



(51) International Patent Classification:

G08B 17/06 (2006.01) H02H 5/04 (2006.01)

G08B 17/10 (2006.01) H02J 7/00 (2006.01)

H01R 13/713 (2006.01)

(21) International Application Number:

PCT/NO2019/050232

(22) International Filing Date:

24 October 2019 (24.10.2019)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

20181389 29 October 2018 (29.10.2018) NO

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,

HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, 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.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: A SAFETY DEVICE AND A METHOD OF USING SAME

(57) Abstract: A safety device (1) and a method for increasing safety during charging of a battery-operated electronic device (M) via an energy supplying device (A), the safety device (1) comprising: a housing (3) provided with; a USB input (5) for connecting with a USB output (A5) of the energy supplying device (A); a USB output (7) for receiving a USB connection (C7) for connecting the safety device (1) to the electronic device (M); a temperature sensor (13) arranged in thermal contact with the USB input (5) for determining a temperature of the USB input (5); a signal element (9, 11); a controller (15) operatively connected with the temperature sensor (13) and the signal element (9, 11), wherein the controller (15), the signal element (9, 11) and the temperature sensor (13) are configured for making the signal element issue an alarm signal when an abnormal situation is detected.

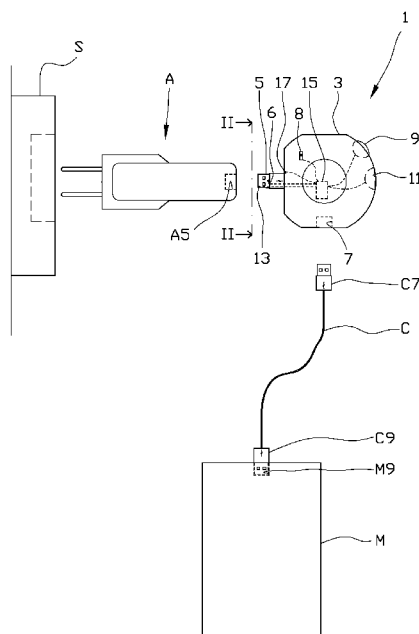


Fig. 1



A SAFETY DEVICE AND A METHOD OF USING SAME

The present invention relates to a safety device and a method of using same. More particularly, the invention is related to a safety device and method for increasing safety during charging of a battery-operated electronic device via an energy supplying device. The electronic device will hereinafter also be denoted apparatus.

The energy supplying device may typically be an adapter connected to a power network, or a battery bank commonly denoted a "power bank". For simplicity, the energy supplying device will hereinafter also be denoted a charger.

The apparatus or electronic device may for example be a mobile phone, a so-called tablet, a camera or other devices comprising an internal battery which is charged via a USB cable.

In what follows, the description will be focussing on charging a mobile phone since mobile phones are by far the single most numerous devices being charged via USB connections.

There are over five billion active mobile phones in the world. When purchasing a new mobile phone, an AC/DC adapter (a "charger") and a separate USB cable for connecting to the charger and to the mobile phone are normally included. The cable may also be used for connecting the mobile phone for example to a power bank or a computer.

Experience shows that charging a mobile phone (or other electronic devices) represents a potential fire hazard. For this reason, *inter alia* authorities in many countries request or give warnings that a mobile phone should not be left unattended during charging, and in any case not during the night.

Despite of the warnings, surveys tend to show that seven out of ten people normally charge their mobile devices, for example a mobile phone or a tablet, at night. A major reason for charging at night is probably due convenience; it is practical to charge when not using the mobile phone or tablet.

Experience further shows that the potential fire hazard tends to increase when using low-cost third-party chargers. Among other factors, manufacturers of for example mobile phones, tablets, cameras, etc. oftentimes state that a warranty will be void if third party chargers are used for charging “their” products. Authorities and skilled personnel also tend to warn about using low-cost third-party chargers.

Publication WO 2017/154891 A1 discloses a special made USB plug for preventing a malfunction caused by static electricity, and to protect a contact from excessive current.

Publication CN 205811191 U discloses a special made USB charging socket provided with a temperature sensing device.

Publication US 6,217, 389 B1 discloses a USB connector with an integral over-current protection device and indicator.

Prior art products disclosed in the publications above, requires replacement of at least some of the “original” accessories supplied together with for example a mobile phone or a tablet.

A USB cable has a first end USB plug or male USB connector for connection to an external device, such as a charger, computer or other devices, and a second end USB plug or male USB connector adapted to the USB plug of the electronic device. Thus, in a great majority the first end connector of a USB cable is of a common, standard type as will be appreciated by a person skilled in the art. However, the type of second end connector varies. Therefore, as best understood by the applicant, the connectors and devices according to prior art mentioned above, must be manufactured in several variants. This has a drawback that different types of cables or devices must be purchased to increase safety when charging different types of electronic devices or apparatuses that a person or a group of persons may use.

The replacement of original accessories and the possible need for a number of various types of accessories may result in a person omitting or disregarding purchasing such accessories. A reduced safety may thus be a result.

There is therefore a need for a much more user-friendly safety device for increasing safety during charging of a battery-operated electronic device via an energy supplying device.

The invention has for its object to remedy or to reduce at least one of the drawbacks of the prior art, or at least provide a useful alternative to prior art.

The object is achieved through features, which are specified in the description below and in the claims that follow.

The invention is defined by the independent patent claims. The dependent claims define advantageous embodiments of the invention.

In a first aspect the invention there is provided a safety device for increasing safety during charging of a battery-operated electronic device via an energy supplying device, the safety device comprising:

a housing provided with;

- a USB input for connecting with a USB output of the energy supplying device;

- a USB output for receiving a USB connection for connecting the safety device to the electronic device;

- a temperature sensor arranged in thermal contact with the USB input for determining a temperature of the USB input;

- a signal element;

- a controller operatively connected with the temperature sensor and the signal element, wherein the controller, the signal element and the temperature sensor are configured for

making the signal element issues an alarm signal when an abnormal situation is detected.

