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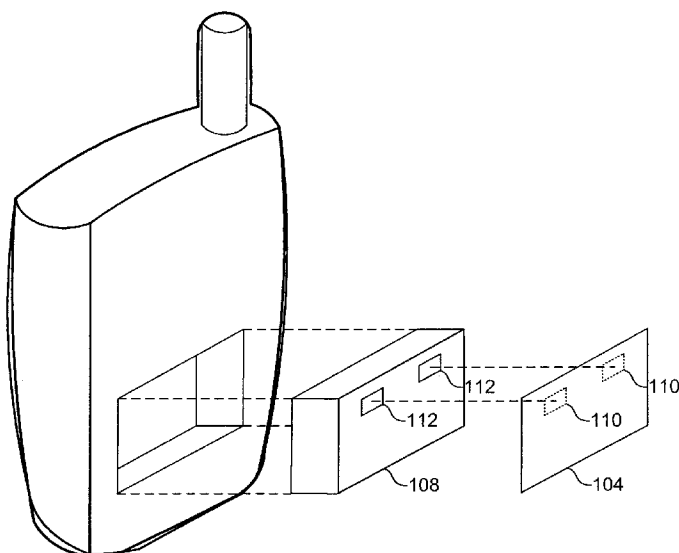


FIG. 5

(57) Abstract: A removable solar charger is provided to charge a battery powering an electrical device, such as a mobile device. A solar panel of the removable solar charger is preferably provided on an outside face of a user-removable battery compartment cover. Charging contacts on the inside of the battery compartment cover are in electrical communication with the battery to trickle charge the battery when the cover is closed. A charge indicator can provide an indication that the device is charging the battery via the solar panel. The solar charger battery compartment cover and/or battery for a particular device can be purchased separately from the device allowing a user to retrofit a current device not originally designed for solar charging while the battery is in place. Alternatively, a new electrical device can be manufactured with the removable solar panel charger battery cover, modified battery (or other necessary components) to allow for trickle charging.

SOLAR PANEL BATTERY CHARGER FOR ELECTRICAL DEVICE**CROSS REFERENCE TO RELATED APPLICATIONS**

This application claims the benefit of priority of United States Provisional Patent
5 Application No. 61/075,400 filed June 25, 2008 and of United States Provisional
Application No. 61/152,437 filed February 13, 2009, both of which are incorporated
herein by reference in their entirety.

FIELD

The present application relates generally to the provision of power to devices.
10 More particularly, the present application relates to providing solar power to electrical
devices.

BACKGROUND

Many electrical devices commonly utilize batteries as a power source. However,
any given battery can only supply power to a device for a limited period of time. Such
15 electrical devices, including mobile phones, wireless messaging devices and media
players, are used more and more frequently and for extended periods of time.
Consequently, it may be necessary to recharge the battery very frequently. However, it is
inconvenient for users to constantly carry with them spare batteries or a charger.

Alternatives to powering wireless communications device exist. Some known
20 approaches have suggested incorporating solar panels into wireless communication
devices. US Patent No. 5,898,932 discloses a mobile phone that utilizes a solar panel on
the back cover of the phone to charge the battery. Some commercial examples include the
Nokia 1611 and the Hitech Wealth S1156 mobile phones. Similarly, Japanese patent
application publication JP2006/229741 discloses a mobile flip phone with solar panels on
25 the top portion of the phone that is protected by a transparent cover.

US Patent Application Publication No. 2008/0061732 discloses a mobile flip
phone with solar panels that fold out of the top portion of the phone. U.S. Patent No.
7,206,044 discloses a device wherein a solar panel is coupled to a liquid crystal display.
The solar panels can be used to power the display or, alternatively, the entire device.

US Patent Application Publication No. 2006/000530112, Japanese publication JP2005027269 and European patent publication No. 1,274,223A1 disclose a cellular phone containing retractable solar panels for charging the phone.

However, a drawback of these technologies is that they are device specific. These technologies cannot be retrofitted into models of phones that are currently on the market. Another drawback with some of these technologies is that charging can often only take place when the device is not in use.

It is, therefore, desirable to provide a system for charging a battery in an electrical device that overcomes the drawbacks described above.

10 BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments will now be described, by way of example only, with reference to the attached Figures, wherein:

Figs. 1 and 2 are front and rear perspective views, respectively, of a known mobile device.

15 Fig. 3 is a rear perspective view of a mobile device comprising a removable battery cover charger according to an embodiment.

Fig. 4 illustrates the inside of the removable battery cover charger of Fig. 3 as well as a battery to be charged.

20 Fig. 5 is an exploded view illustrating a mobile device, battery and removable battery cover charger according to an embodiment.

Fig. 6 illustrates a removable battery cover solar charger according to another embodiment.

Fig. 7 illustrates a removable battery cover solar charger and associated device according to a further embodiment.

25 Fig. 8 illustrates an exploded view of a mobile device and removable battery cover solar charger according to another embodiment.

Fig. 9 illustrates various views of a battery according to an embodiment of the present application, for use with the exemplary embodiment of Fig. 8.

30 Fig. 10 illustrates various views of a removable battery cover solar charger with charge indicator, for use with the exemplary embodiment of Fig. 8.

Fig. 11 illustrates a view of the inside of a removable solar charger according to a further embodiment.

Fig. 12 illustrates a side view of the removable solar charger of Fig. 11.

Fig. 13 illustrates a removable battery cover charger according to an embodiment connected to a mobile device for testing or charging.

DETAILED DESCRIPTION

5 Generally, the present application provides a removable solar charger to charge a battery powering an electrical device, such as a mobile device. A solar panel of the removable solar charger is preferably provided on an outside face of a user-removable battery compartment cover. Charging contacts on the inside of the battery compartment cover are in electrical communication with the battery to trickle charge the battery when
10 the cover is closed. The solar charger battery compartment cover and/or battery for a particular device can be purchased separately from the device allowing a user to retrofit a current device not originally designed for solar charging while the battery is in place. Alternatively, a new electrical device can be manufactured with the removable solar panel charger battery cover, modified battery (or other necessary components) to allow for
15 trickle charging.

It is an object of the present application to obviate or mitigate at least one disadvantage of previous charging arrangements for electrical devices.

In a first embodiment, the present application provides a solar charger to charge a battery that powers an electrical device, such as a mobile device. The solar charger
20 includes a removable battery compartment cover and a solar panel. The solar panel is disposed on an outer face of the battery compartment cover to absorb light and convert solar energy to electrical energy to provide charge to the battery. Charge emitting contacts are disposed on the inner face of the battery compartment cover and in electrical communication with the solar panel and with the battery when the cover is in a closed
25 position to trickle charge the battery while the battery remains in the electrical device.

The charge emitting contacts can be in operative connection with charge receiving contacts of the battery, for transmitting a charge to the corresponding charge receiving contacts when the cover is in the closed position. The charge receiving contacts of the battery can be integral with power delivery contacts of the battery that delivery power to
30 the device. In that case, the charge emitting contacts can extend to and be in electrical contact with the power delivery contacts of the battery when the cover is in the closed position.

The solar charger can further include a charging circuit provided between the solar panel and the charge emitting contacts to convert the solar energy to electrical energy that is suitable for transmission in trickle charging the battery.

5 The solar panel can be easily manipulated by a user to be removed from the battery compartment cover, such as for replacement or for re-use in another solar charger in another device. The solar panel can cover substantially the entire external surface area of the outer face of the battery compartment cover.

The removable battery compartment cover can further include a charge indicator arranged to provide an indication that the device is charging the battery via the solar panel.
10 The charge indicator can be arranged to provide a charge indication in response to a received battery charge status from the electrical device.

