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(54) **METHOD AND DEVICE FOR DETECTING STATE OF OVERCURRENT PROTECTOR FOR BATTERY**

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(57) **ABSTRACT**

The disclosure discloses a method and device for detecting a state of an overcurrent protector for a battery, wherein a voltage U_{out} of a power supply and a voltage U_{bat} of a battery connected to the power supply via an overcurrent protector is acquired, and $U=|U_{out}-U_{bat}|$ is calculated; when $U_L \leq U \leq U_H$ and $|I_{bat}| \leq I_{min}$, the voltage of the power supply is adjusted to be U'_{out}, wherein U_L and U_H are the minimum value and maximum value of a difference between the voltage of the power supply and the voltage of the battery, respectively, I_{bat} is a current of the battery, and I_{min} is a current detecting precision for detecting a current equipment of the battery; the voltage of the battery U'_{bat} after adjusting the voltage of the power supply is acquired, and $U'=|U'_{out}-U'_{bat}|$ is calculated; and a state of the overcurrent protector for the battery is determined. With the disclosure, in the case that the difference between the voltage of the battery and the supply voltage is small, by regulating the supply voltage and comparing the voltage difference across the overcurrent protector again, accurate detection of the state of the overcurrent protector for the battery as well as reduction of detecting costs is enabled.

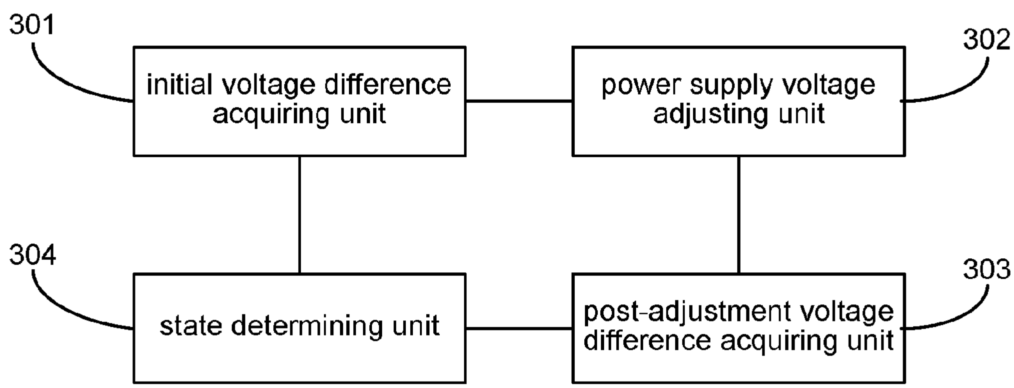


Fig. 1

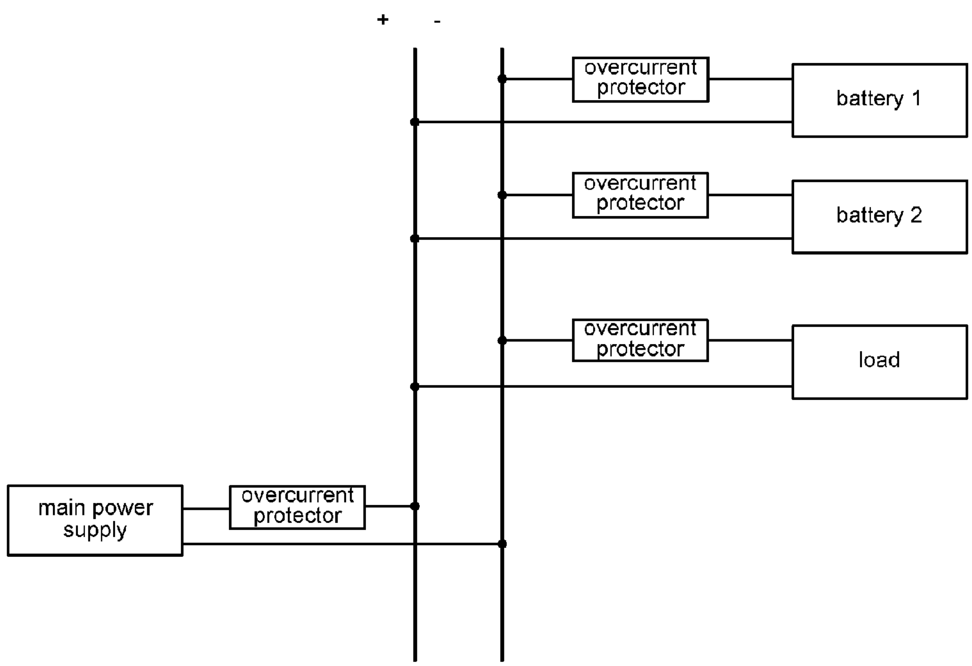

+
-
overcurrent protector
battery 1
overcurrent protector
battery 2
overcurrent protector
load
main power supply
overcurrent protector

