to
the first body and functionally connected to the first and the second display.
2. An electronic device according to claim 1, wherein the second body is
10 movable relative to the first body about a single pivotable point.
3. An electronic device according to claim 2, wherein the second display is
rotatable 360 degrees around an axis vertical to the first and the second display.
4. An electronic device according to claim 2 or 3, wherein the single pivotable
point is implemented by means of a hollow single axis hinge.
- 15 5. An electronic device according to claim 1, wherein the second body is
movable relative to the first body by means of a hinge.
6. An electronic device according to any of claims 1-5, wherein the second
display is smaller than the first display.
7. A display arrangement according to any of claims 1-6, wherein the first
20 display and the second display are configured to display different parts of data
from a single source.
8. An electronic device according to any of claims 1-7, wherein the first body
is foldable towards the third body to a closed position.
9. An electronic device according to claim 8, wherein the first viewing
25 orientation is towards inside of the closed position and the second viewing
orientation is towards outside of the closed position.
10. An electronic device according to any of claims 1-9, comprising one of a
portable electronic device and a mobile communication device.
11. An electronic device according to claim 10, comprising a fold concept
30 mobile communication device.

12. A method for displaying data in an electronic device, the method comprising:

displaying data in a first display visible in a first viewing orientation; and

5 displaying data in a second display movable relative to the first body from the first viewing orientation to at least a second viewing orientation opposite to the first viewing orientation; and

10 controlling the steps of displaying the data in the first display and displaying the data in the second display by means of a control interface in a third body, the third body pivotably connected to the first body and functionally connected to the first and the second display.

13. A method according to claim 11, wherein the steps of displaying data in the first display and displaying data in the second display comprise displaying different parts of data from a single source.

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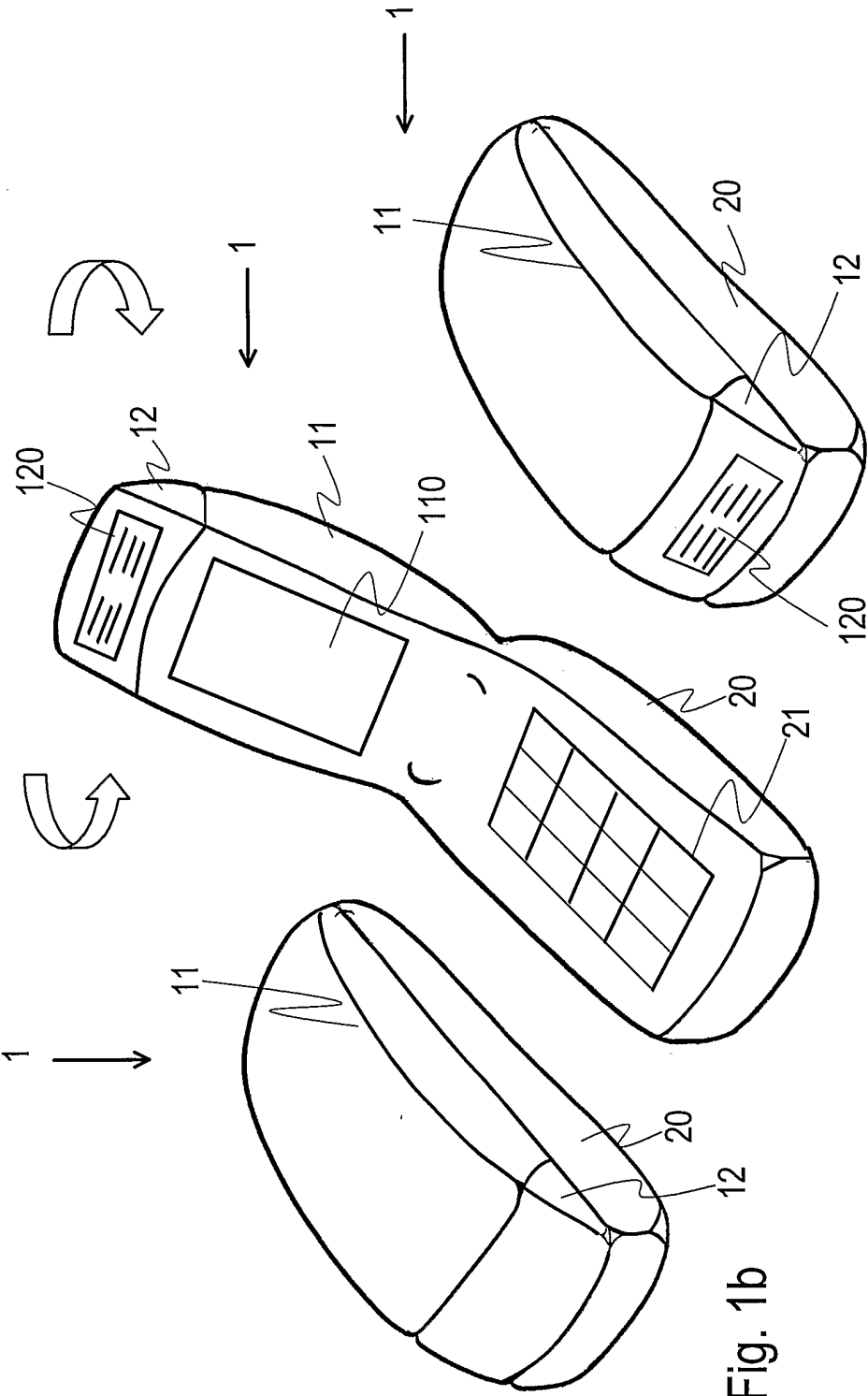