In another embodiment, the present application provides an electrical device having a removable solar charger. The electrical device, which can be a mobile device, includes a battery and a removable battery compartment cover. A solar panel is disposed
15 on an outer face of the battery compartment cover to absorb light and convert solar energy to electrical energy to provide charge to the battery. The inner face of the battery compartment cover is in electrical communication with the solar panel and the battery to trickle charge the battery while the battery remains in the electrical device. The electrical device can be a mobile device, an audio device arranged for coupling with a mobile
20 device, or a media player. Other features similar to those described in relation to the first embodiment can be provided in this second embodiment.

In a further embodiment, the present application provides a removable solar charger to power an electrical device, including: a removable battery compartment cover; a battery provided integral with the removable battery compartment cover; a solar panel
25 disposed on an outer face of the battery compartment cover to absorb light and convert solar energy to electrical energy to provide charge to the battery; and charge emitting contacts in electrical communication with the solar panel and with the battery to trickle charge the battery. In such an embodiment, the battery can be solar charged when removed from the electrical device. Other features similar to those described in relation to the first
30 embodiment can be provided in this third embodiment.

Other aspects and features of the present application will become apparent to those ordinarily skilled in the art upon review of the following description of specific embodiments in conjunction with the accompanying figures.

While some known approaches provide solar panels on mobile devices, such as mobile phones or smart phones, these are typically provided in a mobile device specifically adapted for that purpose. Embodiments of the present application provide a solar charger for a mobile device that is easily user-removable and user-replaceable, and can be retrofitted to existing mobile devices that were not originally intended to allow the user to charge the battery using solar power while it is in the device.

While embodiments are described herein primarily in relation to a mobile device, a worker skilled in the art will appreciate that the solar panel charger system can be used for any electrical device from alarm clocks to desk clocks to virtually any device containing a battery or backup battery and having a battery compartment cover. For example, the electrical device can be a smoke detector, carbon dioxide (CO₂) detector, carbon monoxide (CO) detector, or any such device using a battery and/or a backup battery, where the solar panel is provided on a battery compartment cover. Of particular value to a user is when the system is used to trickle-charge portable devices such as cell phones, mobile messaging devices, or media players where the ability to charge the device is limited or inconvenient and where high demands are placed on the battery.

Figs. 1 and 2 are a front and rear perspective views, respectively, of a known mobile device 100. While the illustrated mobile device is a mobile phone, it is to be understood that an electrical device or mobile device as referred to herein can include any portable device powered by battery including a mobile phone, smart phone, wireless communications device, media player, or any other similar device as known to one of ordinary skill in the art. Fig. 2 shows a conventional removable battery cover 102 having no other functionality than to cover and protect the battery and other internal circuitry in the battery compartment.

Fig. 3 is a rear perspective view of an electrical device, such as a mobile device, comprising a removable battery cover solar charger 104 according to an embodiment. In this embodiment, the solar charger includes a solar panel 106 provided on an outside facing portion of the removable battery cover. Preferably, the solar panel 106 covers substantially the entire external surface area of the battery cover. The solar panel 106 absorbs light and converts solar energy to electrical energy, which is then used to charge the mobile device's battery while the battery remains in the mobile device, and can be while the device is operating.

In another embodiment (not shown), the solar panel 106 is removable from the battery compartment cover. When an electrical device reaches end of life, rather than disregarding the solar panel, it can be reused on another electrical device's battery cover compartment. From a manufacturing perspective, manufacturers can make battery
5 compartment covers and solar panels removable therefrom, (and the components could be sold separately) to maximize the re-use of the solar panels.

Fig. 4 illustrates the inside of the removable battery cover charger 104 of Fig. 3 as well as a battery 108 that it covers. When the battery compartment cover 104 is secured in place (e.g. in a closed position), the inside thereof is in electrical communication with the
10 battery 108 to trickle charge the battery. As shown in Fig. 4, the inside of the battery compartment cover can comprise charge emitting contacts 110, in operative connection with the solar panel, for transmitting a charge to corresponding charge receiving contacts 112 of the battery within the battery compartment. In the embodiment shown in Fig. 4, there are two charge emitting contacts 110 and two charge receiving contacts 112. The
15 number and placement of the charge emitting and charge receiving contacts can be varied as long as they correspond with one another such that they can provide electrical contact for transmission of the charge from the solar charger to the battery when the cover is closed.

A charging circuit (not shown) can be provided between the solar panel 106 and
20 the charge emitting contacts 110 to convert the solar energy to electrical energy that is suitable for transmission in trickle charging the battery. Such charging circuits are known to those of ordinary skill in the art, and can include such functionality as a maximum power point tracker. The charging circuit can be provided in the body of the removable battery cover, or on the inside or outside thereof.

25 In operation, when the solar charger battery compartment cover is in place, the solar panel, when receiving light, trickle-charges the battery so that the electrical device's operating time can be extended. The solar panel charges the battery by way of contacts on the battery which come into direct contact with the inside of the battery compartment cover which comprises the solar panel itself. The battery can be designed specially for this
30 arrangement of trickle charging via the solar charger. In other words, the charge receiving contacts can be different from power delivery contacts on the battery, which are used to deliver power to the device.

In another embodiment, the solar charger battery compartment cover can include charge emitting contacts that extend to and are in electrical contact with the power delivery contacts of the battery when the cover is closed. This arrangement is possible in cases where the power delivery contacts of the battery can also be used for trickle
5 charging. In this case, the charge receiving contacts and the power delivery contacts of the battery are the same. This can eliminate the need for providing the user with a retrofit cover and retrofit battery, as only a retrofit cover would be required.

Embodiments of the present application can provide a significant advantage by enabling the retrofitting of existing electrical devices for use with a solar panel charger. By
10 simply replacing an existing battery compartment cover for the electrical device with a solar panel charger battery cover according to an embodiment, the ability to charge the battery by solar power can be imparted on any number of devices. Since the space between the inside of the battery cover and the battery and the device's internal circuitry is usually limited, embodiments of the present application can provide a solar charger battery
15 compartment cover that is slightly thicker in profile than a battery compartment cover it is replacing, in order to fit the device while providing any extra space needed for the charging circuit.

A solar panel charger according to an embodiment of the present application can be modified in size and shape to correspond to the shape of existing battery compartment
20 covers and to make suitable electrical contact with the battery and/or battery contacts.

Fig. 5 is an exploded view illustrating a mobile device, a battery 110 and removable battery cover solar charger 104 according to an embodiment. In this view, only the outer side or face of the solar charger which bears the solar panel is shown. The inner face of the charger that makes electrical contact with the battery is not shown in Fig. 5, but
25 is shown in Fig. 4.

In an exemplary embodiment, the battery is a Lithium 3.7v / 850mAh battery, and the solar panel has 5.5v / 30mA characteristics. In another exemplary embodiment, the battery is a Lithium 3.7v/1000mA battery, and the solar panel has 5.5/60mA characteristics, and the battery door has the following measurements: 59 x 51 x 1.5mm.
30 An additional car charger with USB connectivity can also be provided when selling the solar panel charger to a consumer, to provide a complete charging solution including the solar charger according to an embodiment of the present application.

In another embodiment, the battery compartment cover and solar panel can extend to cover a significant portion of the face of the electrical device on which it is provided, and can cover substantially the entire face. For example, the battery compartment cover for some mobile phones takes up a substantial part of the back of the phone; some even
5 have the battery compartment cover taking substantially all of the real estate of the back of the mobile phone. The removable battery compartment cover solar charger can include a securing or latching means, to further secure or lock the battery door in place.