The controller may typically be an MCU (Micro Controller Unit).

The safety device may therefore be connected in series between the energy supplying device, for example an AC/DC adapter, and a USB cable. Thus, the original accessories supplied by the manufacturer of the apparatus or electronic device, such as AC/DC

adapter ("charger") and USB cable (for example iOS or Android compatible) may be utilized.

The effect of providing a USB input of the safety device suitable for connecting the USB output of the energy supplying device is that a metal forming part of the mating USB connectors are in thermal contact. Preferably, the temperature sensor is arranged at an outer

end portion of the USB input, such that the temperature sensor is positioned as far as possible inside the adapter when the safety device is connected to the adapter. Thus, any

excessive heat within the energy supplying device is transferred directly to the USB input of the safety device. By means of the temperature sensor being in thermal contact with the USB input and operatively connected to the controller, the signal element may therefore be configured for issuing an alarm immediately when the temperature sensor detects an abnormal situation. Typically, an abnormal situation is a temperature being higher than a pre-set value.

The signal element may be configured for providing one or both of a light signal and an

audio signal.

The USB connection that may connect the USB output of the safety device with the electronic device or apparatus, is typically a USB cable provided together with the apparatus. However, it may alternatively be a USB adapter for connecting the USB output “directly” to the USB input of the apparatus, i.e. providing a connection without a cable. Such a “direct” connection will result in the apparatus substantially abutting the safety device. The abutment results in the USB output of the safety device being in thermal contact with the USB input of the apparatus. If the safety device is further provided with a second temperature sensor being in thermal contact with the USB output and communicating with the controller, such as an MCU, the safety device may issue an alarm also if any abnormal heat arises at the USB input of the apparatus. The safety device effectively utilizes the accessories supplied by the manufacturer of the electronic device and provides a single add-on without requiring modifying or replace any of the existing equipment or cables. The safety device may easily be used with various types of electronic devices, all having their own charging adapter.

The safety device may further comprise an electrical switch placed in a current path between the USB input and the USB output, the electronic switch being controlled by the controller. The purpose of the electrical switch is to interrupt or open the current path in an abnormal situation.

The electrical switch may open for interrupting the current running through the current path of the safety device when the temperature sensor detects an abnormal situation.

In one embodiment, the safety device according to the invention may further comprise a current sensor configured determining a value of an electrical current through the current path of the safety device, i.e. between the USB input and the USB output. The current sensor may be controlled by the controller which may be configured to activate the signal element to issue an alarm signal when the current sensor detects an electrical current above a predetermined level. The predetermined level is typically programmed in the controller.

Thus, the safety device may issue an alarm signal based also on excessive current. An excessive current may for example be an indication of malfunction of the apparatus receiving electrical energy.

In one embodiment the electrical switch may be opened by the controller for interrupting

the current running through the safety device when the current sensor detects an electrical current above a predetermined level. Thus, in such an embodiment the apparatus is electrically disconnected from the charger if the temperature sensor detects an abnormal situation, typically an "overheating" inside the charger.

- 5 Thus, depending on the configuration of the safety device, the controller may open the electrical switch based on input from either one of or both the temperature sensor and the current sensor.

The safety device may be provided with a smoke sensor operatively connected with the controller. The smoke sensor may be configured for detecting smoke generated by the energy supplying device, wherein the smoke has entered the housing of the safety device.
10 The smoke may typically be generated due to excessive heat within the energy supplying device, for example the AC/DC adapter. When the safety device is provided with a smoke sensor, the controller, such as an MCU, is programmed to activate the signal element to issue an alarm signal when the smoke sensor detects an abnormal situation.

- 15 An AC/DC adapter (charger) for use with the present invention is normally provided with a housing having only one opening. The opening is through the USB output of the charger. Therefore, any smoke sensor is preferably arranged within the housing of the safety device, adjacent the USB input. The smoke may flow into the safety device via the USB connection. However, the housing of the safety device is advantageously provided with at least one aperture for facilitating communication of any smoke from the charger into contact with the smoke sensor. The smoke sensor may typically be an optical smoke sensor.
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In one embodiment, the safety device may be provided with a battery for supplying power to the controller and the signal element. The signal element may be operated by power from the controller. The safety device may thus be operated independent of any current from the energy supplying device, or from the electrical device or apparatus to receive energy from the energy supplying device. A signal element in the form of a light, such as for example an LED (Light Emitting Diode) may be configured for providing a light sufficient for use as a torch in an emergency situation wherein a power supply to a building is blacked out. The signal element may therefore be configured for issuing a light for the safety device to be used as a torch for illuminating surrounding environment. This is of particular importance if a person has to find an escape route in the case of fire in for example a building or any other compartment. Preferably, the safety device is configured for providing such a torch light automatically if the power to a socket connected to the adapt-
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er ceases, and/or if the safety device detects an abnormal situation and issues an alarm signal. Thus, the safety device may be configured for issuing a torch light if the power to the adapter ceases, and if the safety device issues an alarm. When the safety device is not connected to the adapter, a LED may in one embodiment be manually activated by means of a switch, or the LED may be controlled by means of a timer keeping the LED active a certain time after the safety device has been disconnected from the adapter. In one embodiment the safety device is normally powered by means of the energy supplying device but operated by means of the battery when the controller activates the signal element to issue an alarm signal. This has *inter alia* the advantage that the alarm may be active even if the power from the charger has been disconnected by the safety device as discussed above.

In one embodiment the safety device is provided with a rechargeable battery and a charging device for charging the battery by power from the energy supplying device.

