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(54) **ELECTRONIC DEVICE**

(57) According to an aspect, there is provided an electronic device (210; 410) comprising an electrical connector (112) for receiving a connector (122) of an electric power cable (120); a temperature-sensitive element (214; 412) in thermal contact with the electrical connector (112), wherein a property of the temperature-sensitive element (214; 412) changes in response to a change in temperature of the electrical connector (112); and a switch (212) configured to provide a conductive path across two electric contact elements (114a, 114b) of the electrical connector (112) when the switch (212) is closed. The device (210; 410) is configured such that the switch (212) closes when a temperature of the temperature-sensitive element (214; 412) increases and passes a first threshold value.

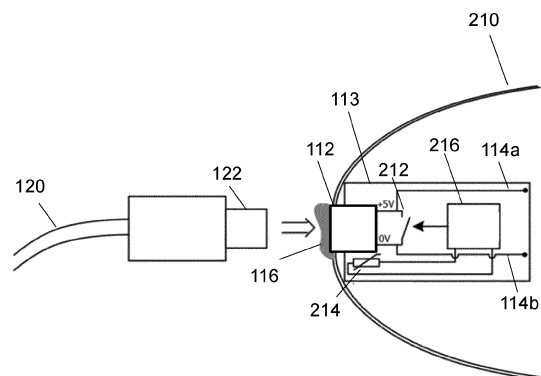


Fig. 2

Description

FIELD OF THE INVENTION

[0001] This disclosure relates to an electronic device with a switch.

BACKGROUND OF THE INVENTION

[0002] Some electronic devices are used in wet environments. For example, electric shavers and electric toothbrushes are typically used in bathrooms and washrooms. Such electronic devices are designed in such a way as to prevent water contacting the electronics in the device. This constrains the design and can prevent certain power supply and charging options from being used.

[0003] Fig. 1 is a schematic showing an electronic device 110 with a Universal Serial Bus (USB) connector 112 for receiving the corresponding USB connector 122 on the end of an electric power cable 120. For example, the USB connector 112 could be a USB port 112 and the USB connector 122 could be a USB plug 122. The USB plug 122 is inserted into the USB port 112 of the device 110 to provide power to the device 110 and, in some cases, to charge a rechargeable battery inside the device 110. The USB port 112 may be mounted on, or be part of, a printed circuit board (PCB) 113. The device 110 has power lines 114a, 114b connecting the USB port 112 to the electronics of the device 110 (e.g. a main PCB - not shown in Fig 1). The power lines 114a, 114b, conduct electricity from the powered USB cable 120 to the electronics/battery inside the device 110.

[0004] A problem arises when water 116 is present on the USB port 112. Water typically contains dissolved ions and impurities that make it a conductor of electricity. Thus, when the USB plug 122 of a powered electric power cable 120 contacts the water 116 on the USB port 112, an electric current will pass through the water 116. This causes dissipation of energy and an increase in temperature of the water and consequently the device 110. This can damage the electronics in the device 110, as well as presenting a safety hazard for the user of the device 110.

[0005] In existing devices, this problem may be avoided by instead using induction charging to charge a rechargeable battery inside the device. Induction charging uses a magnetic field to transfer energy to the device. The magnetic field can pass through a protective, waterproof case of the device, thus dispensing with the need for exposed metal contacts/terminals that are at risk of getting wet.

[0006] However, induction charging is less efficient when compared to electric charging via a powered charging cable that is connected directly to the device. This is because the magnetic coils used for induction charging are inherently lossy and some energy is lost as heat. Induction charging is also slower than electric charging.

SUMMARY OF THE INVENTION

[0007] Therefore, it is desirable to provide electric power for electronic devices (e.g., an electric shaver or electric toothbrush) in a manner that is suitable for wet environments, i.e., that remains safe if the device becomes wet.

[0008] According to the disclosure herein, it is proposed to include in the electronic device a safety feature that prevents an electric current from a powered electric power cable overheating any water that is present when the powered charging cable is plugged into the electrical connector of the device.

[0009] According to a first aspect, there is provided an electronic device. The electronic device comprises an electrical connector for receiving a connector of an electric power cable; a temperature-sensitive element in thermal contact with the electrical connector, wherein a property of the temperature-sensitive element changes in response to a change in temperature of the electrical connector; and a switch configured to provide a conductive path across two electric contact elements of the electrical connector when the switch is closed. The device is configured such that the switch closes when a temperature of the temperature-sensitive element increases and passes a first threshold value.

[0010] Thus, the present invention provides an electronic device that is safe to use when the device, and specifically the electrical connector, is wet. In particular, the present invention reduces the risk of damage to the device due to overheating when the device is wet, and the risk of harm to the user when the device is wet.

[0011] These and other aspects will be apparent from and elucidated with reference to the embodiment(s) described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Exemplary embodiments will now be described, by way of example only, with reference to the following drawings, in which:

Fig. 1 is a schematic showing some of the components of an electronic device and some of the components of an electric power cable;

Fig. 2 is a schematic showing some of the components of an electronic device according to various embodiments;

Fig. 3 is a circuit diagram showing part of the electronic circuitry comprised in an electronic device according to various embodiments;

Fig. 4 is a schematic showing some of the components of an electronic device according to various embodiments; and

Fig. 5 is a block diagram showing some components of an electronic device according to various embodiments.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0013] Electronic devices that are intended for use in wet environments must be designed to prevent water ingress causing damage to the electronics and/or harming a user of the device. Electric power cables such as USB cables are therefore not typically used for such devices.