Fig. 2

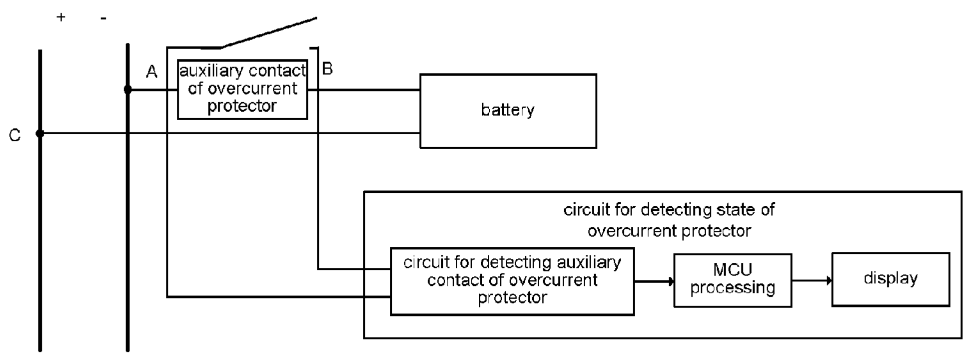
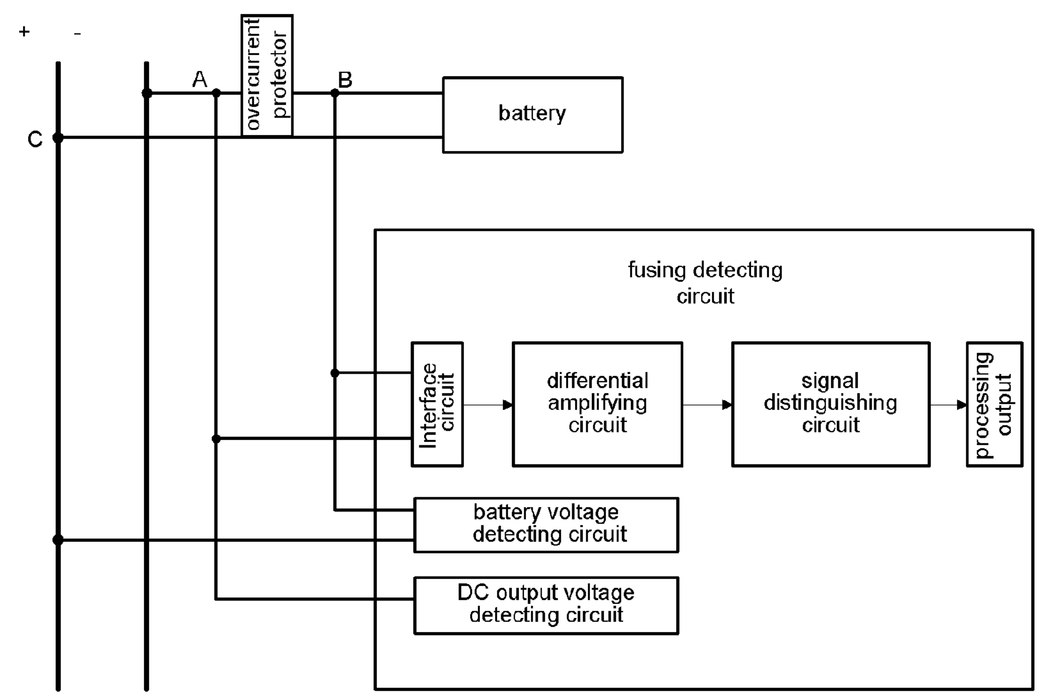

+
-
A
auxiliary contact of overcurrent protector
B
battery
C
circuit for detecting state of overcurrent protector
circuit for detecting auxiliary contact of overcurrent protector
MCU processing
display

Fig. 3



+
-
A
overcurrent protector
B
battery
C
fusing detecting circuit
Interface circuit
differential amplifying circuit
signal distinguishing circuit
processing output
battery voltage detecting circuit
DC output voltage detecting circuit