The safety device may further comprise a timer for activating the electrical switch. Such a timer may interrupt the current running through the current path by opening the electrical switch after a predetermined time. Thus, an apparatus or electronic device connected to the safety device will be disconnected from the energy supplying device after the predetermined time. Preferably, the timer is controlled by the controller.

In one embodiment the controller is provided with an RF (Radio Frequency) transceiver for wireless communication with external devices. The wireless communication may typically be based on Bluetooth® technology. One purpose of providing the controller with a RF transceiver for wireless communication, it that the controller may be controlled from remote, such as via a mobile phone App. The RF transceiver may be provided with an antenna. Another purpose of providing the controller with a RF transceiver for wireless communication, it that two or more safety devices within a house may be configured for communicating with each other. Thus, if one safety device detects an abnormal situation and issues an alarm signal, one or more other active safety devices may be activated to issue the alarm. This is similar to a smoke alarm system wherein any smoke detected by one smoke detector of the system, activates the other(s) smoke detector to also issue the alarm.

In one embodiment the safety device may be configured for receiving back-up electrical energy from a battery of the electronic device. In still another embodiment, the safety device may be configured for monitoring a condition of the battery of the electronic device.

In a second aspect of the invention there is provided a method for increasing safety during charging of a battery-operated electronic device via an energy supplying device, the method comprising:

- providing the energy supplying device having a USB output ;
- 5 - inserting the USB input of the safety device according to claim 1 into the USB output of the energy supplying device;
- connecting the USB output of the safety device to a USB input of the battery-operated electronic device via a USB-connection.

The USB-connection may be one of a group comprising a cable having USB connectors
10 at both ends; and a USB adapter comprising two USB connectors of the same type.

In a third aspect of the invention there is provided a safety device for increasing safety during charging of a battery-operated electronic device via an energy supplying device, the safety device comprising:

- a housing provided with;
- 15 - a USB input for connecting with a USB output of the energy supplying device;
- a USB output for receiving a USB connection for connecting the safety device to the electronic device;
- a temperature sensor arranged in thermal contact with the USB input for determining a temperature of the USB input;
- 20 - an electrical switch placed in a current path between the USB input and the USB output,
- a controller operatively connected with the temperature sensor and the electrical switch, wherein the controller, the temperature sensor and the electrical switch are configured for interrupting the current path between the USB input and the USB output a predetermined time after an abnormal situation is detected. Thus, the electrical switch opens for interrupt-
- 25 ing the current running through the current path of the safety device when the temperature sensor detects an abnormal situation. In one embodiment, the predetermined time is within ten seconds after detection of the abnormal situation. In another embodiment, the predetermined time is within one minute after an abnormal situation is detected. In still another embodiment the predetermined time is within three minutes after an abnormal situation
- 30 is detected.

The safety device according to the third aspect of the invention may further be provided with a signal element operatively connected to the controller, wherein the controller, the signal element and the temperature sensor are configured for making the signal element issues an alarm signal when an abnormal situation is detected. The alarm is issued sub-

stantially immediately, for example within one or a few seconds, after an abnormal situation is detected. Thus, the alarm will be issued before the current path between the USB input and the USB output is interrupted.

5 The safety device according to the third aspect of the invention may further comprise one or more of a smoke sensor, a current sensor, and a battery as discussed in relation to the first aspect of the invention. A battery may be particularly useful for allowing the alarm signal to continue also after the electrical switch has interrupted or opened the current path between the USB input and the USB output.

10 The individual elements of the safety device may be based on existing technology, i.e. build "from the shelf" components as such. Nevertheless, these off-the-shelf components are combined in a way to achieve the favourable effects of providing a safety device that may be used with any type of battery-operated USB-charged electronic device.

In the following is described an example of a preferred embodiment illustrated in the accompanying drawings, wherein:

- 15 Fig. 1 shows a view of the safety device according to the invention prior to being connected to an AC/DC adapter and a USB cable for providing communication with an electronic device;
- Fig. 2 shows in a larger scale a view of the safety device seen from II-II in fig. 1;
- 20 Fig. 3a shows a block schematic diagram of a basic configuration of the safety device;
- Fig. 3b shows a block schematic diagram of a safety device provided with additional features; and
- Fig. 3c shows a block schematic diagram in fig. 3b, wherein the safety device is provided with a battery.

25 Positional specifications such as right and left, refer to the positions shown in the figures.

In the figures, the same reference numerals indicate the same or corresponding elements. As the figures are only principle drawings, the relative size ratios between individual elements may be distorted.

In figures 1 and 2, the reference numeral 1 denotes a safety device according to the in-

vention. The safety device 1 comprises a housing 3. A USB input 5 for connecting a USB output A5 of an energy supplying device, in fig. 1 shown as an AC/DC adapter A, protrudes from the housing 3. The USB input 5 is a so-called "male" USB connector. The USB output A5 of the energy supplying device is a so-called "female" USB connector. The adapter A is configured for being inserted into a socket S.

The safety device 1 further comprises a female USB connector, hereinafter denoted USB output 7, for receiving a USB connector, here in the form of a male USB connector C7 provided at a first end portion of a USB cable C. In the second end portion of the USB cable C, there is provided a second male USB connector C9 for inserting into a mating USB connector M9 of an electronic device or apparatus M, such as a mobile phone.

When purchasing an apparatus M, the manufacturer of the apparatus M typically provides the adapter A and the USB cable C. Thus, the USB connector C7 of the cable C fits the USB output A5 of the adapter A.

A temperature sensor 13 is arranged in thermal contact with the USB-input 5. The temperature sensor 13 is arranged at an outer end portion of the USB-input 5 so that, when connected to the adapter A, the temperature sensor 13 senses a temperature as far as possible inside the adapter A. The temperature sensor 13 is operatively connected with a controller 15 via a cable indicated by a dotted line in fig. 1. The controller 15 will hereinafter also be denoted MCU (Micro Controller Unit) 15. If the temperature sensor 13 issues a signal to the MCU 15 indicating an abnormal situation, for example a temperature exceeding a predetermined level, the MCU activates a signal element 9, 11.