Fig. 6 illustrates a removable battery cover solar charger according to another embodiment. A removable battery cover solar charger 114 in Fig. 6 is similar to the
10 removable battery cover solar charger 104 previously described. In addition to a solar panel 116, the battery cover solar charger 114 includes a charge indicator 118. The charge indicator 118 can be implemented as a light emitting diode (LED) indicator. The charge indicator 118 is arranged to provide a first charge indication, indicating that the device is charging the battery via the solar panel 116. The first charge indication can comprise a
15 constant lighting of the LED. Alternatively, the first charge indication can comprise flashing the LED.

The device itself can be used to provide other indications of whether the battery is in need of charge, or is fully charged. Alternatively, in an embodiment, the charge indicator 118 is arranged to provide a second charge indication indicating that the battery
20 is fully charged, and/or a third charge indication, indicating that the battery requires charging. In this embodiment, the charge indicator 118 is in communication with the device to receive a battery charge status, and to provide a charge indication in response to the battery charge status.

Fig. 7 illustrates a removable battery cover solar charger and associated device 120
25 according to a further embodiment of the present application. In the embodiment of Fig. 7, the device 120 for which the removable battery cover solar charger 114 has been designed is an audio device arranged for coupling with a second electrical device. In Fig. 7, the audio device is a Bluetooth™ headset arranged to be coupled with, and for use with, a mobile device. The audio device can alternatively be a wireless headphone for use with a
30 portable media player. The removable battery cover solar charger 114 in Fig. 7 includes a charge indicator 118, similar to Fig. 6.

Fig. 8 illustrates an exploded view of a mobile device and removable battery cover solar charger according to another embodiment. Various details are provided in this

exemplary embodiment regarding the manner in which certain elements of embodiments of the present application can be constructed and arranged for production. Fig. 9 illustrates various views of a battery according to an embodiment, for use with the exemplary embodiment of Fig. 8. Fig. 10 illustrates various views of a removable battery cover solar charger with charge indicator, for use with the exemplary embodiment of Fig. 8.

Fig. 11 illustrates a view of the inside of a removable solar charger 120 according to a further embodiment. In this embodiment, the removable solar charger includes a battery cover 122 that is provided with an integral battery 124. The battery cover 122 and battery 124 can be described as a unitary component, such as a battery cover and battery component. From the end user's perspective, the battery cover 122 and battery 124 are provided as a single piece, or a one piece solution. In this embodiment, the entire removable solar charger can be conveniently retrofitted into an existing electronic device in a way that avoids any potential issues with interoperability of an existing battery with the solar charger. The required contacts to charge the battery are provided in the integral battery and battery cover. As shown in Fig. 11, the battery cover can include other features on the inside thereof, and can define one or more apertures, such as to permit operation of camera and/or flash functions.

An advantage of the embodiment of Fig. 11 is that the battery can be charged even when the battery is not in use in the electrical device. This can be useful if it is desirable to charge the battery in one location while, for example, using a different battery in operation of the electrical device. Such an implementation can be effective when it can be a challenge to expose the electrical device to light during normal operation, yet it is still desirable to charge the battery using solar power.

Fig. 12 illustrates a side view of the removable solar charger of Fig. 11. This side view shows the solar panel 126 and the optional charge indicator 128. This figure further illustrates that having the battery attached to the battery door can provide for convenient replacement of an existing battery door and battery with a removable solar charger according to an embodiment. Moreover, it shows that the battery cover can include tapered ends that cooperate with corresponding mating portions of the electrical device with which it is used, in order to preserve an original form factor of the electrical device.

Fig. 13 illustrates a removable battery cover charger 114 according to an embodiment connected to an electrical device for testing or charging. In some cases, it is desirable to be able to test the functioning of the solar panel charger. In addition to a solar

panel 116, the battery cover solar charger 114 includes an indicator 118. In an embodiment, the removable battery cover charger can be provided in a kit with a multipurpose cable 130. The multipurpose cable 130 can be connected between the electrical device, or mobile device, 100 and the removable battery cover charger 114. The indicator 118 can be used as an operational indicator, to indicate that the solar panel is working properly and charging the electrical device. A corresponding indication can be displayed on a display 132 of the electrical device, and can take any form of indication, such as a moving or still image or text, or combination thereof.

In another embodiment, the electrical device 100 can include a charging display mechanism to display a charging indication when the solar panel is charging the electrical device directly, or is charging a battery used to power the electrical device. Therefore, the multipurpose cable 130 can be used to charge the electrical device directly, or to charge a battery used to power the electrical device. The multipurpose cable 130 can also be used to test the functionality of the solar charger, either prior to delivery to the end user, or can be used by the end user to test whether the charger is functioning properly. In an embodiment, the multipurpose cable 130 can be provided as any standard electronics connection cable type, such as USB, IEEE 1394 or FireWire, or any other proprietary or customized cable type, that can carry power and/or the necessary information to indicate a transfer of power or charge.

In the preceding description, for purposes of explanation, numerous details are set forth in order to provide a thorough understanding of the embodiments described herein. However, it will be apparent to one skilled in the art that these specific details are not required in order to practice the embodiments. In other instances, well-known electrical structures and circuits are shown in block diagram form in order not to obscure the embodiments. For example, specific details are not provided as to whether the embodiments described herein are implemented as a software routine, hardware circuit, firmware, or a combination thereof.

The above-described embodiments are intended to be examples only. Alterations, modifications and variations can be effected to the particular embodiments by those of skill in the art without departing from the scope of the invention, which is defined solely by the claims appended hereto.

CLAIMS:

1. A removable solar charger to charge a battery that powers an electrical device, comprising:
 - a removable battery compartment cover;
 - 5 a solar panel disposed on an outer face of the battery compartment cover to provide charge to the battery; and
 - charge emitting contacts disposed on the inner face of the battery compartment cover and in electrical communication with the solar panel and with the battery when the cover is in a closed position to trickle charge the battery while the battery remains in the electrical device.
- 10 2. The solar charger of claim 1 wherein the charge emitting contacts are in operative connection with charge receiving contacts of the battery, for transmitting a charge to the corresponding charge receiving contacts when the cover is in the closed position.
3. The solar charger of claim 2 wherein the charge receiving contacts of the battery are integral with power delivery contacts of the battery that delivery power to the device, and
- 15 4. wherein the charge emitting contacts extend to and are in electrical contact with the power delivery contacts of the battery when the cover is in the closed position.
5. The solar charger of claim 1 further comprising a charging circuit provided between the solar panel and the charge emitting contacts to convert the solar energy to electrical energy that is suitable for transmission in trickle charging the battery.
- 20 6. The solar charger of claim 1 wherein the solar panel is easily manipulated by a user to be removed from the battery compartment cover.
7. The solar charger of claim 1 wherein the solar panel covers substantially the entire external surface area of the outer face of the battery compartment cover.
- 25 8. The solar charger of claim 1 wherein the removable battery compartment cover further comprises a charge indicator arranged to provide an indication that the device is charging the battery via the solar panel.

8. The solar charger of claim 1 wherein the removable battery compartment cover further comprises a charge indicator arranged to provide a charge indication in response to a received battery charge status from the electrical device.

9. The solar charger of claim 1 wherein the electrical device is a mobile device.

5 10. An electrical device having a removable solar charger, comprising:

a battery;

a removable battery compartment cover;

a solar panel disposed on an outer face of the battery compartment cover to absorb light and convert solar energy to electrical energy to provide charge to the battery; and

10 charge emitting contacts disposed on the inner face of the battery compartment cover and in electrical communication with the solar panel and with the battery when the cover is in a closed position to trickle charge the battery while the battery remains in the electrical device.

11. The electrical device of claim 10 wherein the battery comprises charge receiving contacts, and the charge emitting contacts are in operative connection with the solar panel and
15 with the charge receiving contacts of the battery when the cover is in the closed position, for transmitting a charge to the corresponding charge receiving contacts.