[0014] To overcome this problem, it is proposed to introduce a switch in the device that can short-circuit an external power supply in the event that the device, and in particular the electrical connector (e.g., port), is wet.

[0015] Fig. 2 is a schematic showing some of the components of an electronic device 210 according to various embodiments of the present invention. The electronic device 210 could be a handheld device such as an electric shaver. The device 210 is similar to the device depicted in Fig. 1 in that it comprises an electrical connector 112 for receiving an electrical connector 122 of an electric power cable 120.

[0016] The electrical connector 112 of the device is a point of entry for electrical energy in the form of an electric current that flows from the electric power cable into the device. The electrical connectors 112, 122 may each comprise a pair of terminals for this purpose. Throughout this specification, the electrical connector on the device may be referred to as an electrical port, and the electrical connector on the electric power cable may be referred to as an electrical plug. Furthermore, throughout this specification the connectors may be referred to as USB connectors, although it will be appreciated that the teachings of this disclosure are also applicable to types of connectors other than USB, such as a 2-pin power connector, or 2-pin power cable. A USB connector may be any type of USB connector, for example, any one of: USB type A (USBa) connector, USB type B (USBb) connector, USB type C (USBc) connector, USB 3.0 connector, USB 3.1 connector, USB 3.2 connector, USB mini connector, USB micro connector, or USB micro B connector. It will be appreciated that the specific electrical connectors referenced herein are only provided as examples, and that the term electrical connector is intended to cover any type of electrical connector that acts as a point of entry or exit for electrical energy/an electric current. The electrical energy/current may be used to charge a battery in the device, and/or it may be used to power the device to enable the device to operate.

[0017] The USB port 112 in the device 210 acts as an interface for conducting electricity from the USB power cable 120 to the electronics inside the device 210. Power lines 114a, 114b connect the USB port 112 to electronics inside the device 210, which may include a rechargeable battery. For example, the power lines 114a, 114b may connect a pair of terminals in the USB port 112 to electronics inside the device 210.

[0018] The device 210 in Fig. 2 further includes a switch 212 and a temperature-sensitive element 214 (e.g., a temperature sensor). This illustrated embodiment also comprises, a detection circuit 216, although this may

be omitted in other embodiments. The detection circuit 216 is also referred to herein as an electronic controller.

[0019] The switch 212 is configured to provide a conductive path across two electric contact elements of the electrical connector 112 when the switch 212 is closed, and to break that conductive path when the switch 212 is open. The power lines 114a, 114b may respectively connect to the two electric contact elements.

[0020] The temperature-sensitive element 214 is in thermal contact with the electrical connector 112, so that a property of the temperature-sensitive element 214 changes in response to a change in temperature of the electrical connector 112.

[0021] During normal use of the device 210, the switch 212 is open. When the switch 212 is open, a USB power cable 120 can provide power to the electronics in the device 210 when the USB power cable plug 122 is inserted into the USB port 112. If there is water 116 on or in the USB port 112 when the powered USB plug 122 is inserted into the USB port 112, electric energy from the USB power cable 120 will be dissipated as thermal energy in the water 116, and the water 116 will heat up. Consequently, the USB port 112 and the temperature-sensitive element 214 will also heat up.

[0022] The detection circuit 216, when present in the device 210, is configured to monitor the property of the temperature-sensitive element 214 that is indicative of changes in temperature of the electrical connector 112. If the temperature measured by the temperature-sensitive element 214 increases above a threshold value - as indicated by the property of the temperature-sensitive element 214, and detected by the detection circuit 216 - the detection circuit 216 is configured to close the switch 212. Closing the switch 212 short-circuits the path of the electric current coming into the device 210 by providing an alternative, low-resistance, conductive path. This alternative conductive path has a lower resistance than the electronic circuitry inside the device 210 and the water 116 on the USB port 112. The resistance of the alternative conductive path when the switch 212 is closed is as close to zero as feasible. A USB connection can be rated for currents up to 5 Amps, and so the resistance of the alternative conductive path should be less than 1 Ohm, and for example less than 0.1 Ohm. However, the dissipation in the switch 212 should be limited to prevent overheating of the switch 212. Therefore, in some embodiments, the resistance of the alternative conductive path can be around 0.04 Ohms, as this will limit the dissipation in the switch 212 to around 1 Watt (5 Amps * 0.04 Ohms = 1 Watt). Those skilled in the art will be able to derive other suitable values for the resistance based on the specific implementation of the device 210, electrical connector 112 and switch 212. Thus, the energy dissipation in the water 116 and/or USB port 112 is reduced to a very low level.

[0023] When the switch 212 is closed, the short-circuit current protection of the USB host (which could be any electronic device with a USB port, or a USB power supply)

will activate and prevent a surge in current from the power cable 120. This overload protection operates immediately to prevent a surge in current entering the device 210. Thus, the voltage across the switch 212 is reduced to zero or almost zero, and the temperature of the USB port 112 will decrease as the thermal energy dissipates in the absence of any electric current.

[0024] The switch 212 may be a semiconductor switch such as a Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET). Semiconductor switches such as MOSFETs are low cost and are available with low ohmic RDSon values (the resistance between the drain and the source of the MOSFET when the switch 212 is closed, i.e., when the switch is "on").

