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BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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(54) **Title:** COMMUNICATIONS CABLE WITH STATUS INDICATOR FOR ELECTRONIC DEVICES

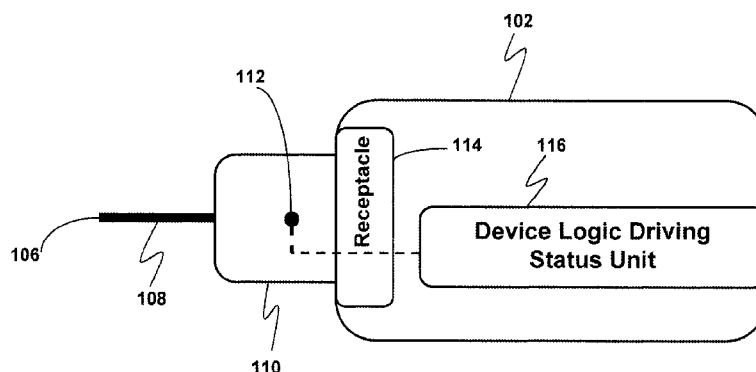


FIG. 2

(57) **Abstract:** An electronic device system can include an electronic device. The electronic device can include a receptacle, and a device logic driving status unit configured to generate a status signal indicating activity of the electronic device, and a communications cable. The communications cable can include a first plug configured to connect to the receptacle and receive the status signal, wherein the first plug includes a status indicator configured to indicate activity of the electronic device based on the status signal.

COMMUNICATIONS CABLE WITH STATUS INDICATOR FOR ELECTRONIC DEVICES

BACKGROUND

[0001] Conventionally, a data storage device is operated indoors. Thus, the conventional data storage device was built without the need to make it weather-resistant or weather-proof. Absent a direct intentional effort by the user to douse the data storage device in water, the data storage device may operate smoothly relative to the weather conditions within a house or building.

[0002] The data storage device is often beneficial and the user may want to use it outside a house or building. However, if there is moisture or dust, the data storage device may become damaged. This may be especially true with a hard disk drive as particles or moisture drops may damage the magnetic rotating disk located within the hard disk drive.

[0003] However, conventional methods of protecting the data storage device may be costly, cumbersome, or reduce access to the data storage device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] The features and advantages of the present embodiments will become more apparent from the detailed description set forth below when taken in conjunction with the drawings, wherein:

[0005] FIG. 1 depicts an electronic device system according to an embodiment;

[0006] FIG. 2 depicts an electronic device connected to a communications cable according to an embodiment; and

[0007] FIG. 3 depicts an electronic device connected to a communications cable according to an embodiment.

DETAILED DESCRIPTION

[0008] In an embodiment, an electronic device system 100 is shown in FIG. 1. The electronic device system 100 can comprise an electronic device 102 and a communications cable 106. The

communications cable 106 can connect the electronic device 102 to the host 104. The host 104 can comprise, for example, a laptop, a computer, or other device which may need to store data in the electronic device 102. In an embodiment, the host 104 can comprise a host processor and also an operating system.

[0009] In an embodiment, the electronic device 102 can comprise a portable device such as a data storage device, a battery, a power supply, or any other device comprising electronic components which are portable. In an embodiment, the data storage device comprises a direct attached storage (“DAS”) device, or a network attached storage (“NAS”) device. The data storage device can also comprise a magnetic rotating disk, a solid state memory, or any combination thereof.

[0010] While the description herein refers to solid state memory generally, it is understood that solid state memory may comprise one or more of various types of solid state non-volatile memory devices such as flash integrated circuits, Chalcogenide RAM (C-RAM), Phase Change Memory (PC-RAM or PRAM), Programmable Metallization Cell RAM (PMC-RAM or PMCm), Ovonic Unified Memory (OUM), Resistance RAM (RRAM), NAND memory (e.g., single-level cell (SLC) memory, multi-level cell (MLC) memory, or any combination thereof), NOR memory, EEPROM, Ferroelectric Memory (FeRAM), Magnetoresistive RAM (MRAM), other discrete NVM (non-volatile memory) chips, or any combination thereof.