12. The electrical device of claim 11 wherein the charge receiving contacts of the battery are integral with power delivery contacts of the battery that delivery power to the device, and wherein the charge emitting contacts extend to and are in electrical contact with the power
20 delivery contacts of the battery when the cover is in the closed position.

13. The electrical device of claim 10 further comprising a charging circuit provided between the solar panel and the charge emitting contacts to convert the solar energy to electrical energy that is suitable for transmission in trickle charging the battery.

14. The electrical device of claim 10 wherein the solar panel is user-removable from the
25 battery compartment cover.

15. The electrical device of claim 10 wherein the solar panel covers substantially the entire external surface area of the outer face of the battery compartment cover.

16. The electrical device of claim 10 wherein the removable battery compartment cover further comprises a charge indicator arranged to provide an indication that the device is charging the battery via the solar panel.
17. The electrical device of claim 10 wherein the removable battery compartment cover further comprises a charge indicator arranged to provide a charge indication in response to a received battery charge status from the electrical device.
18. The electrical device of claim 10 wherein the electrical device is a mobile device.
19. The electrical device of claim 10 wherein the electrical device is an audio device arranged for coupling with a mobile device.
20. The electrical device of claim 10 wherein the electrical device is a media player.
21. The electrical device of claim 10 wherein the electrical device is a smoke detector.
22. The electrical device of claim 10 wherein the electrical device is a carbon monoxide detector.
23. A removable solar charger to power an electrical device, comprising:
a removable battery compartment cover;
a battery provided integral with the removable battery compartment cover;
a solar panel disposed on an outer face of the battery compartment cover to absorb light and convert solar energy to electrical energy to provide charge to the battery; and
charge emitting contacts in electrical communication with the solar panel and with the battery to trickle charge the battery.
24. The solar charger of claim 23 further comprising a charging circuit provided between the solar panel and the charge emitting contacts to convert the solar energy to electrical energy that is suitable for transmission in trickle charging the battery.
25. The solar charger of claim 23 wherein the solar panel covers substantially the entire external surface area of the outer face of the battery compartment cover.

26. The solar charger of claim 23 wherein the removable battery compartment cover further comprises a charge indicator arranged to provide an indication that the device is charging the battery via the solar panel.
27. The solar charger of claim 23 wherein the removable battery compartment cover further
5 comprises a charge indicator arranged to provide a charge indication in response to a received battery charge status from the electrical device.
28. The solar charger of claim 23 wherein the electrical device is a mobile device.
29. The solar charger of claim 23 wherein the electrical device is an audio device arranged for coupling with a mobile device.
- 10 30. The solar charger of claim 23 wherein the electrical device is a media player.
31. The solar charger of claim 23 wherein the electrical device is a smoke detector.
32. The solar charger of claim 23 wherein the electrical device is a carbon monoxide detector.