[0025] The temperature-sensitive element 214 is in thermal contact with the USB port 112 and therefore the property of the temperature-sensitive element 214 is indicative of the temperature of the USB port 112. The temperature-sensitive element 214 could be any temperature-sensitive element with a property that changes with temperature. For example, in the embodiment shown in Fig. 2, the temperature-sensitive element 214 could be a thermistor such as a Negative Temperature Coefficient (NTC) thermistor, where the property that changes in response to temperature changes is resistance. NTC thermistors provide electronic temperature sensing at a low cost.

[0026] The detection circuit 216 is configured to subsequently open the switch 212 so that normal operation of the device 210 can recommence. The detection circuit 216 may be configured to open the switch 212 after a certain period of time has passed from the closure of the switch 212. Alternatively, the detection circuit 216 may open the switch 212 after the temperature measured by the temperature-sensitive element 214 has fallen to normal operating levels. For example, the switch 212 may be opened when the temperature measured by the temperature-sensitive element 214 falls below a predetermined threshold value.

[0027] The detection circuit 216 may include a micro-controller unit (MCU) that is configured to perform the opening and/or closing of the switch 212. The MCU may be part of the main Printed Circuit Board Assembly (PCBA) of the electronic device. In alternative embodiments, the detection circuit 216 may be a hardware-based circuit with a comparator that detects changes in the resistance of the temperature-sensitive element 214 relative to a reference resistance and controls the opening and closing of the switch 212 accordingly.

[0028] In some embodiments, the electronic device 210 may comprise a battery that powers the MCU both when the switch 212 is open and when the switch 212 is closed. This means that the MCU is powered even when a power cable 120 is not inserted into the device 210, and the detection circuit 216 can keep the switch 212 closed until the temperature has dropped to a normal level.

[0029] In some electronic devices, the electronics are

powered by the power cable voltage and not by a battery. Therefore, when the switch 212 is closed and the power cable voltage has been shortcircuited, the MCU is no longer powered and cannot re-open the switch 212 to allow normal operation of the device 210. In these electronic devices, the re-opening of the switch 212 may be controlled by a capacitor in the detection circuit 216. This is depicted in Fig. 3.

[0030] Fig. 3 is a circuit diagram showing part of the electronic circuitry comprised in an electronic device according to various embodiments. Fig. 3 shows a USB connector 112, a switch 212 and a detection circuit 216 that also includes the temperature-sensitive element 214, each of which were discussed with reference to Fig. 2. The detection circuit 216 in Fig. 3 can be a comparator-based circuit as mentioned above. In addition, Fig. 3 shows a capacitor 310, such as a buffer capacitor 310. This capacitor 310 is charged during normal use of the device, i.e., when the switch 212 is open, and remains fully charged until the switch 212 is closed. When the switch 212 is closed by the detection circuit (e.g., by a powered MCU), the capacitor 310 begins to discharge. The switch 212 remains closed until the capacitor 310 has discharged or when the charge in the capacitor 310 falls below a threshold value. Thus, the switch 212 is closed based on the charge on the capacitor 310, regardless of the temperature of the temperature-sensitive element 214 and USB connector 112. The capacitance of the capacitor 310 is selected such that the discharging time is sufficient for the connector 112 to sufficiently cool down, but does not prevent the device from being used for longer than is necessary.

[0031] In some embodiments (which typically do not include or require the detection circuit 216), the temperature-sensitive element is a bimetallic element, e.g., a bimetallic strip. A bimetallic element comprises two metals that are bonded together, e.g., two lengths of metal bonded lengthwise. When heated, the two metals expand at different rates causing the bimetallic element to change shape e.g., to bend/curve. Thus, a bimetallic element converts a temperature change into a mechanical displacement.

[0032] Fig. 4 is a schematic showing components of an electronic device 410 according to some of these embodiments where the temperature-sensitive element 412 is a bimetallic element. The device 410 comprises a USB connector 112 and power lines 114a and 114b connecting the connector 112 to the electronics of the device 410. The bimetallic element 412 is thermally connected to the USB connector 112, and is part of switch 212. The switch 212 may be the bimetallic element 412 itself such that changes in shape due to increases in temperature close the switch 212 and changes in shape due to decreases in temperature open the switch 212.

[0033] The device 410 is configured such that, when the temperature of the bimetallic element 412 increases above a certain temperature (e.g., due to water on the connector 112 when a powered plug 122 is inserted), the

switch 212 is closed and short-circuits the connector 112 by providing an alternative, low-resistance, conductive path. Advantageously, the bimetallic element 412 does not need to be powered by an electric power source because it opens and closes the switch 212 in response to temperature (i.e., without a supply voltage).

[0034] As above, the resistance of the alternative conductive path should be less than 1 Ohm, in some embodiments, the resistance of the alternative conductive path can be around 0.04 Ohms.

[0035] Fig. 5 is a block diagram showing some components of an electronic device 500 according to various embodiments.

[0036] The electronic device 500 could be a personal care device such as an electric shaver. The electronic device 500 could be a handheld device.

[0037] The electronic device 500 comprises an electrical connector 502 for receiving a connector of an electrical power cable. The electrical connector 502 may be of any type that can join with a power cable connector to electrically connect the electronic device 500 to the power cable. The electrical connector 502 may comprise a pair of terminals connected to the electronics inside the device 500. In some embodiments, the electrical connector 502 is for receiving an electrical current from the power cable for charging the electronic device 500. The electrical connector 502 may be a port and the connector of the power cable may be a plug. In some embodiments the electrical connector 502 is one or more of: a 2-pin power connector, a 2-pin power cable, a USB type A port, a USB type B port, a USB type C port, a USB 3.0 port, a USB 3.1 port, a USB 3.2 port, a USB mini port, a USB micro port, and a USB micro B port.