In fig. 1, signal element is a dual signal element configured to issue an alarm signal by means of light signal from a LED (light emitting diode) 9 and an audio signal by means of a buzzer 11. The LED 9 may also be used as a guiding light for a user leaving for example a building in an emergency situation, or in any other situations where a torch is needed.

A mechanical switch 6 is arranged on a portion of the USB input 5. The switch 6 is operatively connected to the MCU 15 via a cable indicated by a dotted line. The purpose of the switch 6 is to sense whether the safety device 1 is connected to the adapter A. If the safety device 1 is connected to the adapter A, and the power from the adapter A to the safety device 1 ceases, typically when the power from the socket ceases, the MCU 15 is programmed to activate the LED 9 to issue a light sufficient for the safety device to be used as a torch as discussed above. However, when the safety device 1 is disconnected from the adapter A, the switch 6 will be deactivated. In an emergency situation, such a torch

light (LED 9) may still be desired for use to illuminate for example an escape route. In one embodiment, the safety device 1 is provided with a timer (not shown) that will keep the LED 9 active a certain time, for example five minutes, after the safety device 1 has been disconnected from the adapter A. Alternatively or additionally, the safety device 1 may be provided with a manual switch 8 for activating the LED 9 manually. The manual switch 8 operatively connected to the MCU 15 as shown by a dotted line.

In the embodiment shown in fig. 1, the safety device 1 is further provided with a smoke sensor 17 operatively connected to the MCU 15 via a cable indicated by a dotted line. The smoke sensor 17 shown in fig. 1 is arranged on the inside of the housing 3 of the safety device 1.

A main purpose of the smoke sensor 17 is to detect any smoke from the adapter A. Since an adapter A of the type discussed herein is provided with a housing, any smoke arising from within the adapter A due to over-current and/or over-heating, may flow from the inside to the outside of the adapter A via the USB output A5.

To allow any smoke from the adapter A to be sensed by the smoke sensor 17, the housing 3 of the safety device 1 is provided with at least one aperture 20 as shown in fig. 2

Fig. 2 shows in a larger scale a view of the safety device seen from II-II in fig. 1. In the embodiment shown, the housing 3 of the safety device 1 is provided with a plurality of apertures 20 (ten oblong apertures shown) surrounding the USB input 5.

If the smoke sensor 17 issues a signal to the MCU 15 indicating smoke, the MCU 15 activates the signal element 9, 11 to issue an alarm, here in the form of light and sound.

Fig. 3a shows a block schematic diagram of a basic configuration of the safety device 1.

In the embodiment shown in fig. 3a, the safety device 1 is configured for monitoring a temperature of the USB input 5 by means of the temperature sensor 13 arranged inside the USB input 5. The temperature sensor 13 communicates with the MCU 15 which is configured for activating the signal elements 9, 11 when the temperature sensor and MCU detects an abnormal situation, typically a temperature being higher than a predetermined level.

Fig. 3b shows a block schematic diagram of a safety device 1 provided with additional features with respect to the basic configuration shown in fig. 3a.

A first additional feature shown in fig. 3b, is a smoke sensor 17 arranged in communica-

tion with the MCU 15 as discussed above with respect to figures 1 and 2.

A second additional feature shown in fig. 3b, is an electrical switch 22 placed in a current path 21 between the USB input 5 and the USB output 7. The electrical switch 22 is operatively connected to the MCU 15 so that the electrical switch 22 is opened for interrupting the current running through the current path 21 of the safety device 1 when the temperature sensor 13 communicates an abnormal situation to the MCU 15.

In one embodiment, the electrical switch 22 which is activated by the MCU 15, interrupts the current running through the current path 21 of the safety device 1 when the smoke sensor 17 detects an abnormal situation.

The electrical switch shown in fig. 3b may also comprise a current sensor 23 configured for determining a value of an electrical current running through the current path 21 of the safety device 1. Such a current sensor 23 is operatively connected to the MCU 15 which is configured to activate the signal element 9, 11 to issue the alarm signal when the current sensor detects an electrical current above a predetermined level. The MCU 15 may also be configured to activate the electrical switch 22 if the current sensor 23 detects an abnormal situation.

A third additional feature shown in fig. 3b is a second temperature sensor 14 in thermal contact with the USB output 7. The second temperature sensor 14 is operatively connected with the MCU 15. By means of the temperature sensor 13 in the USB input 5 and the temperature sensor 14 at the USB output, any temperature difference between the USB input 5 and the USB output 7 can be detected. A temperature difference may indicate an abnormal situation. Thus, if said temperature difference exceeds a predetermined level, the MCU 15, the temperature sensors 13, 14 and the signal element 9, 11 are configured for making the signal element issue an alarm. Further, the MCU 15 controlling the electrical switch 22, may be opened for interrupting the current running through the current path 21 of the safety device 1 when a temperature difference between the USB input 5 and the USB output 7 exceeds a predetermined level.

The second temperature sensor 14 may also be useful if the USB input M9 of the apparatus M to receive energy, is connected directly to the USB output 7 of the safety device via an USB female-female adapter, i.e. without the cable C. Thus, the second temperature sensor 14 provides an opportunity for detecting any abnormal heat in the apparatus M. Due to the requirement of an USB-adapter, which should cover various standards of the USB input M9 of the apparatus M, more than one adapter may be required. In one em-

bodiment, such one or more adapters are stored in slots (not shown) in the housing 3 of the safety device.