Fig. 1c

Fig. 1a

Fig. 1b

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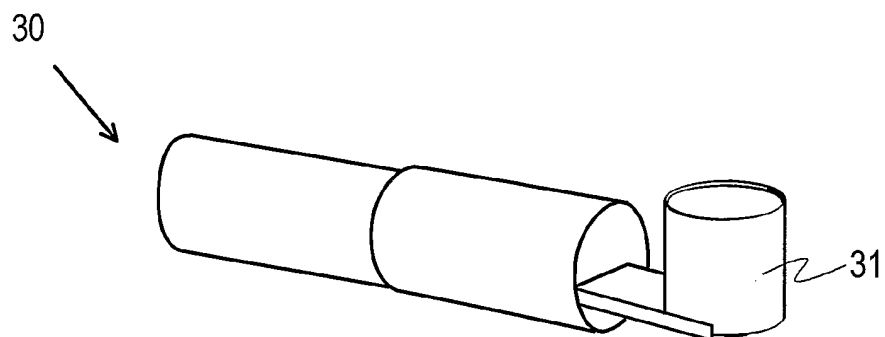


Fig. 2

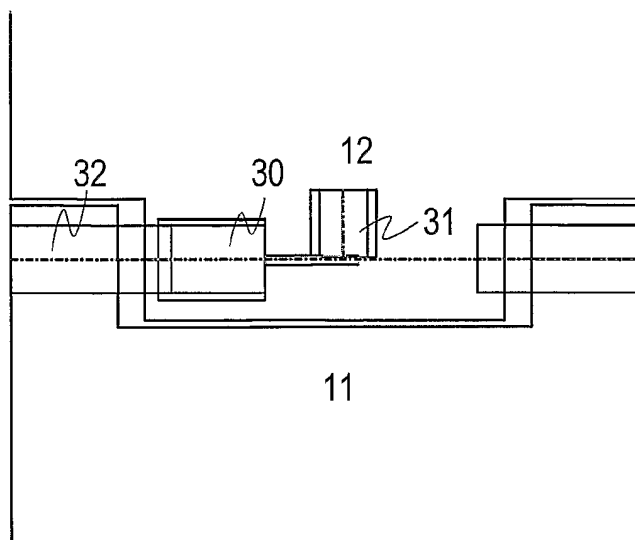


Fig. 3

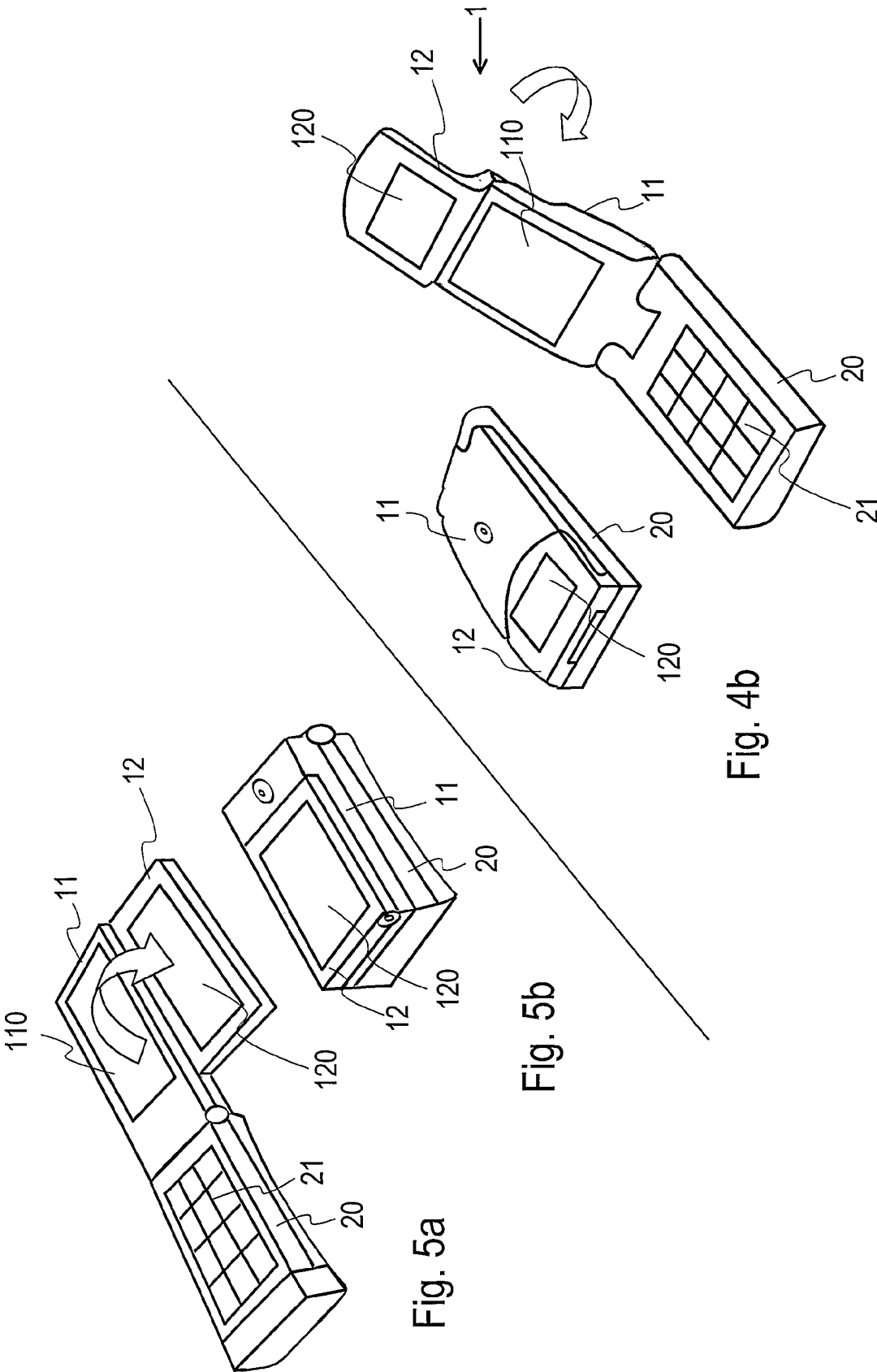


Fig. 4a

Fig. 4b

Fig. 5b

Fig. 5a

INTERNATIONAL SEARCH REPORT

Intern Application No
PCT/GB2004/004565

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04M1/02 G06F1/16

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 7 H04M G06F

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)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2004/028010 A (KIM, SI HAN) 1 April 2004 (2004-04-01) page 14, line 8 - page 17, line 7; figures 5a,5b,6 page 32, lines 2-10; figures 24a,24b	1,5-13
X	----- US 6 222 507 B1 (GOUKO JUNICHI) 24 April 2001 (2001-04-24) column 3, lines 23-67; figures 1,3 column 5, lines 24-61	1,2,6,7, 10,12,13
A	----- US 2003/228847 A1 (MATSUMOTO MITSUYOSHI) 11 December 2003 (2003-12-11) paragraphs '0027! - '0033!; figures 3,4	1-4,8-12

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

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