[0011] In an embodiment, the electronic device 102 can comprise a ruggedized electronic device which is sealed. That is, the electronic device 102 can be weather-resistant or weather-proof. In an embodiment, when the electronic device 102 is weather-resistant or weather-proof, the electronic device 102 can utilize a weather-resistant or a weather-proof seal. For example, the electronic device 102 can be sealed such that it resists or prevents moisture entry into the electronic device 102. In an embodiment, the electronic device 102 can be sealed such that it resists or prevents dust or other foreign objects from entering into the electronic device 102. For

example, the electronic device 102 can be dipped in a rubber solution to aid in sealing the electronic device 102.

[0012] The ruggedization of the electronic device 102 may be beneficial for users which seek to use the electronic device 102 in non-traditional settings. That is, settings outside the home. For example, the electronic device 102 may be utilized outdoors which are prone to exposure to the elements. Such uses may include data transfers from a movie shoot, data transfer from a photo shoot, uses at a beach, uses during combat excursions, uses while camping, or other uses which may not be within the safety of a structure to protect the electronic device 102 from the elements.

[0013] In an embodiment shown in FIG. 2, the electronic device 102 comprises a receptacle 114 configured to mate with a first plug 110 in a first end of the communications cable 106. While the receptacle 114 is shown as being located inside a housing of the electronic device 102, the receptacle 114 can also be connected via a cable to extend a distance away from the electronic device 102. The cable can be part of or unitary with the electronic device 102.

[0014] The receptacle 114 can also comprise one or more pins which are sealed. That is, the receptacle 114 can also be weather-resistant or weather-proof. In an embodiment, when the receptacle 114 is weather-resistant or weather-proof, the receptacle 114 can utilize a weather-resistant or a weather-proof seal. For example, the receptacle 114 can be sealed such that it resists or prevents moisture entry into the electronic device 102. In an embodiment, the receptacle 114 can be sealed such that it resists or prevents dust or other foreign objects from entering into the electronic device 102. Should the receptacle 114 be connected via a cable to the housing of the electronic device 102, the cable and the connection between the cable and the housing of the electronic device 102 can also be weather-resistant or weather-proof.

[0015] In an embodiment, the electronic device 102 can comprise a device logic driving status unit 116, light emitting diode (“LED”) located within the housing of the electronic device, a light pipe, or any combination thereof, which will be described in more detail later.

[0016] The communications cable 106 can be configured to transfer data to the electronic device 102 and from the electronic device 102. In an embodiment, the communications cable 106 can comprise a universal serial bus (“USB”) interface, a Thunderbolt interface, a serial ATA (“SATA”) interface, a serial attached small computer system interface (“SAS”), or other types of interfaces which utilizes other transfer protocols. In an embodiment, the communications cable 106 can also be configured to connect to the host 104, such as through a second plug in a second end of the communications cable 106.

[0017] The first plug 110 and the second plug can be connected, for example, through a cable unit 108. In an embodiment, the cable unit 108 can comprise one or more copper cables, one or more fiber optic cables, or one or more types of cables which are capable of transmitting data between the first plug 110 and the second plug. Thus, the communications cable 106 can be configured to connect between the electronic device 102 and the host 104.

[0018] In an embodiment, the first plug 110 of the communications cable 106 can also comprise one or more pins which are sealed. That is, the first plug 110 can also be weather-resistant or weather-proof. In an embodiment, when the first plug 110 is weather-resistant or weather-proof, the first plug 110 can utilize a weather-resistant or a weather-proof seal. For example, the first plug 110 can be sealed such that it resists or prevents moisture entry into the communications cable 106. In an embodiment, the first plug 110 can be sealed such that it resists or prevents dust or other foreign objects from entering into the communications cable 106.

[0019] Furthermore, when the first plug 110 mates or cooperates with the receptacle 114, such a connection can also be weather-resistant or weather-proof. In an embodiment, when the connection is weather-resistant or weather-proof, the connection can utilize a weather-resistant or a weather-proof seal. For example, the connection can be sealed such that it resists or prevents moisture entry into the communications cable 106 or the electronic device 102. In an

embodiment, the connection can be sealed such that it resists or prevents dust or other foreign objects from entering into the communications cable 106 or the electronic device 102.