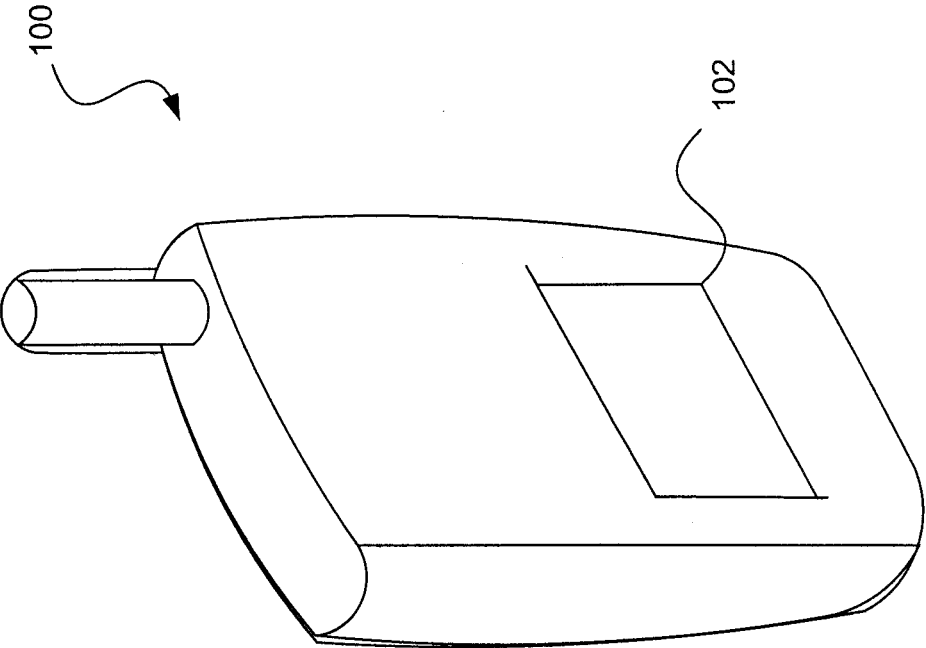


FIG. 2

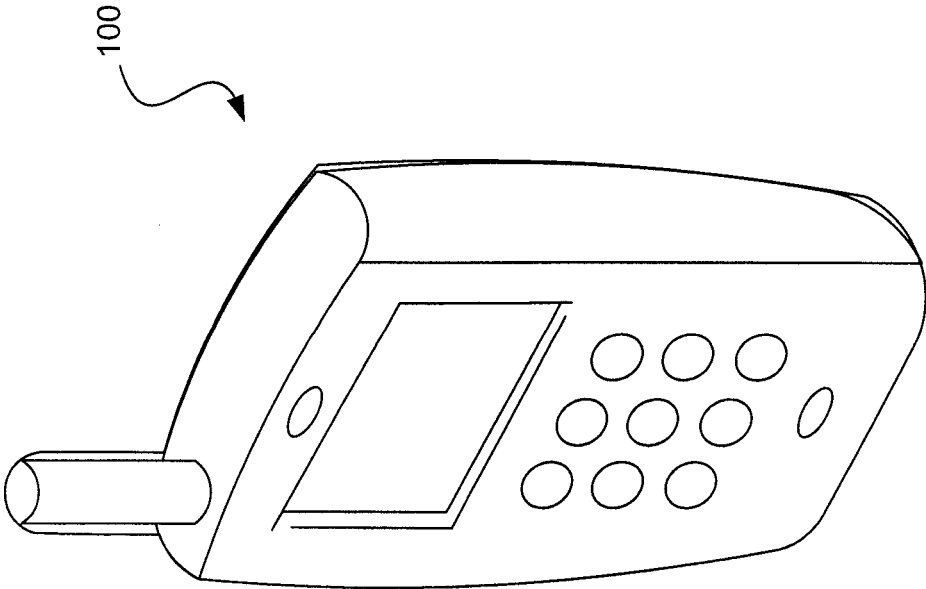


FIG. 1

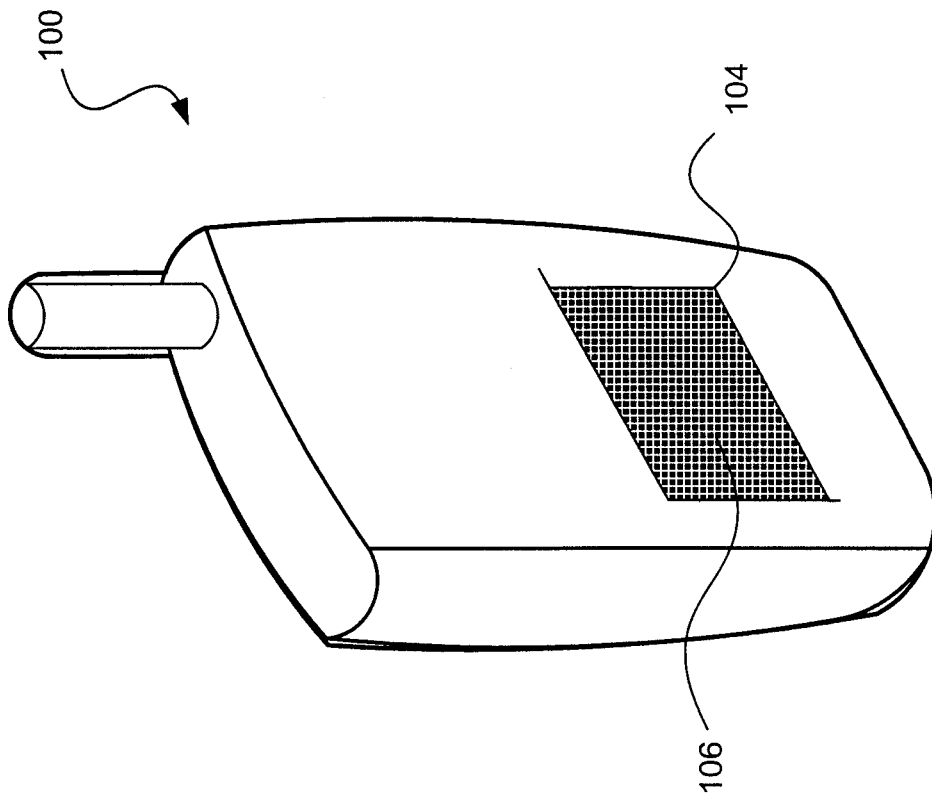


FIG. 3

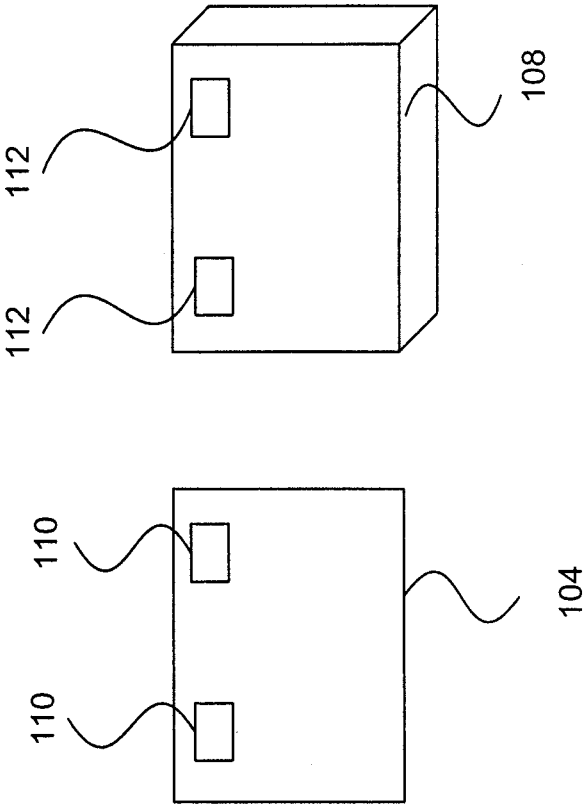


FIG. 4

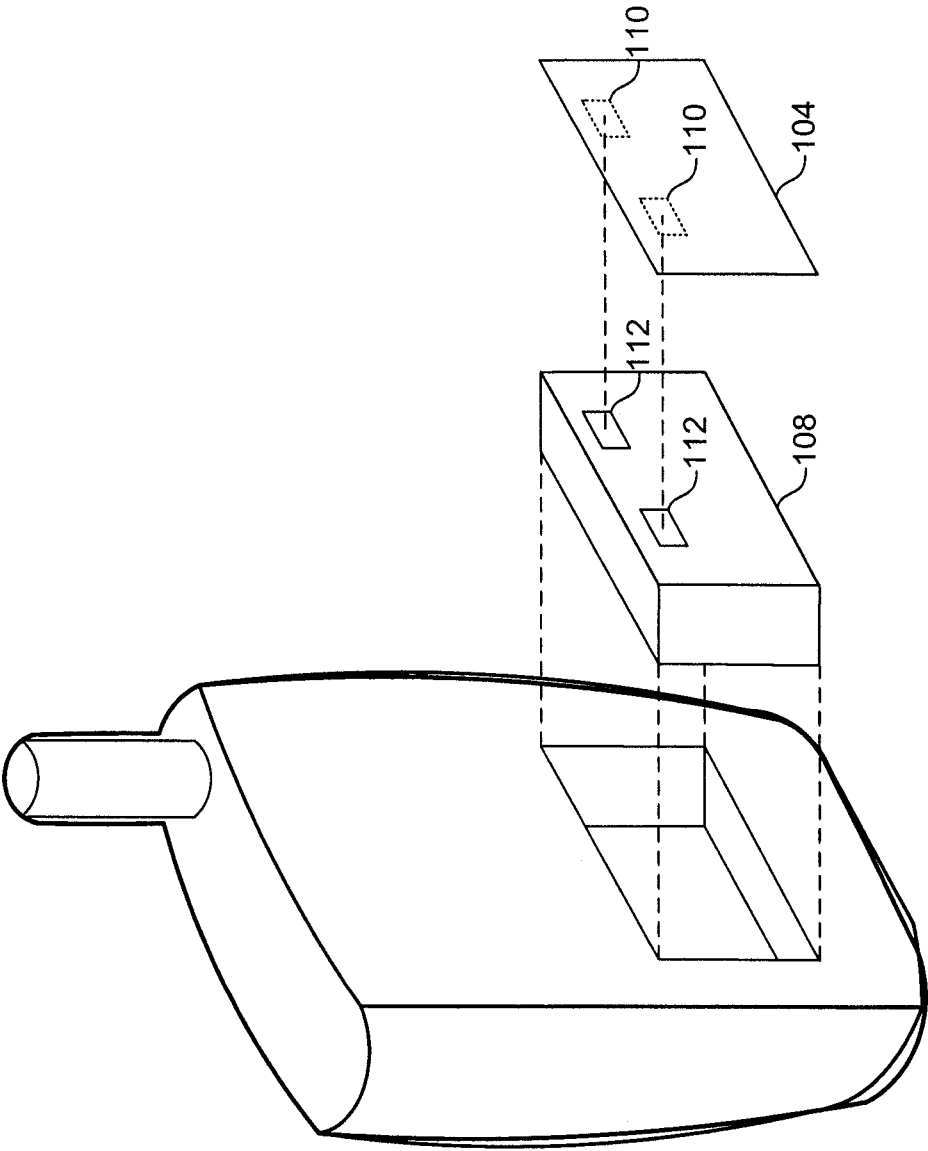