To be able to keep the signal elements 9, 11 activated, i.e. issuing an alarm, also after the current running through the current path 21 of the safety device 1 have been interrupted
5 by the switch 22, the safety device 1 may be provided with a battery 25, as indicated in fig. 3c.

Fig. 3c also shows an embodiment wherein a switch is 6 arranged on a portion of the USB input 5 and operatively connected to the MCU 15. Fig. 3c also shows a manual switch 8 for activating the LED 9 manually 8.

10 In one embodiment, the battery 25 is rechargeable and charged by a charging device 27 connected to the power from the USB input 5 of the safety device 1.

In figures 3a and 3b an optional additional current path 21' are shown by dotted lines. The additional current path 21' is in parallel to the current path 21 running between the USB input 5 and the USB output 7. The purpose of the parallel current path 21' is to supply
15 power to the safety device 1 from the battery of the electrical device M in a situation where the USB input 5 does not receive power from the energy supplying device A. In the embodiment shown, the parallel current path 21' is provided with a device 29 for controlling a direction of the current. In the embodiment shown the device 29 allows current in the direction from the USB output 7 to the USB input 5. The device 29 may for example be a
20 diode or transistor.

The controller 15, such as an MCU, may be programmed to receive data from the electronic device M, for example a mobile phone. When available in the electronic device, data concerning a temperature of an internal battery of the electronic device is of particular interest since the safety device 1 thus may monitor the battery and issue an alarm if an
25 abnormal and potentially dangerous situation arises with respect to the battery of the electronic device M.

From the disclosure herein, it should be understood that the safety device according to the present invention represents advantages with respect to ease of use as it is simply connected in series between for example an AC/DC adapter and a USB cable that are commonly supplied by a manufacturer of an electronic device such as for example a mobile
30 phone or a tablet. The safety device is therefore suitable for increasing safety when charging various types of electronic devices. The safety device may in one embodiment be con-

figured for use as a torch suitable for use as a guiding light in for example an emergency situation.

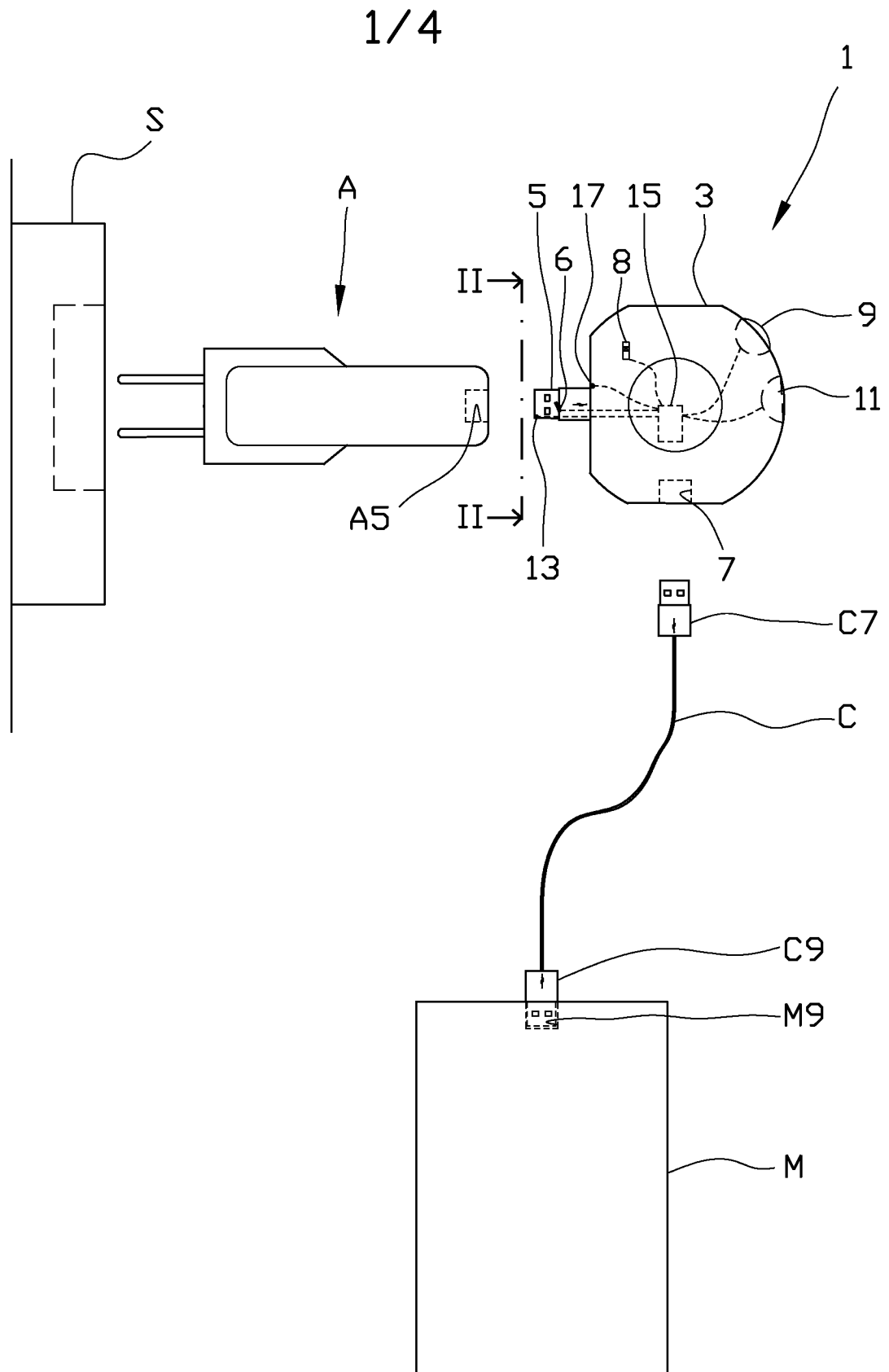
It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodi-
5 ments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. Use of the verb "comprise" and its conjugations does not exclude the presence of elements or steps other than those stated in a claim. The article "a" or "an" preceding an element does not exclude the presence of a plurality of such elements.