[0020] In an embodiment, the communications cable 106 can comprise a status indicator 112 located on the first plug 110 which connects to the electronic device 102. The status indicator 112 can be configured to indicate a status of the electronic device 102. The status of the electronic device 102 can include, for example, activity of the electronic device 102, temperature data of the electronic device 102, a shock indication for shock applied to the electronic device 102, health indication of the electronic device 102, error indications of the electronic device 102, or other types of information about the electronic device 102.

[0021] In an embodiment, the status indicator 112 can comprise one or more lights, such as one or more LEDs. The one or more lights can also be varied in color. In such a case, activating or deactivating the LEDs can indicate the status of the electronic device 102. For example, activating the LEDs can indicate a first status of the electronic device 102 while deactivating the LEDs can indicate a second status of the electronic device 102 different than the first status. Furthermore, the LEDs can also have various colors to indicate the various statuses of the electronic device 102.

[0022] In an embodiment, the status indicator 112 indicates the status of the electronic device 102 based on a status signal from the device logic driving status unit 116 in the electronic device. In an embodiment the status signal can be transmitted through one or more of the pins for one of the protocols for the interfaces disclosed above. However, in an embodiment, the status signal can also be sent in a pin which has been added in addition to the pins for one of the protocols for the interfaces disclosed above. In the case where the status indicator 112 comprises a LED, the LED will then turn on or off based on the status signal from the device logic driving status unit 116. In an embodiment, the device logic driving status unit 116 can comprise a controller for the electronic device 102.

[0023] In an embodiment, the device logic driving status unit 116 is configured to detect when the first plug 110 is connected to the receptacle 114. When the device logic driving status unit 116 detects that the first plug 110 is connected to the receptacle 114, the device logic driving status unit 116 commences transmission of the status signal to the status indicator 112.

[0024] This can reduce the manufacturing cost of the electronic device 102 since the electronic device 102 is ruggedized. By reducing the amount of holes or weak spots in the housing of the electronic device 102, such as an LED or lens for the LED on an external portion of the housing, the housing can be more easily manufactured. For example, if there were holes or weak spots in the housing, such holes or weak spots may need to be reinforced with gaskets, sealant or other types of materials which can aid in preventing water or other foreign objects from entering the electronic device 102. Thus, the absence or reduction in the number of holes or weak spots in the housing can reduce the manufacturing cost of the electronic device 102.

[0025] In an embodiment shown in FIG. 3, the status indicator 112 comprises a first light pipe 118. In such a case, the electronic device 102 can comprise one or more LEDs 120 and a second light pipe 122. The second light pipe 122 is configured to cooperate with the first light pipe 118 to ensure transmission of the light from the one or more LEDs 120 located in the electronic device 102 to the status indicator 112.

[0026] Thus, the light from the one or more LEDs 120 located in the electronic device 102 will be visible on the first plug 110, even without the first plug 110 comprising an LED. In an embodiment, the first light pipe 118 can reflect the light from the one or more LEDs 120 so that the light from the one or more LEDs 120 is visible on the first plug 110. In an embodiment, the status signal will thus comprise the light from the one or more LEDs 120. In an embodiment, the first light pipe 118 can comprise one or more mirrors to aid in reflecting the light from the one or more LEDs 120.

[0027] Since the one or more LEDs 120 are located within the electronic device 102, this also reduces an amount of holes or weak spots in the housing of the electronic device 102. The second light pipe 122 may be easier to seal or weather-proof than a LED or a LED lens that is exposed in an exterior of the housing (as opposed to being located inside the housing). In addition, the second light pipe 122 can also be located within the connection between the communications cable 106 and the electronic device 102 so additional sealing or weather-proofing may not be necessary.

[0028] Furthermore, should the communications cable 106 be damaged due to a breach from the status indicator 112, replacement of the communications cable 106 will be relatively inexpensive compared with replacement of the electronic device 102. Furthermore, a user will be able to have multiple communications cable 106 available and a replacement communications cable 106 will result in little down time. In addition, the data stored in the electronic device 102 will not be lost or inaccessible for long periods of time.