FIG. 5

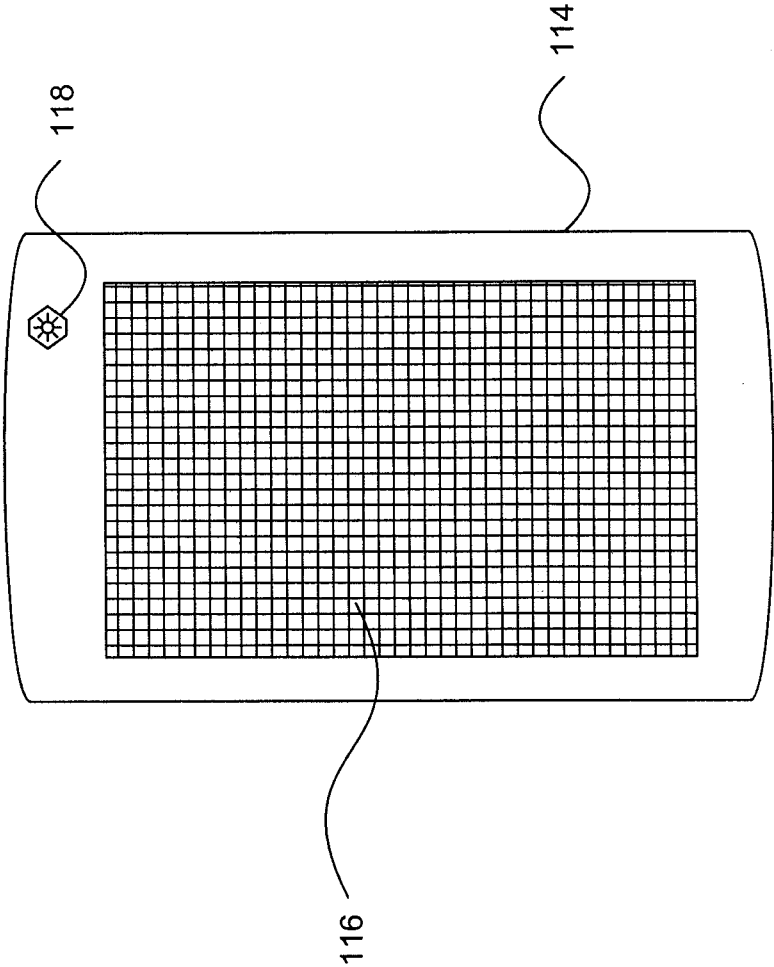


FIG. 6

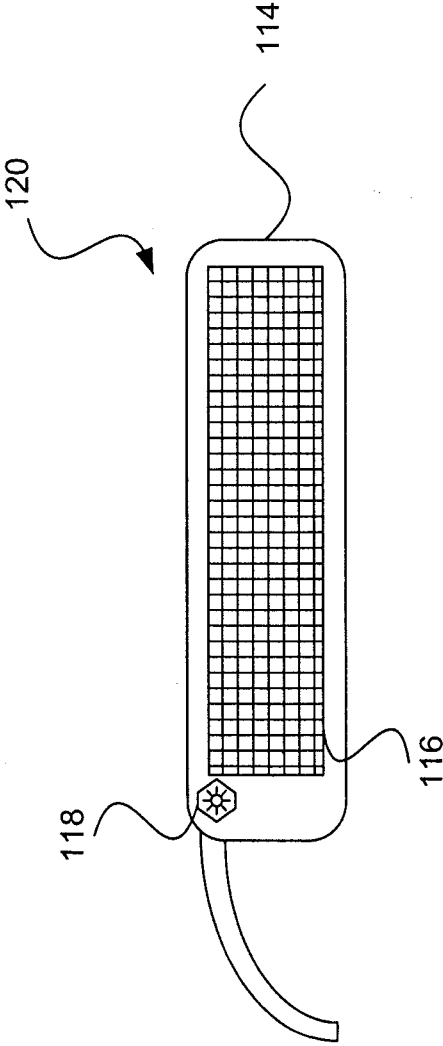


FIG. 7

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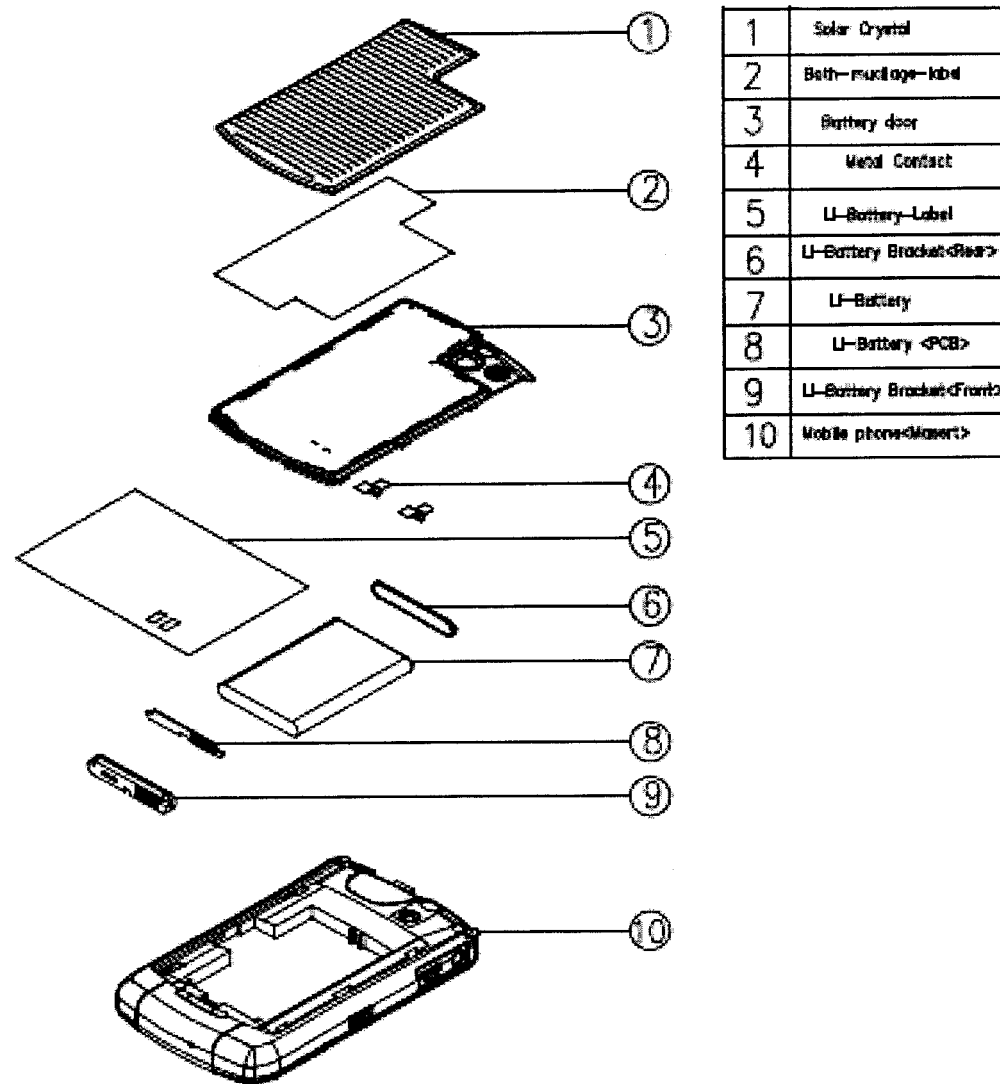