Fig. 4

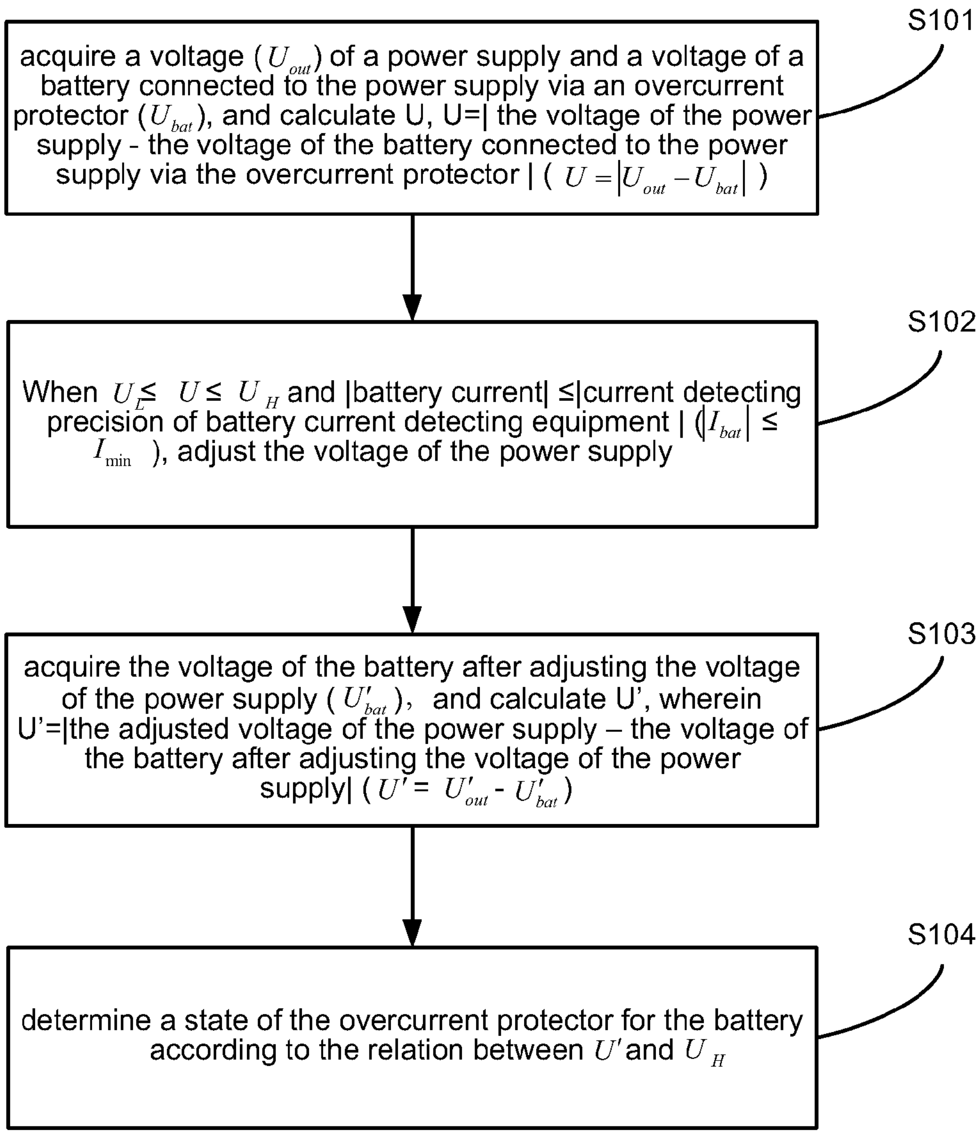

acquire a voltage (U_{out}) of a power supply and a voltage of a battery connected to the power supply via an overcurrent protector (U_{bat}), and calculate U, U=| the voltage of the power supply - the voltage of the battery connected to the power supply via the overcurrent protector | ($U = |U_{out} - U_{bat}|$)
S101
When $U_L \leq U \leq U_H$ and |battery current| ≤|current detecting precision of battery current detecting equipment | ($|I_{bat}| \leq I_{min}$), adjust the voltage of the power supply
S102
acquire the voltage of the battery after adjusting the voltage of the power supply (U'_{bat}), and calculate U', wherein U'=|the adjusted voltage of the power supply – the voltage of the battery after adjusting the voltage of the power supply| ($U' = U'_{out} - U'_{bat}$)
S103
determine a state of the overcurrent protector for the battery according to the relation between U' and U_H
S104