[0029] In an embodiment, the first plug 110 can comprise a translucent material to allow the status indicator 112 to be more visible to a user. For example, all of the first plug 110 can comprise a translucent material. In such a case, portions of the first plug 110 can be painted or coated over to restrict visibility to other internal components of the first plug 110, while allowing the status indicator 112 to be visible to the user. However, the first plug 110 need not be painted or coated. Alternatively, only portions of the first plug 110 can comprise a translucent material to restrict visibility to other internal components of the first plug 110, while allowing the status indicator 112 to be visible to the user.

[0030] In an embodiment, the status indicator 112 need not be located just in the first plug 110. Instead, the status indicator 112 or portions of the status indicator 112 can be located in the cable unit 108, the second plug, or any combination thereof. Furthermore, if at least a portion of

the status indicator 112 is located in the cable unit 108, portions of the cable unit 108 can comprise a translucent material to allow the status indicator 112 to be more visible to a user.

[0031] Those of ordinary skill would appreciate that the various illustrative logical blocks, modules, and algorithm parts described in connection with the examples disclosed herein may be implemented as electronic hardware, computer software, or combinations of both. Furthermore, the embodiments can also be embodied on a non-transitory machine readable medium causing a processor or computer to perform or execute certain functions.

[0032] To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and process parts have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the disclosed apparatus and methods.

[0033] The parts of a method or algorithm described in connection with the examples disclosed herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. The parts of the method or algorithm may also be performed in an alternate order from those provided in the examples. A software module may reside in RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, hard disk, a removable disk, an optical disk, or any other form of storage medium known in the art. An exemplary storage medium is coupled to the processor such that the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor. The processor and the storage medium may reside in an Application Specific Integrated Circuit (ASIC).

[0034] The previous description of the disclosed examples is provided to enable any person of ordinary skill in the art to make or use the disclosed methods and apparatus. Various modifications to these examples will be readily apparent to those skilled in the art, and the principles defined herein may be applied to other examples without departing from the spirit or scope of the disclosed method and apparatus. The described embodiments are to be considered in all respects only as illustrative and not restrictive and the scope of the disclosure is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

CLAIMS

What is claimed is:

1. An electronic device system comprising:
an electronic device comprising:
a receptacle; and
a device logic driving status unit configured to generate a status signal indicating activity of the electronic device; and
a communications cable comprising:
a first plug configured to connect to the receptacle and receive the status signal, wherein the first plug comprises a status indicator configured to indicate activity of the electronic device based on the status signal.
2. The electronic device system of claim 1 wherein the status indicator comprises at least one light emitting diode (“LED”).
3. The electronic device system of claim 1 wherein the communications cable further comprises a first light pipe connected to the status indicator, and configured to receive the status signal.
4. The electronic device system of claim 3 wherein the electronic device further comprises one or more light emitting diodes (“LEDs”), and the status signal comprises LED signals from the one or more LEDs, wherein the device logic driving status unit is configured to control the one or more LEDs to generate the LED signals.

5. The electronic device system of claim 4 wherein the first light pipe further is further configured to reflect the LED signals from the one or more LEDs in the electronic device, onto the status indicator.
6. The electronic device system of claim 4 wherein the electronic device further comprises a second light pipe configured to transmit the status signal, wherein the first light pipe is further configured to connect to the second light pipe to receive the status signal.
7. The electronic device system of claim 1 wherein the first plug is further configured to connect to the receptacle to form a weather-resistant seal between the first plug and the receptacle.
8. The electronic device system of claim 1 wherein the communications cable further comprises a second plug configured to connect to a host.
9. The electronic device system of claim 1 wherein the first plug is further configured to connect to the electronic device using at least a universal serial bus (“USB”) protocol or a Thunderbolt protocol.
10. The electronic device system of claim 1 wherein the electronic device further comprises at least one of a magnetic rotating disk or a solid state memory.
11. The electronic device system of claim 10 wherein the electronic device comprises a data storage device.
12. A communications cable comprising:

a first plug configured to connect to a receptacle on an electronic device, wherein the first plug comprises a status indicator configured to indicate activity of the electronic device based on a status signal from the electronic device.

13. The communications cable of claim 12 wherein the status indicator comprises at least one light emitting diode (“LED”).