[0038] The electronic device 500 further comprises a temperature-sensitive element 504 in thermal contact with the electrical connector 502. A property of the temperature-sensitive element 504 changes in response to a change in temperature of the temperature-sensitive element 504. Since the temperature-sensitive element is in good thermal contact with the electrical connector 502, the property of the temperature-sensitive element 504 changes when the temperature of the electrical connector 502 changes.

[0039] The electronic device 500 further comprises a switch 506 configured to provide a conductive path across the electrical connector 502 when the switch 506 is closed.

[0040] In some embodiments, the device 500 further comprises two power lines respectively connected to the two electric contact elements of the electrical connector 502 so that the power lines are connected to an electronic component of the electronic device 500. For example, there may be a pair of terminals comprised in the electrical connector 502 that are connected to the two power lines, and the two power lines may be connected to the electronic component of the electronic device 500. The electronic component of the electronic device 500 may be a rechargeable battery or any other electronic com-

ponent comprised in the electronic device 500.

[0041] In some embodiments, the device 500 is configured such that, after the switch 506 is closed, the switch 506 opens when the temperature of the temperature-sensitive element 504 falls below a second threshold value. The second threshold value could be the same as the first threshold value.

[0042] In alternative embodiments, the device 500 is configured such that the switch 506 is opened after a predetermined time period has elapsed since the switch 506 was closed. In these embodiments, the opening and closing of the switch 506 may be controlled by an electronic controller (e.g., an MCU) in the device 500. When the switch 506 is open, the microcontroller unit may be powered by a power cable inserted into the device 500 or a battery comprised in the device 500. When the switch 506 is closed, the microcontroller may be powered by a battery comprised in the device 500.

[0043] In alternative embodiments, the device 500 comprises a capacitor, and the device 500 is configured such that discharge of the capacitor occurs when the switch 506 is closed, and the switch 506 is opened when the capacitor discharge is complete or the charge remaining in the capacitor is below a threshold value. In some of these embodiments, the closing of the switch 506 may be controlled by an electronic controller comprised in the device 500, e.g., an MCU, whereas the opening of the switch 506 may be initiated in the absence of electric power to the microcontroller based on the charge on the capacitor.

[0044] In some embodiments, which may include any of the aforementioned embodiments, the device 500 may further comprise an electronic controller that is configured to close the switch 506 when the temperature of the temperature-sensitive element 504 is above the first threshold value. The electronic controller could be an MCU.

[0045] In some embodiments, the property of the temperature-sensitive element 504 is resistance. The temperature-sensitive element 504 may be a Negative Temperature Coefficient thermistor. The switch 506 may comprise a Metal-Oxide-Semiconductor Field-Effect Transistor.

[0046] In some embodiments, the temperature-sensitive element 504 is a bimetallic element mechanically coupled to, or part of, the switch 506 such that the switch 506 is closed when the temperature of the bimetallic element increases and is above the first threshold value. The switch 506 may be closed by the bimetallic element in the absence of electric power. In some of these embodiments, the switch 506 may be opened by the bimetallic element (when the temperature has decreased), or the switch 506 may be opened by a powered electronic controller (e.g., an MCU).

[0047] Therefore, there is provided an electronic device with an electrical connector, where the electronic device is suitable for wet environments with a reduced risk of damaging the device or causing harm to a user of

the device.

[0048] Variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the principles and techniques described herein, from a study of the drawings, the disclosure and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. A single processor or other unit may fulfil the functions of several items recited in the claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. A computer program may be stored or distributed on a suitable medium, such as an optical storage medium or a solid-state medium supplied together with or as part of other hardware, but may also be distributed in other forms, such as via the Internet or other wired or wireless telecommunication systems. Any reference signs in the claims should not be construed as limiting the scope.

Claims

1. An electronic device (210; 410) comprising:

an electrical connector (112) for receiving a connector (122) of an electric power cable (120);
a temperature-sensitive element (214; 412) in thermal contact with the electrical connector (112), wherein a property of the temperature-sensitive element (214; 412) changes in response to a change in temperature of the electrical connector (112); and
a switch (212) configured to provide a conductive path across two electric contact elements (114a, 114b) of the electrical connector (112) when the switch (212) is closed;
wherein the device (210; 410) is configured such that the switch (212) closes when a temperature of the temperature-sensitive element (214; 412) increases and passes a first threshold value.

2. An electronic device (210; 410) as claimed in claim 1, wherein the electrical connector (112) is configured and arranged for receiving an electrical current for charging a rechargeable battery of the electronic device (210; 410) from the power cable (120).

3. An electronic device (210; 410) as claimed in claim 1 or 2, wherein the electrical connector (112) is one or more of: a 2-pin power connector, a 2-pin power cable, a USB type A port, a USB type B port, a USB type C port, a USB 3.0 port, a USB 3.1 port, a USB 3.2 port, a USB mini port, a USB micro port, and a USB micro B port.

4. An electronic device (210; 410) as claimed in any of

claims 1-3, further comprising two power lines respectively connected to the two electric contact elements (114a, 114b) of the electrical connector (112), wherein the power lines connect the electrical connector (112) to an electronic component of the electronic device (210; 410).