Fig. 5

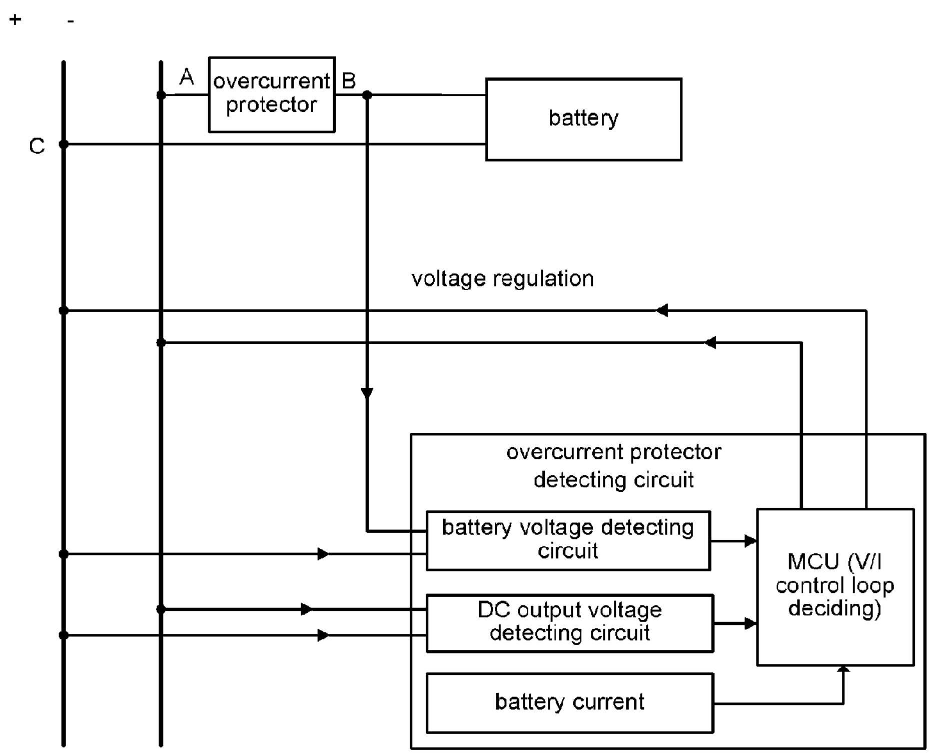

+
-
A
overcurrent protector
B
battery
C
voltage regulation
overcurrent protector detecting circuit
battery voltage detecting circuit
MCU (V/I control loop deciding)
DC output voltage detecting circuit
battery current

Fig. 6

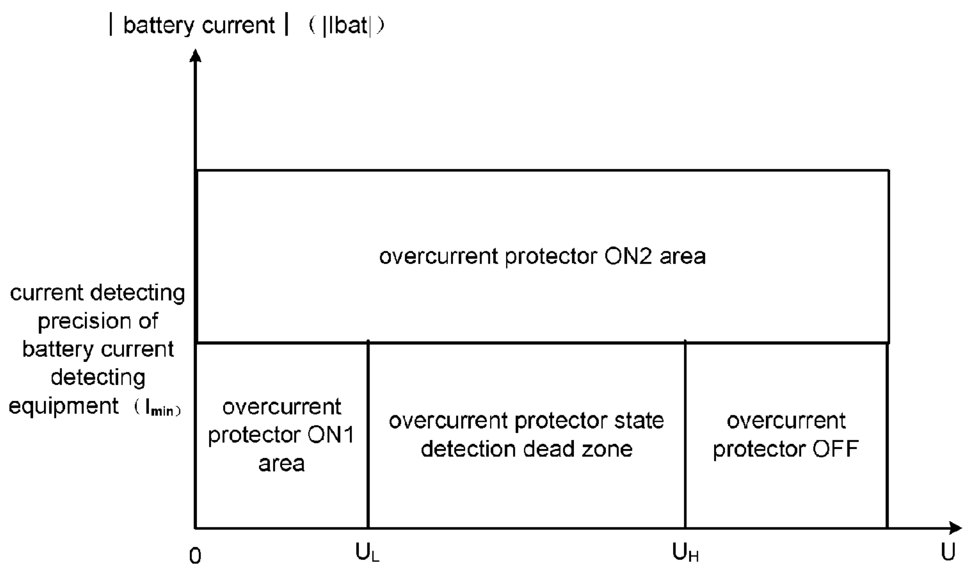

| battery current | (|Ibat|)
overcurrent protector ON2 area
current detecting precision of battery current detecting equipment (Imin)
overcurrent protector ON1 area
overcurrent protector state detection dead zone
overcurrent protector OFF
0
UL
UH
U