C l a i m s

1. A safety device (1) for increasing safety during charging of a battery-operated electronic device (M) via an energy supplying device (A), the safety device (1) comprising:
5 a housing (3) provided with;
- a USB input (5) for connecting with a USB output (A5) of the energy supplying device (A);
- a USB output (7) for receiving a USB connection (C7) for connecting the safety
10 device (1) to the electronic device (M);
- a temperature sensor (13) arranged in thermal contact with the USB input (5) for determining a temperature of the USB input (5);
- a signal element (9, 11);
- a controller (15) operatively connected with the temperature sensor (13) and the
15 signal element (9, 11), wherein the controller (15), the signal element (9, 11) and the temperature sensor (13) are configured for making the signal element issue an alarm signal when an abnormal situation is detected.
2. The safety device (1) according to claim 1, further comprising an electrical switch (22) placed in a current path (21) between the USB input (5) and the USB output (7), the electrical switch (22) being controlled by the controller (15).
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3. The safety device (1) according to claim 2, wherein the electrical switch (22) is opened for interrupting the current running through the current path (21) of the safety device (1) when the temperature sensor (13) detects an abnormal situation.
- 25 4. The safety device (1) according to claim 2, further comprising a current sensor (23) configured for determining a value of an electrical current through the current path (21) of the safety device (1), the current sensor (23) being controlled by the controller (15) which is configured to activate the signal element (9, 11) to issue the alarm signal when the current sensor (23) detects an electrical current above
30 a predetermined level.
5. The safety device (1) according to claim 3, wherein the electrical switch (22) is opened by the controller (15) for interrupting the current running through the safe-

ty device (1) if the current sensor (23) detects an electrical current above a pre-determined level.

6. The safety device (1) according any one of the preceding claims, further comprising a smoke sensor (17) operatively connected with the controller (15), the smoke sensor (17) being configured for detecting smoke generated by the energy supplying device (A) that has entered the housing (3) of the safety device (1).
7. The safety device (1) according to any of the preceding claims, further comprising a battery (25) for supplying power to the controller (15) and the signal element (9, 11).
8. The safety device (1) according to claim 7, wherein the signal element (9) is configured for issuing a light for the safety device to be used as a torch for illuminating surrounding environment.
9. The safety device (1) according to any of the preceding claims 2-8, further comprising a timer for interrupting the current running through the current path (21) by opening the electrical switch (22) after a predetermined time.
10. The safety device (1) according to any of the preceding claims, wherein the controller (15) is provided with an RF transceiver (30) for wireless communication with external devices for the purpose of being able to control the controller (15) from remote, such as via a mobile phone App.
11. A method for increasing safety during charging of a battery-operated electronic device (M) via an energy supplying device (A), the method comprising:
 - providing the energy supplying device (A) having a USB output (A5);
 - inserting the USB input (5) of the safety device (1) according to claim 1 into the USB output (A5) of the energy supplying device (A);
 - connecting the USB output (7) of the safety device (1) to a USB input (M9) of the battery-operated electronic device (M) via a USB-connection (C7, C, C9).
12. The method according to claim 11, wherein the USB-connection is one of a group comprising a cable (C) having USB connectors (C7, C9) at both ends; and a USB adapter comprising two USB connectors of the same type.