5. An electronic device (210; 410) as claimed in any of claims 1-4, wherein the conductive path has a resistance of less than 1 Ohm, or a resistance of less than 0.1 Ohm.

6. An electronic device (210; 410) as claimed in any of claims 1-5, wherein the device (210; 410) is further configured such that, after the switch (212) is closed, the switch (212) opens when the temperature of the temperature-sensitive element (214; 412) decreases and passes a second threshold value.

7. An electronic device (210; 410) as claimed in any of claims 1-5, wherein the device (210; 410) is configured such that the switch (212) is opened after a predefined time period has elapsed since the switch (212) was closed.

8. An electronic device (210; 410) as claimed in any of claims 1-5, further comprising a capacitor (310), and the device (210; 410) is configured such that discharge of the capacitor (310) occurs when the switch (212) is closed, and the switch (212) is opened when the charge in the capacitor (310) falls below a minimum level.

9. An electronic device (210; 410) as claimed in any of claims 1-8, further comprising an electronic controller (216) that is configured to control the switch (212) in dependence on the temperature of the temperature-sensitive element (214; 412).

10. An electronic device (210; 410) as defined in any of claims 1-9, wherein the property of the temperature-sensitive element (214; 412) is electrical resistance.

11. An electronic device (210; 410) as claimed in any of claims 1-9, wherein the temperature-sensitive element (214; 412) is a Negative Temperature Coefficient, NTC, thermistor.

12. An electronic device (210; 410) as claimed in any of claims 1-10, wherein the switch (212) comprises a Metal-Oxide-Semiconductor Field-Effect Transistor, MOSFET.

13. An electronic device (210; 410) as claimed in any of claims 1-6, wherein the temperature-sensitive element (214; 412) is a bimetallic element (412) mechanically coupled to the switch (212) and the property of the temperature-sensitive element (412) is a

mechanical displacement, such that the switch (212) closes when the temperature of the bimetallic element (412) increases and passes the first threshold value.

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- 14.** An electronic device (210; 410) as defined in claim 13, wherein the switch (212) comprises the bimetallic element (412).

- 15.** An electronic device (210; 410) as claimed in any of claims 1-14, wherein the electronic device (210; 410) is a personal care device for performing a personal care operation on a subject.

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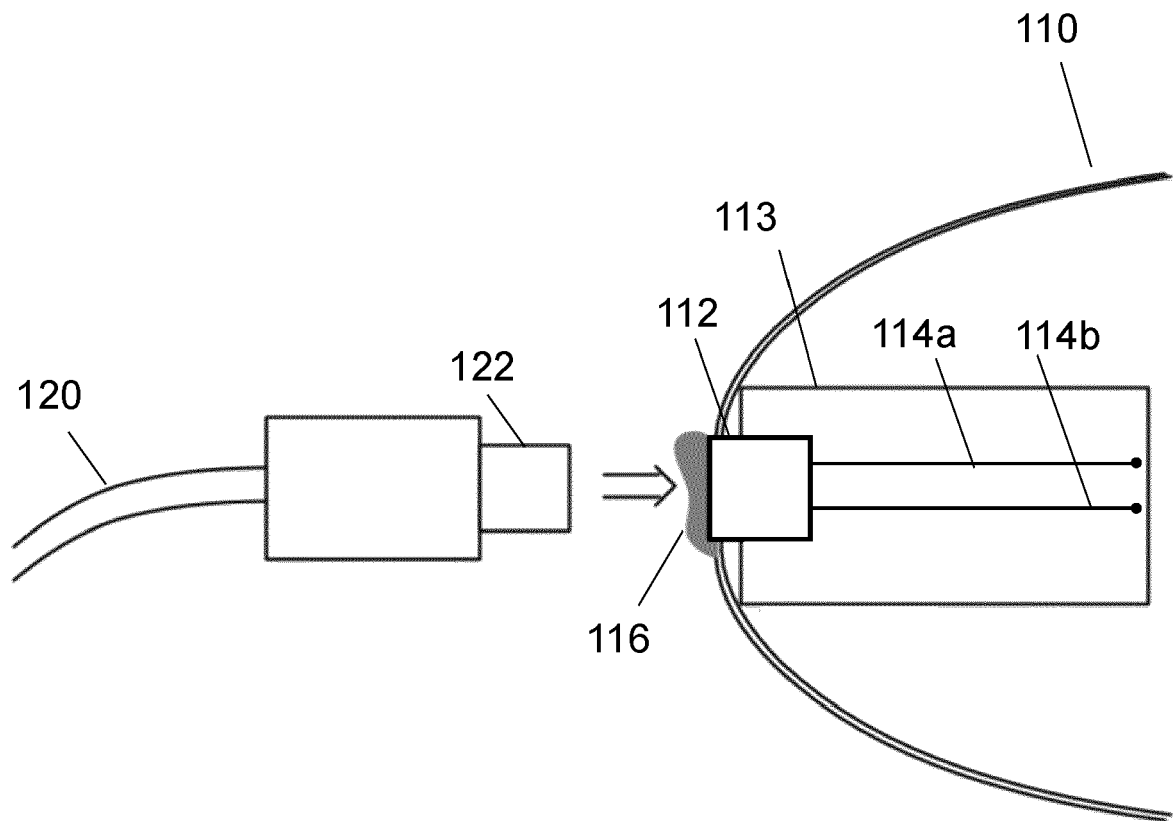