FIG. 8

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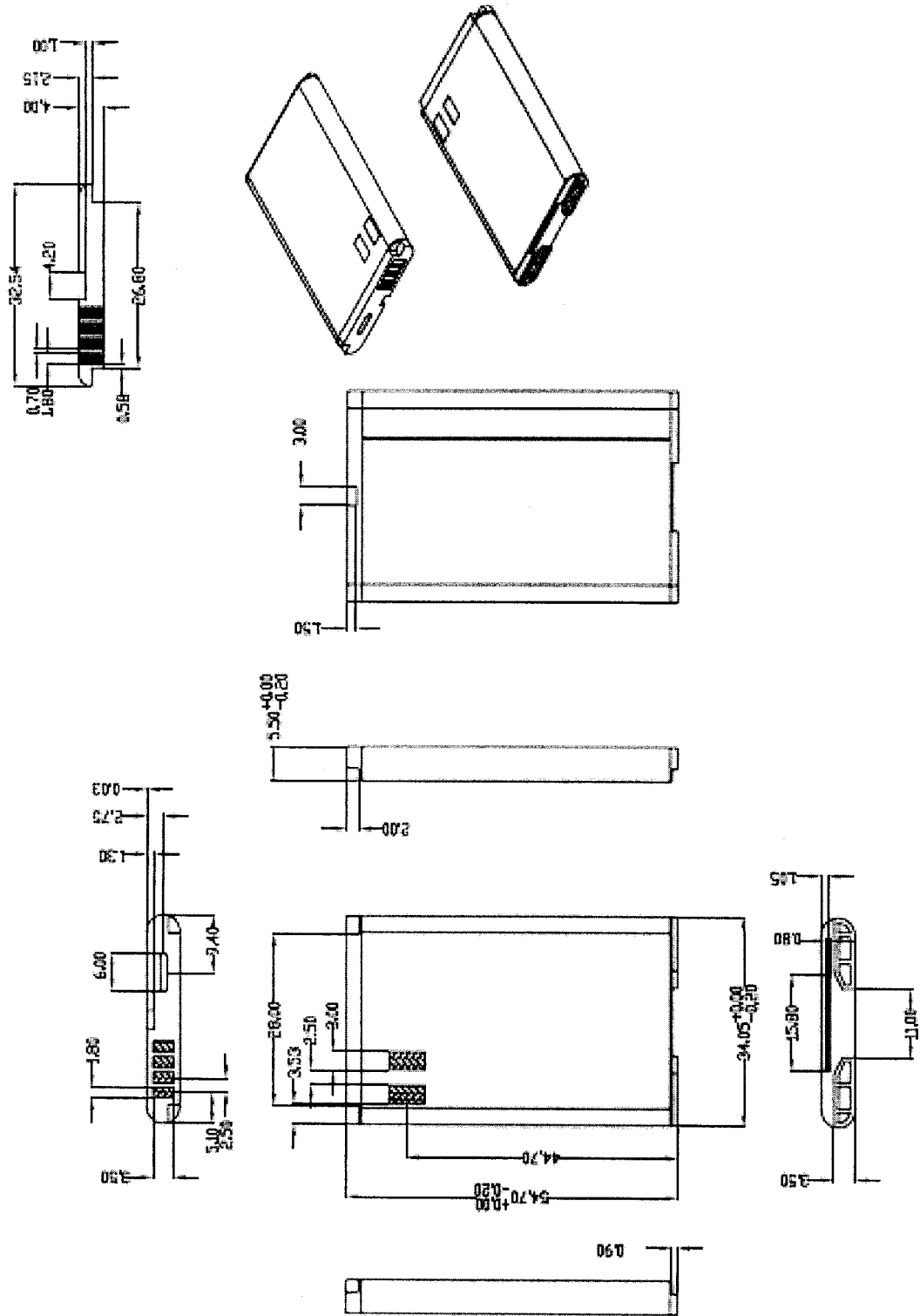


FIG. 9

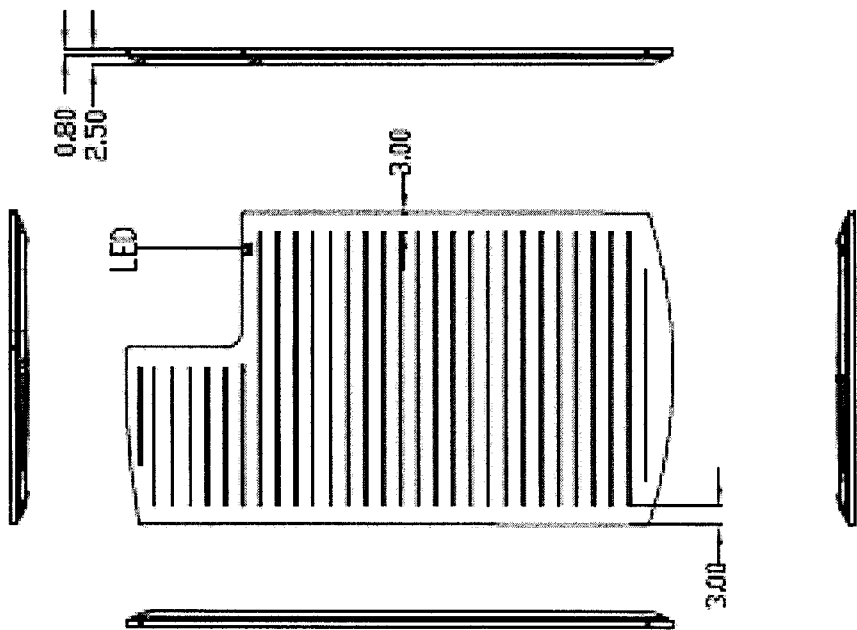


FIG. 10

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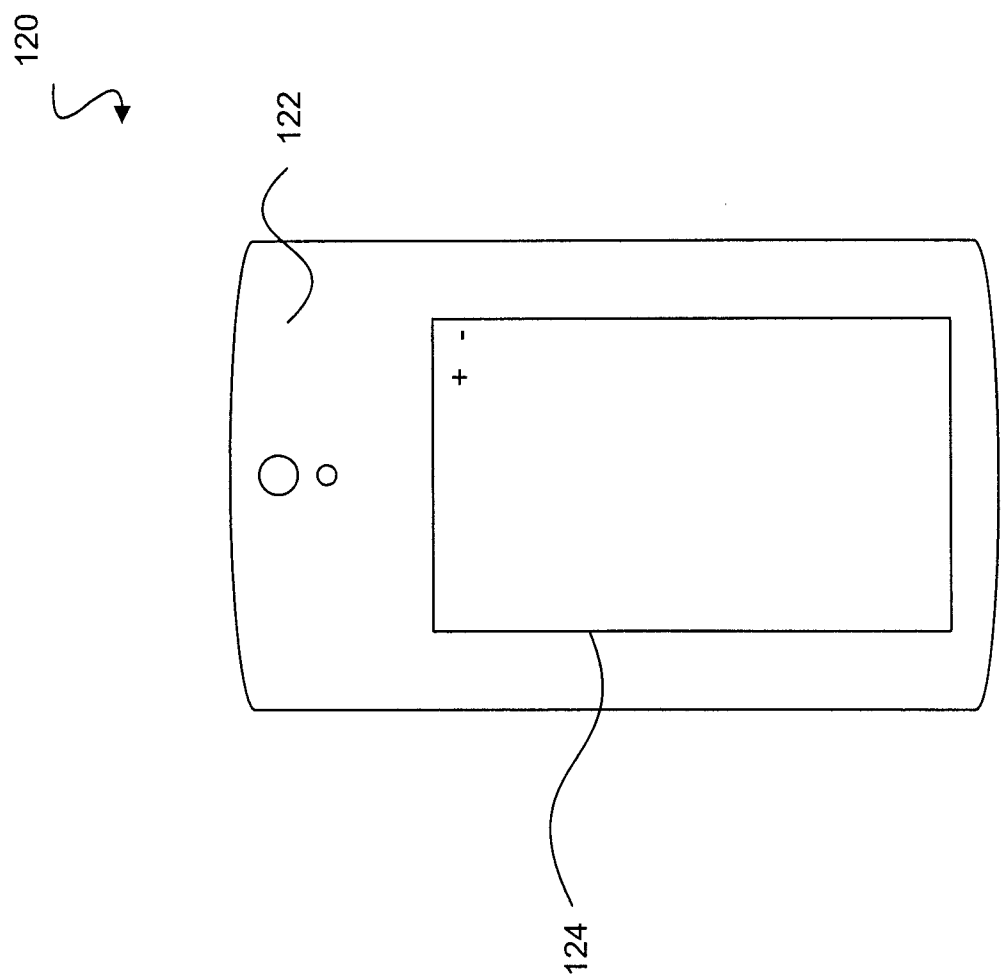