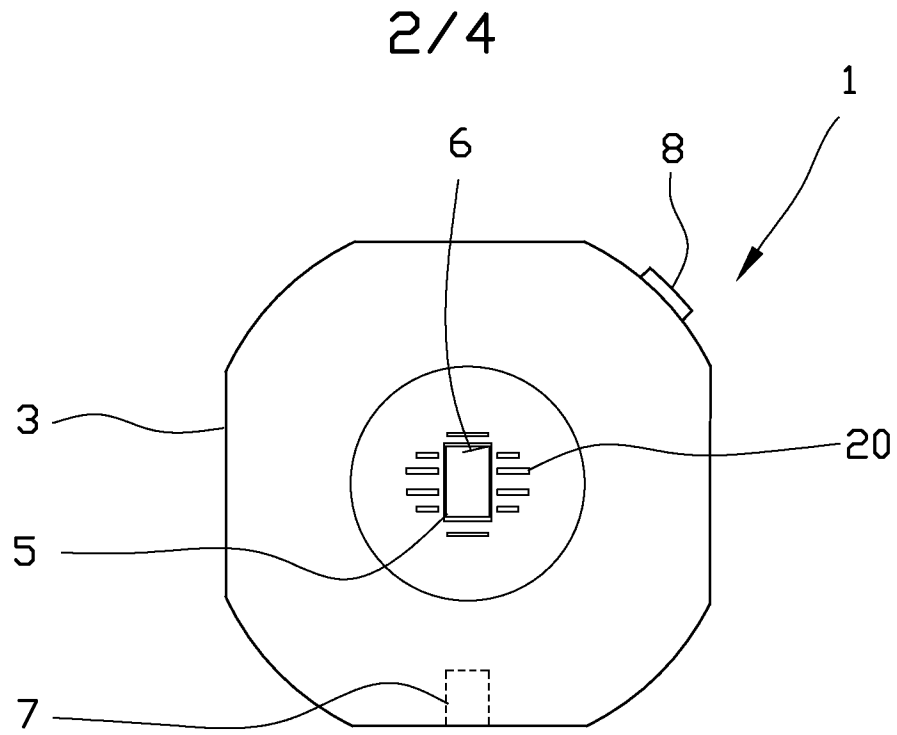


Fig. 2

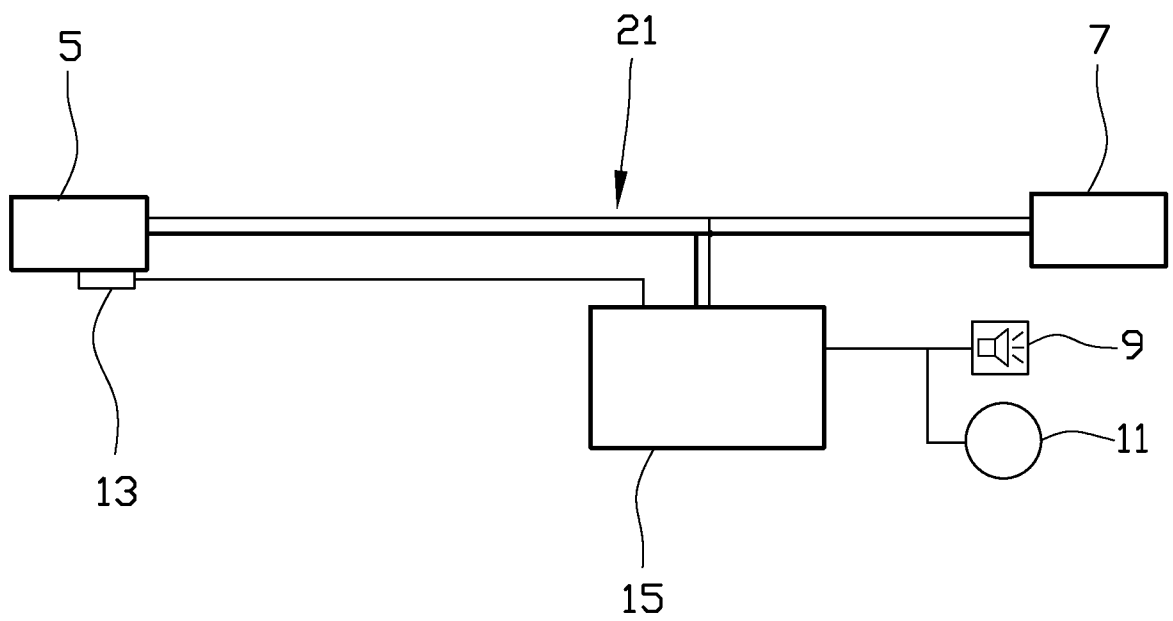


Fig. 3a

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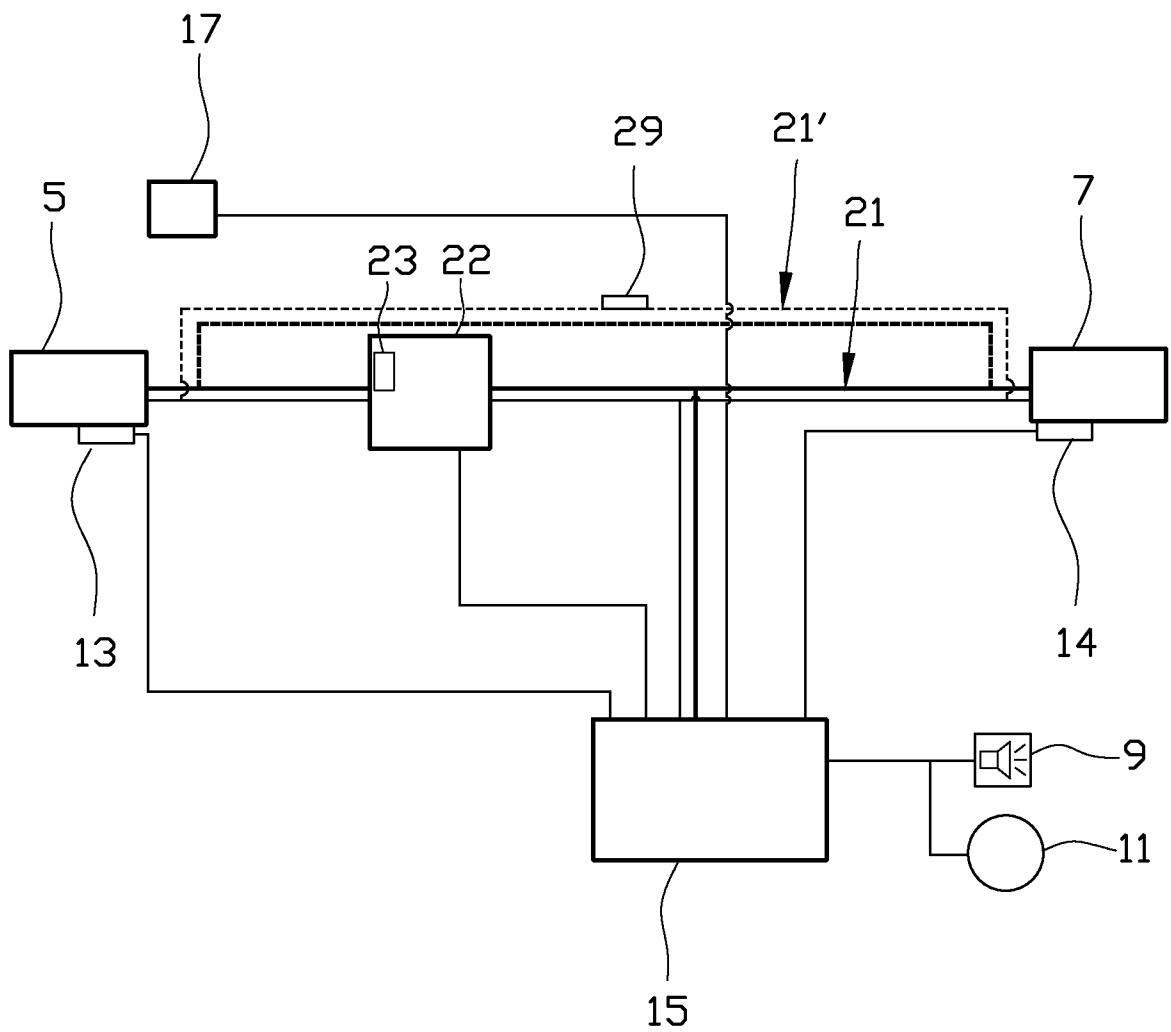