Fig. 1

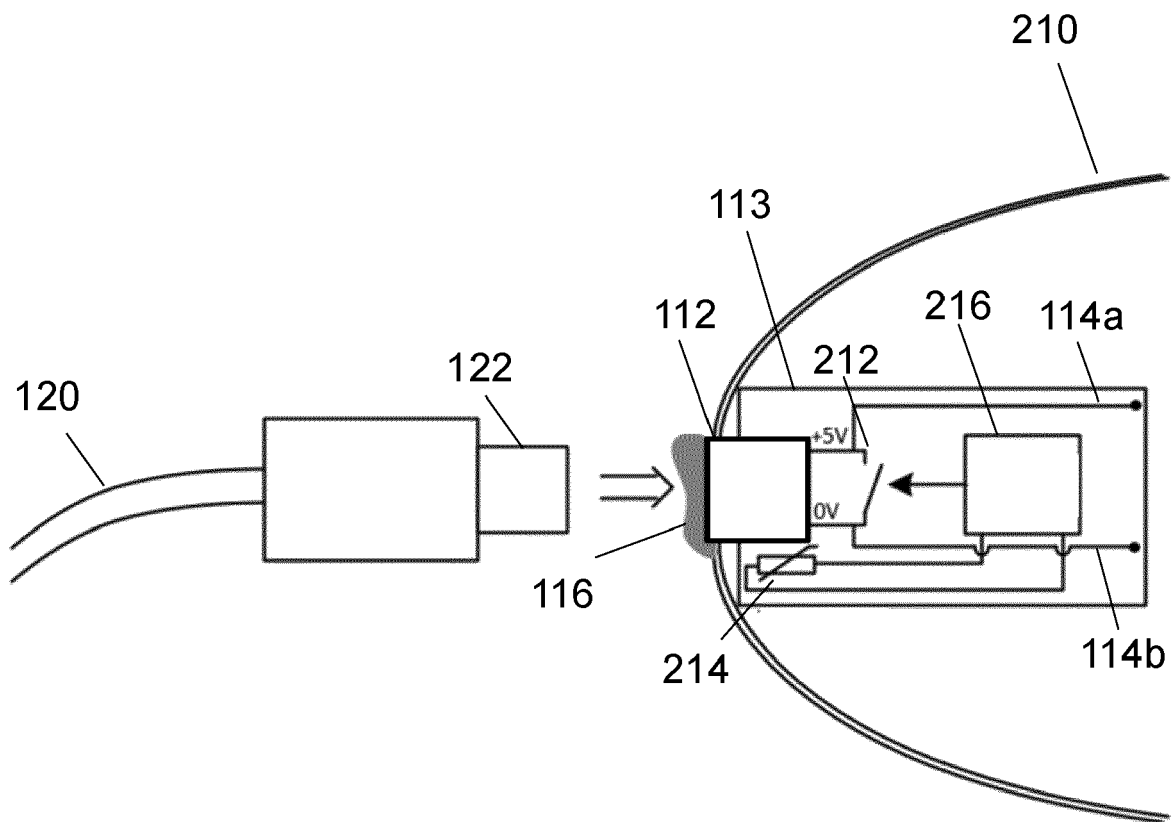


Fig. 2

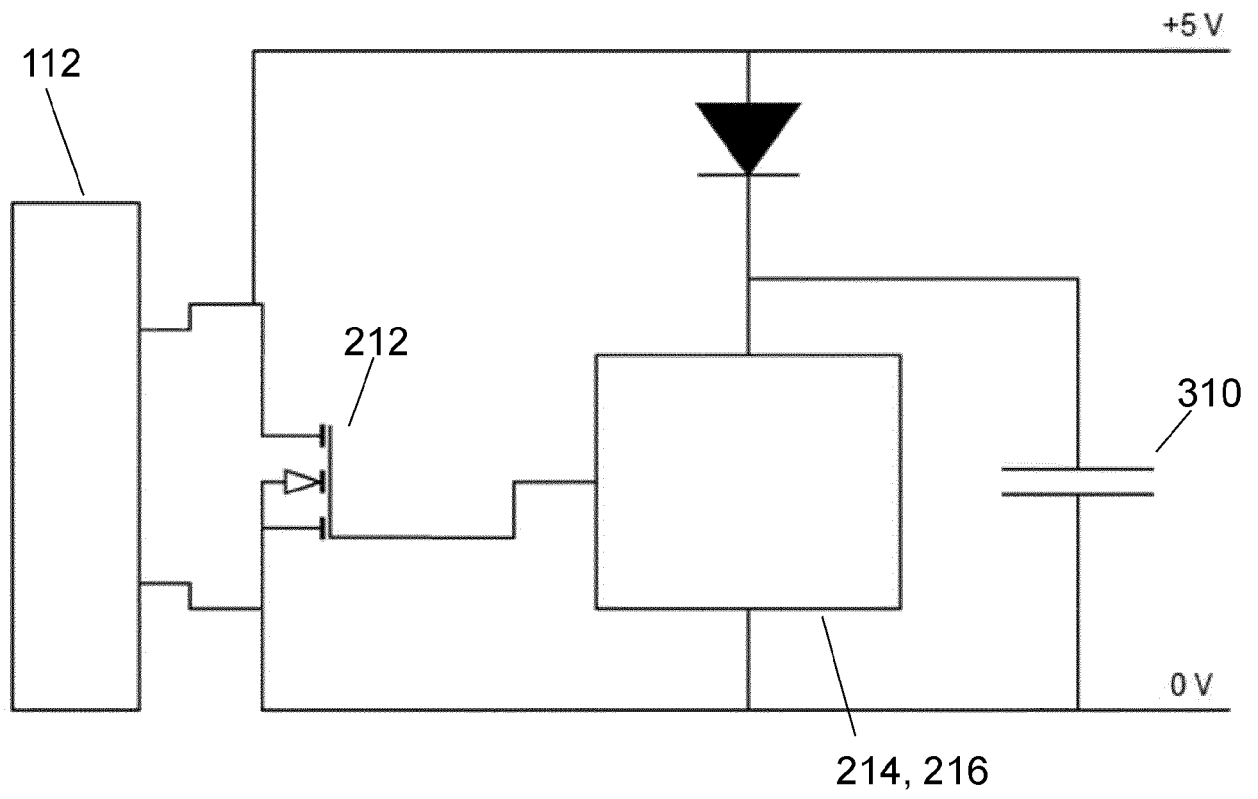


Fig. 3

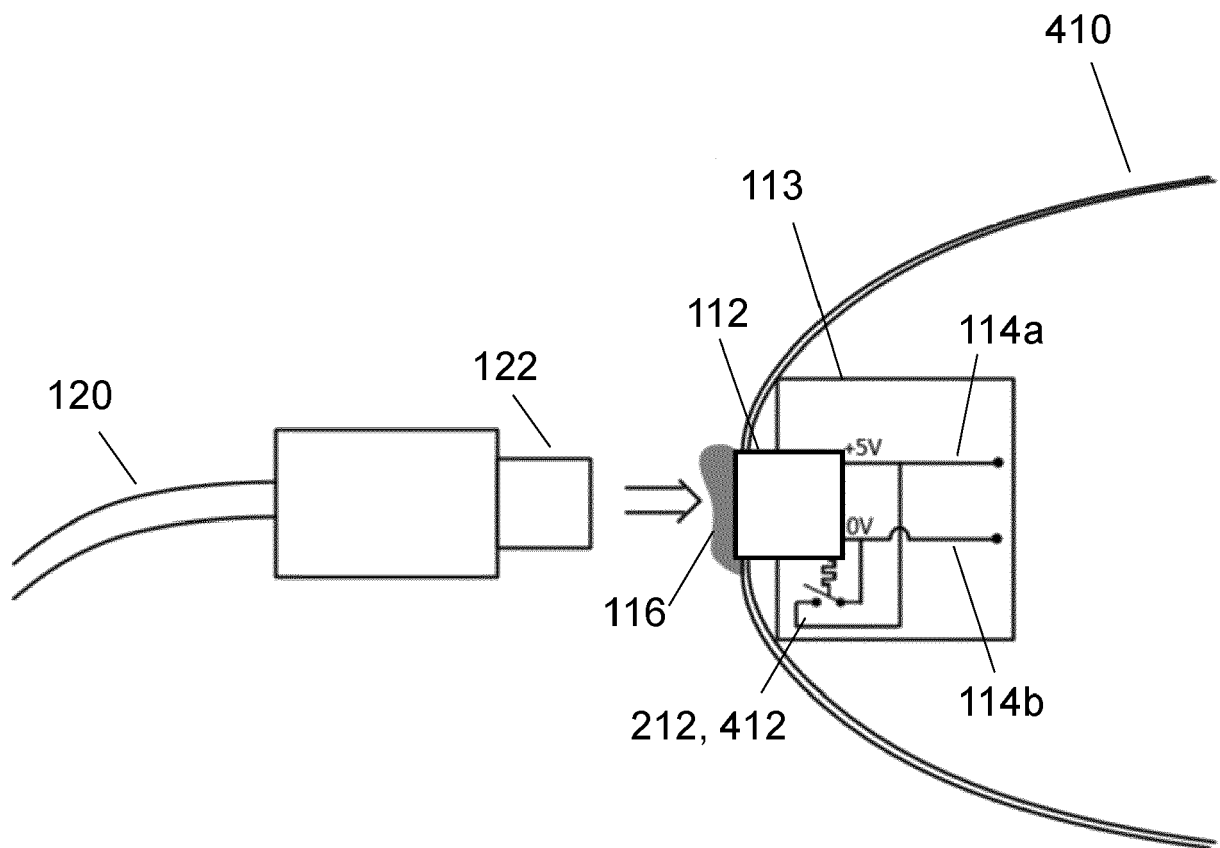


Fig. 4

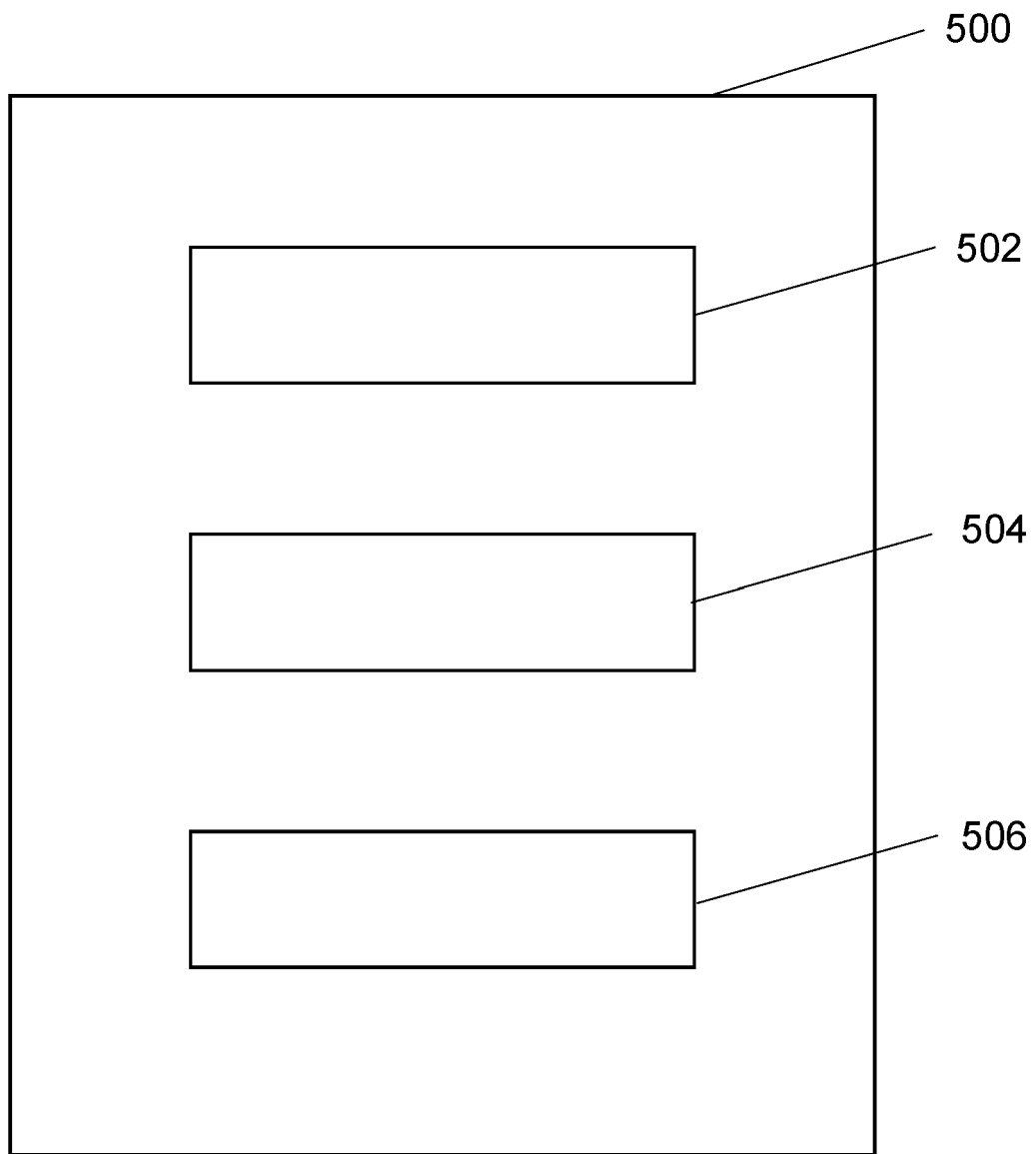


Fig. 5



EUROPEAN SEARCH REPORT

Application Number

EP 22 18 1660

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EPO FORM 1503 03:82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CN 113 949 129 A (ANHUI TAOYUN TECH CO LTD) 18 January 2022 (2022-01-18) * the whole document *	1-15	INV. H01R13/66 H01R13/713
X	CN 109 378 878 B (OPPO CHONGQING INTELLIGENT TECH CO LTD) 5 March 2021 (2021-03-05) * the whole document *	1-15	