FIG. 11

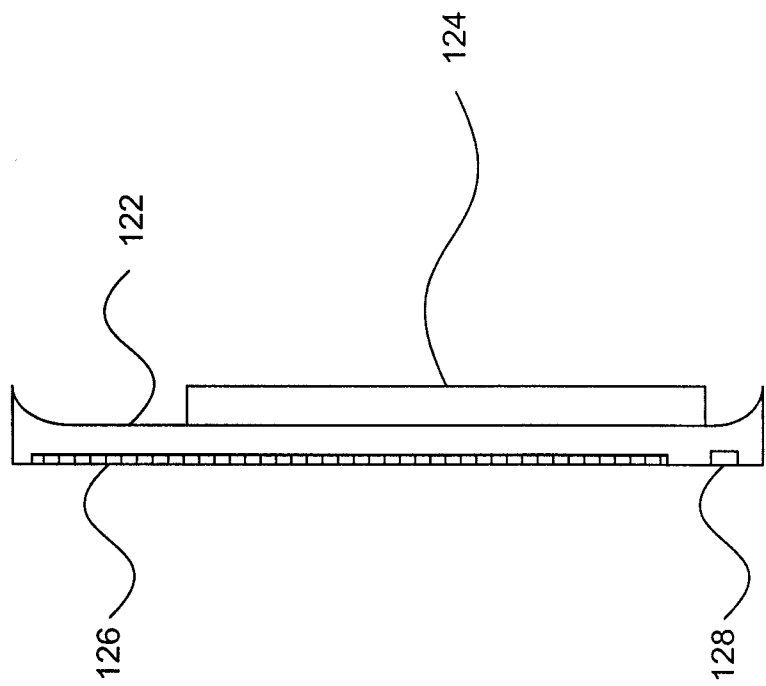


FIG. 12

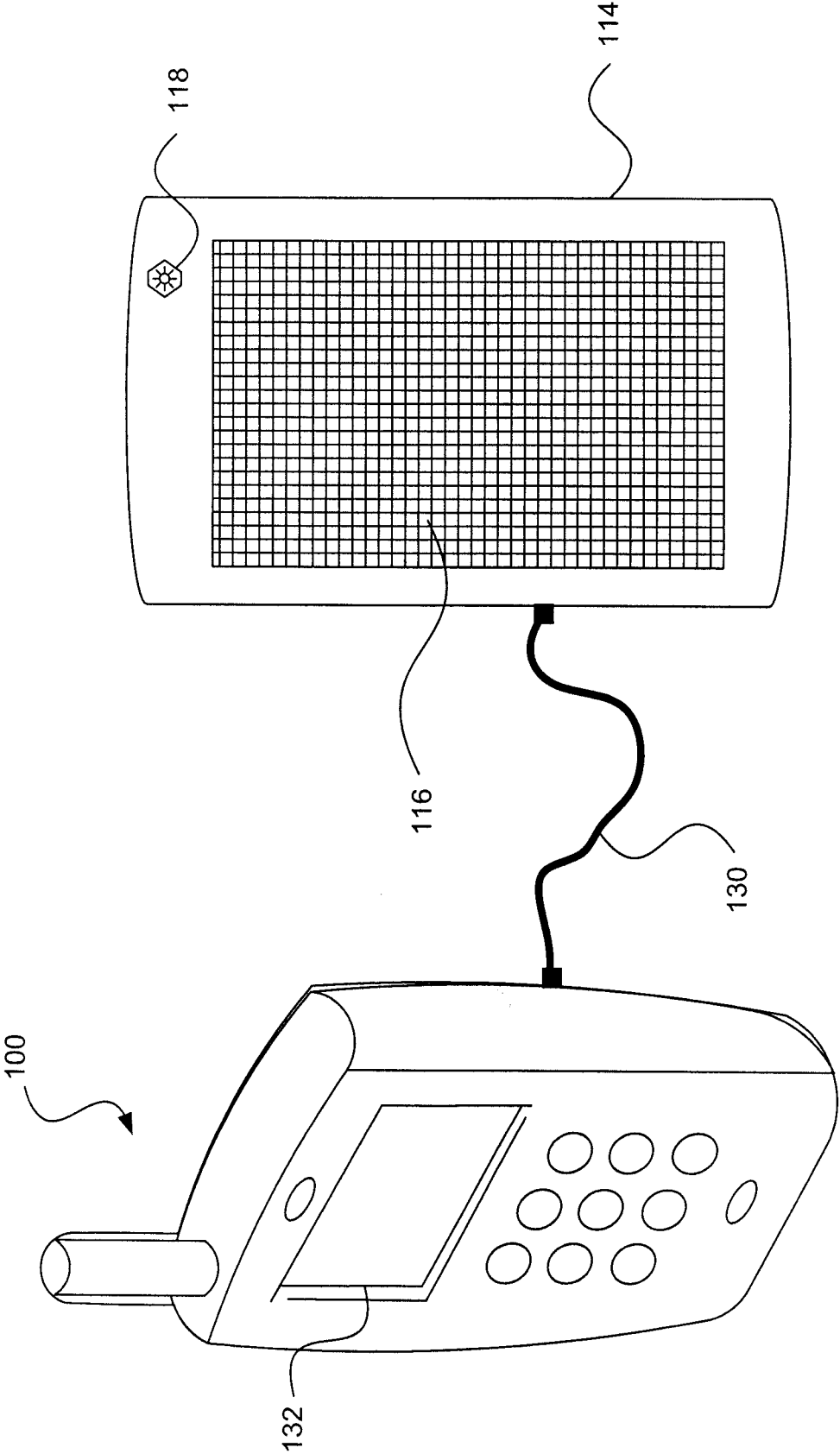


FIG. 13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2009/000867

A. CLASSIFICATION OF SUBJECT MATTER

IPC: **H02J 7/00** (2006.01) , **G06F 1/26** (2006.01) , **H01L 31/042** (2006.01) , **H04W 88/02** (2009.01)

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: **H02J 7/00** (2006.01) , **G06F 1/26** (2006.01) , **H01L 31/042** (2006.01) , **H04W 88/02** (2009.01) ,
H04M 1/02 (2009.01), **H04Q 7/32** (2009.01), **H05K 5/03** (2009.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)

Databases searched: Canadian Patent Database, Delphion, European Patent Database, Abstracts of Japan, US Patent Database, WIPO-PCT Publications (Full text) and IEEE publications.

Keywords Only: Solar, charger, removable, battery, cover, contact, panel.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP2005/027269 (Masayuki), 27 January 2005 (27-01-2005), -see abstract; -see fig. 1; -see whole document.	1 - 32
A	US 2008/0084177A1 (Sander et al.), 10 April 2008 (10-04-2008), -see abstract; -see figs. 4b & 6; -see whole document.	1 - 32
A	-CN20944609Y (Jixian), 05 September 2007 (05-09-2007), -see abstract; -see fig. 1; -see whole document.	1 - 32
A	US 2008/0061732A1 (Lin et al.), 13 March 2008 (13-03-2008), -see abstract; -see figs. 5 & 7;	1 - 32

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

☒ See patent family annex.

* Special categories of cited documents :	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 02 September 2009 (02.09.2009)	Date of mailing of the international search report 30 September 2009 (30-09-2009)
Name and mailing address of the ISA/CA Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001-819-953-2476	Authorized officer Rajiv Agarwal997-2304

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2009/000867

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 5,898,932 (Zurlo et al.), 27 April 1999 (27-04-1999), -see abstract; -see fig. 2; -see whole document	1 - 32
A	EP 1,274,223A1 (Mokhtari), 08 January 2003 (08-01-2003), -see abstract; -see whole document.	1 - 32
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A	US 7,206,044 (Li et al.), 17 April 2007 (17-04-2007), -see abstract; -see whole document.	1 - 32

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2009/000867

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