Fig. 7

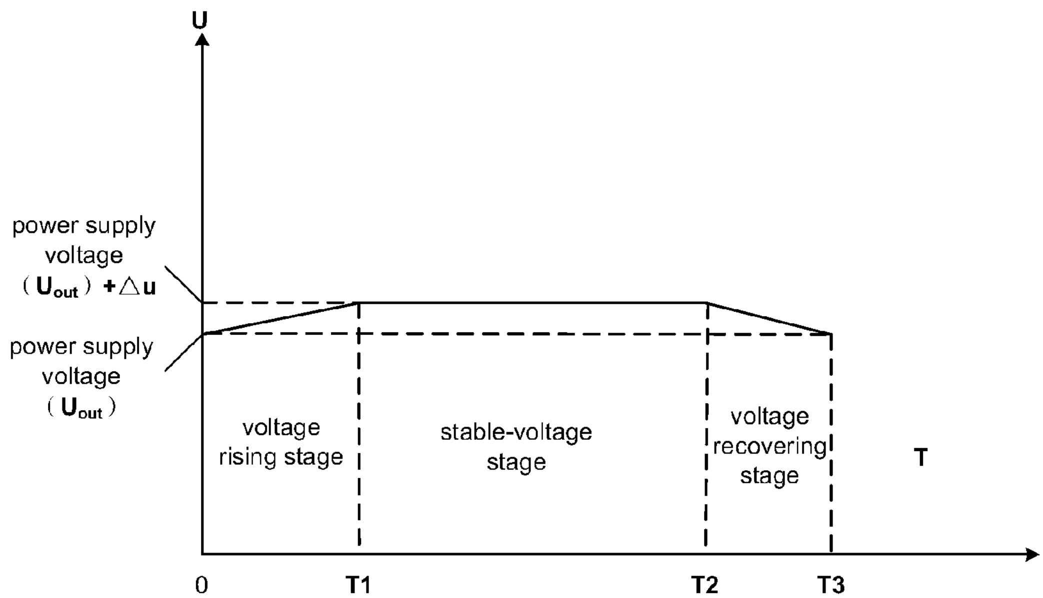

U
power supply
voltage
（U_{out}）+△u
power supply
voltage
（U_{out}）
voltage
rising stage
stable-voltage
stage
voltage
recovering
stage
T
0
T1
T2
T3