A	CN 110 120 691 A (CHUMEN WENWEN INFORMATION TECH CO LTD) 13 August 2019 (2019-08-13) * abstract; figures 1-4 *	1-15	
A	US 2018/212435 A1 (LI GUOXING [US]) 26 July 2018 (2018-07-26) * abstract; figures 1-6 *	1-15	
A	US 2015/372423 A1 (DICKEY J SCOTT [US]) 24 December 2015 (2015-12-24) * paragraphs [0083] - [0084]; figures 1-13 *	13,14	TECHNICAL FIELDS SEARCHED (IPC)
A	US 2016/056588 A1 (MOTOICHI YOSHIHIRO [JP]) 25 February 2016 (2016-02-25) * abstract; figures 1-15 *	1-15	H01R H01H H03K H02J
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 6 December 2022	Examiner Georgiadis, Ioannis
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 18 1660

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-12-2022

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 113949129 A	18-01-2022	NONE	
CN 109378878 B	05-03-2021	NONE	
CN 110120691 A	13-08-2019	NONE	
US 2018212435 A1	26-07-2018	CN 108347089 A	31-07-2018
		CN 113410897 A	17-09-2021
		GB 2543225 A	12-04-2017
		JP 7101484 B2	15-07-2022
		JP 2018121516 A	02-08-2018
		US 2018212435 A1	26-07-2018
US 2015372423 A1	24-12-2015	US 2015372423 A1	24-12-2015
		US 2016211615 A1	21-07-2016
US 2016056588 A1	25-02-2016	CN 105390888 A	09-03-2016
		JP 6295887 B2	20-03-2018
		JP 6458857 B2	30-01-2019
		JP 2016045718 A	04-04-2016
		JP 2018063727 A	19-04-2018
		KR 20160023549 A	03-03-2016
		US 2016056588 A1	25-02-2016
		US 2019148894 A1	16-05-2019