Fig. 3b

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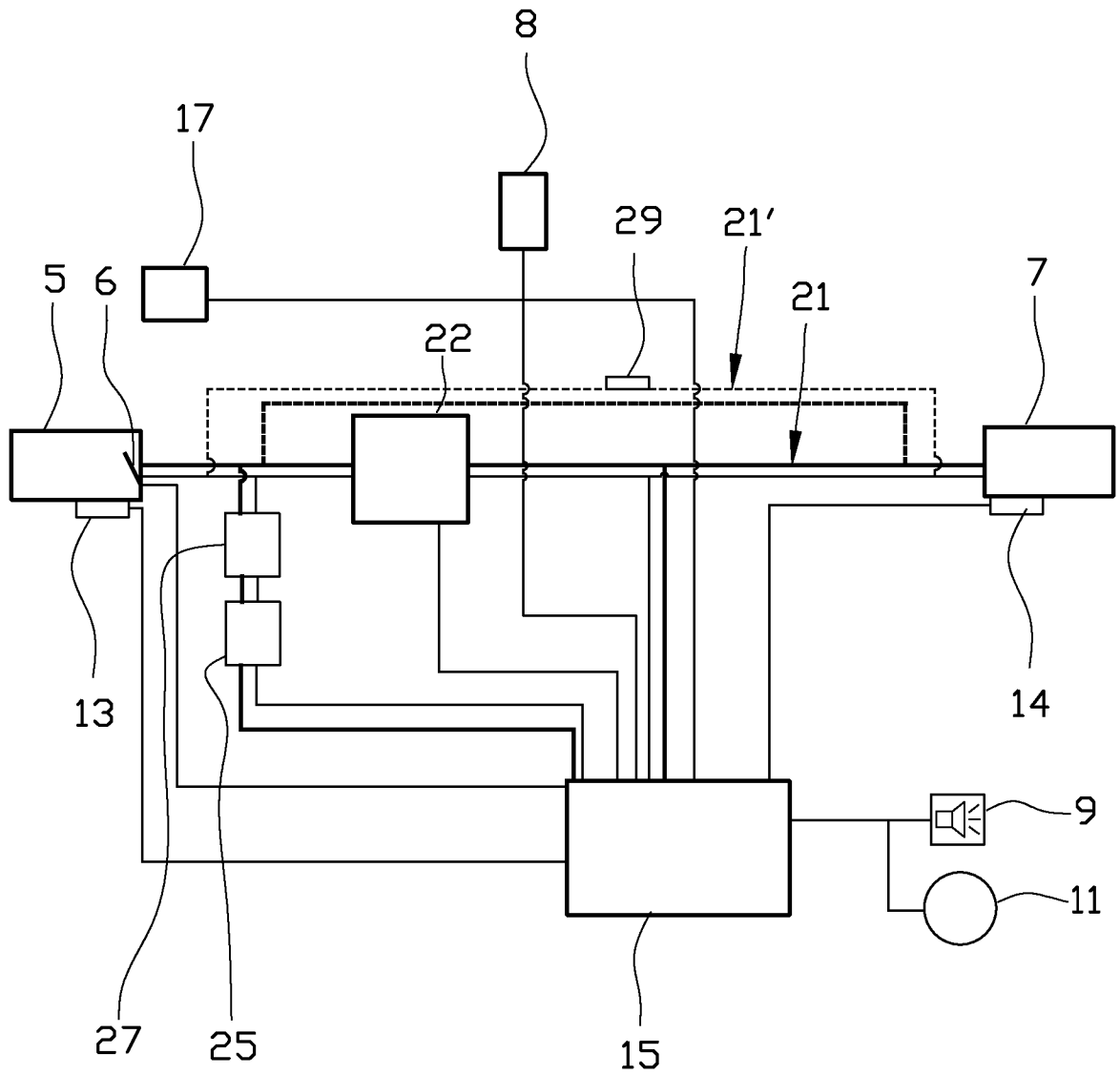


Fig. 3c

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO2019/050232

A. CLASSIFICATION OF SUBJECT MATTER G08B 17/06 (2006.01), G08B 17/10 (2006.01), H01R 13/713 (2006.01), H02H 5/04 (2006.01), H02J 7/00 (2006.01) 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: H02H:H01R;G08B:H02J Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched DK, NO, SE, FI: Classes as above. Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPODOC, WPI, FULL TEXT: ENGLISH, GERMAN, FRENCH		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
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Y	WO 2017/180046 A1 (SOUTH COAST ENG AB) 2017.10.19 figures 1 and 2; page 7, line 28-page 9, line 29, page 10, lines 19-24, page 11, lines 3-24	7,8,10,12
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A	US 2010/0073839 A1 (BAXTER M. et al.) 2010.03.25 abstract; paragraphs [0031], [0046] and [0077]	1-12
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "D" document cited by the applicant in the international application "E" earlier application or patent but published on or after the international filing date "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) "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	"I" 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 "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 "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 "&" document member of the same patent family	
Date of the actual completion of the international search 22/11/2019		Date of mailing of the international search report 04/12/2019
Name and mailing address of the ISA Nordic Patent Institute Helgeshøj Allé 81 DK - 2630 Taastrup, Denmark. Facsimile No. -		Authorized officer Kristoffer Bakkerud Telephone No. +47 22 38 75 84

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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