14. The communications cable of claim 12 wherein the communications cable further comprises a first light pipe connected to the status indicator, and configured to receive the status signal from the electronic device.

15. The communications cable of claim 14 wherein the status signal comprises light emitting diode (“LED”) signals from one or more LEDs located in the electronic device.

16. The communications cable of claim 15 wherein the first light pipe further is further configured to reflect the LED signals from the one or more LEDs located in the electronic device, onto the status indicator.

17. The communications cable of claim 15 wherein the first light pipe is further configured to connect to a second light pipe located in the electronic device to receive the status signal from the electronic device.

18. The communications cable of claim 12 wherein the first plug is further configured to connect to the receptacle to form a weather-resistant seal between the first plug and the receptacle.

19. The communications cable of claim 12 further comprising a second plug configured to connect to a host.

20. The communications cable of claim 12 wherein the first plug is further configured to connect to the electronic device using at least a universal serial bus (“USB”) protocol or a Thunderbolt protocol.

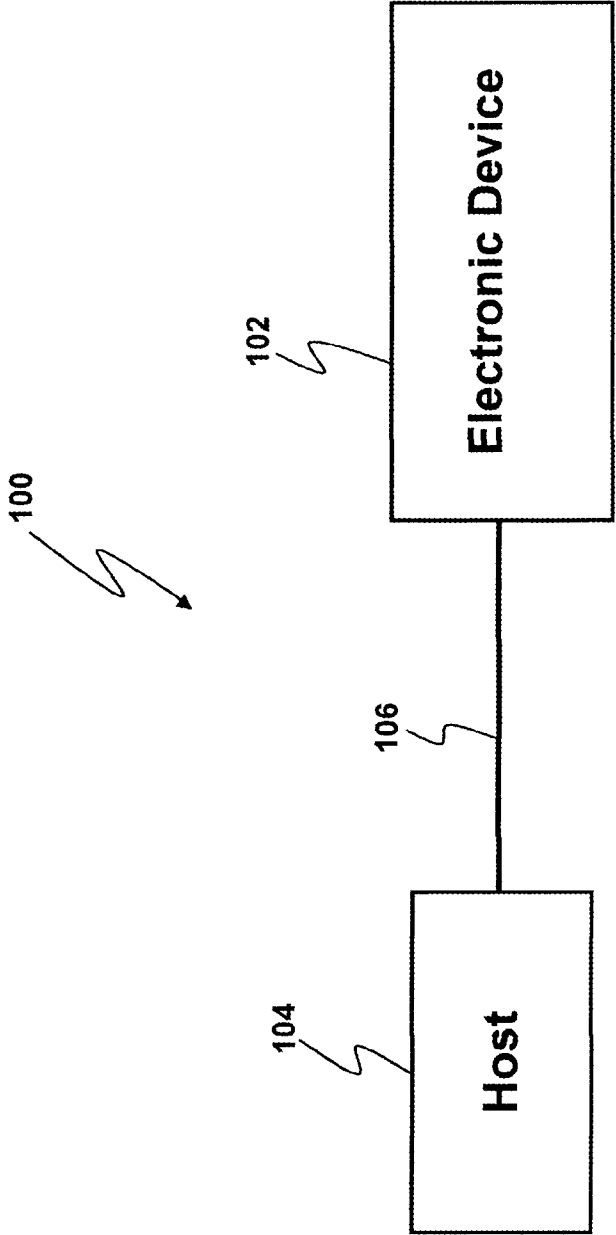


FIG. 1

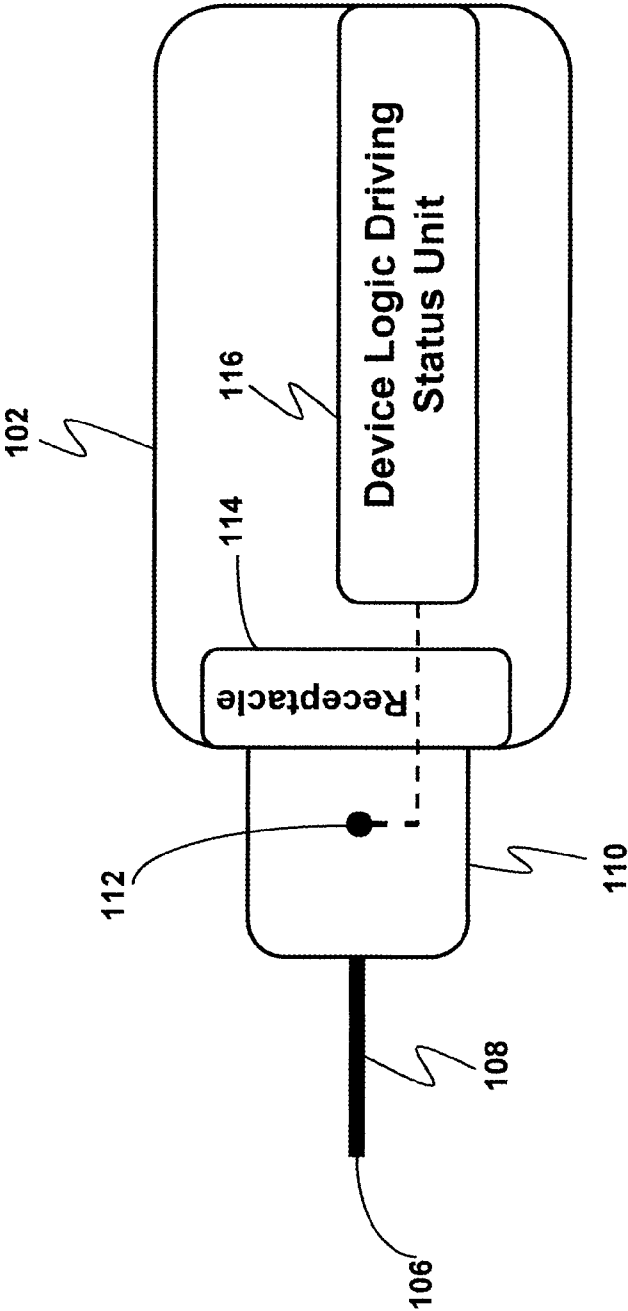


FIG. 2

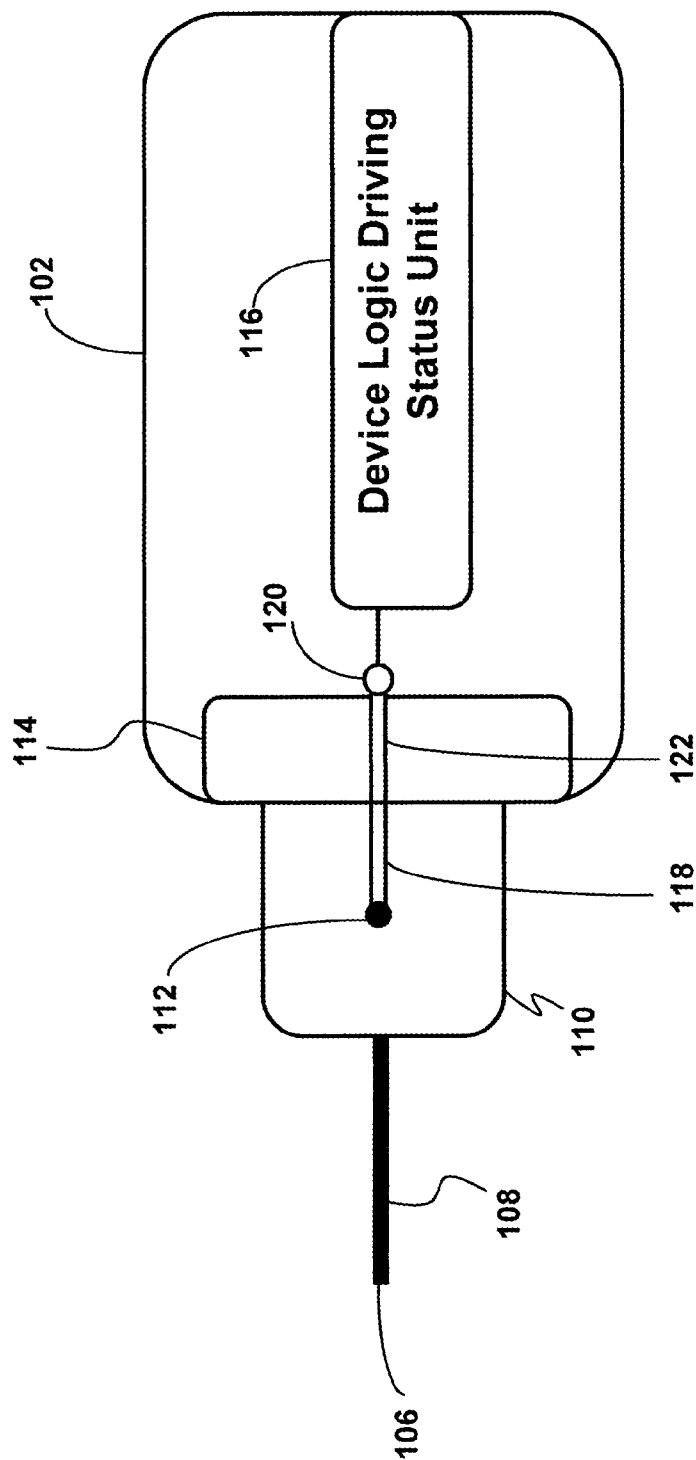


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/025446**A. CLASSIFICATION OF SUBJECT MATTER****H01B 7/28(2006.01)i, G06F 13/40(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)

H01B 7/28; H01R 3/00; H01R 11/00; H01R 13/52; G06F 13/00; G06F 13/40

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: portable device, cable, status indicator, LED

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005-0182876 A1 (OOK KIM et al.) 18 August 2005	1,2,8,12,13,19
Y	See abstract, paragraphs [0043],[0057]-[0061], claims 31,46-52 and figure 4.	3-7,9-11,14-18,20
Y	US 6361357 B1 (KAYLENE C. STILLWELL et al.) 26 March 2002	3-6,10,11,14-17
	See abstract, column 6, line 6-column 10, line 27 and figures 1,2.	
Y	US 2008-0254663 A1 (SERGIO CORONA) 16 October 2008	7,18
	See abstract, paragraph [0028] and claim 1.	
Y	US 6733333 B1 (WILSON CHEN) 11 May 2004	9,20
	See abstract, column 2, lines 4-55 and figures 2-5.	
A	US 2005-0260884 A1 (WEN-HSIANG YUEH) 24 November 2005	1-20
	See abstract, paragraphs [0018]-[0021] and figures 2,3.	



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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"&" document member of the same patent family

Date of the actual completion of the international search

20 July 2015 (20.07.2015)

Date of mailing of the international search report

22 July 2015 (22.07.2015)

Name and mailing address of the ISA/KR

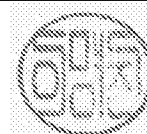
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005-0182876 A1	18/08/2005	AT 452370 T	15/01/2010
		AT 484798 T	15/10/2010
		CN 100483371 C	29/04/2009
		CN 101533379 A	16/09/2009
		CN 101533379 B	02/02/2011
		CN 1898658 A	17/01/2007
		EP 1716491 A2	02/11/2006
		EP 1716491 A4	09/04/2008
		EP 1716491 B1	16/12/2009
		EP 2085889 A2	05/08/2009
		EP 2085889 A3	12/08/2009
		EP 2085889 B1	13/10/2010
		JP 2007-535235 A	29/11/2007
		KR 10-0814207 B1	17/03/2008
		KR 10-2006-0106842 A	12/10/2006
		US 2008-0022023 A1	24/01/2008
		US 7269673 B2	11/09/2007
		US 7500032 B2	03/03/2009
		WO 2005-081659 A2	09/09/2005
		WO 2005-081659 A3	26/01/2006
US 6361357 B1	26/03/2002	None	
US 2008-0254663 A1	16/10/2008	US 2008-0108243 A1	08/05/2008
		US 7390210 B2	24/06/2008
		US 7785123 B2	31/08/2010
US 6733333 B1	11/05/2004	DE 20303478 U1	22/05/2003
US 2005-0260884 A1	24/11/2005	TW 262858 U	21/04/2005
		TW 262858 Y	21/04/2005