Fig. 8

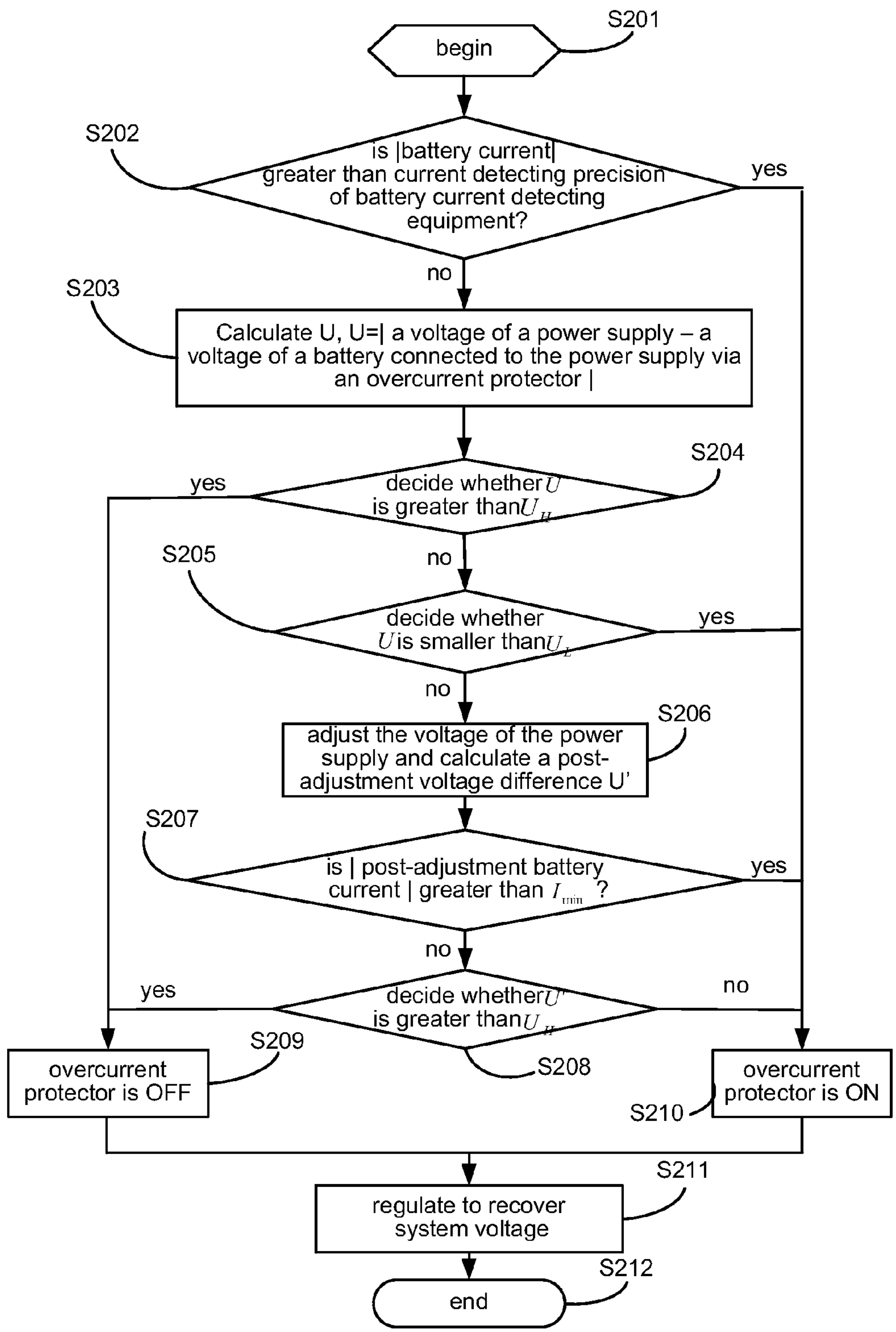
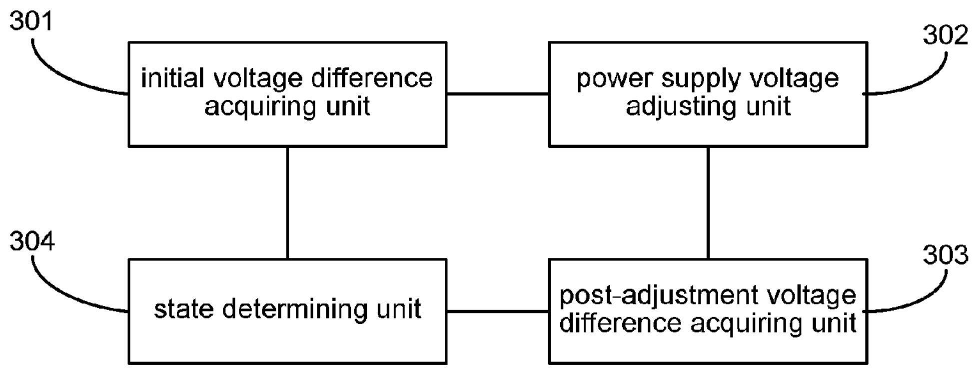

S201
begin
S202
is |battery current| greater than current detecting precision of battery current detecting equipment?
yes
no
S203
Calculate U, U=| a voltage of a power supply – a voltage of a battery connected to the power supply via an overcurrent protector |
S204
yes
decide whether U is greater than U_H
no
S205
decide whether U is smaller than U_L
yes
no
S206
adjust the voltage of the power supply and calculate a post-adjustment voltage difference U'
S207
is | post-adjustment battery current | greater than I_{min} ?
yes
no
yes
decide whether U' is greater than U_H
no
S209
overcurrent protector is OFF
S208
overcurrent protector is ON
S210
S211
regulate to recover system voltage
S212
end

Fig. 9


301
initial voltage difference acquiring unit
power supply voltage adjusting unit
302
304
state determining unit
post-adjustment voltage difference acquiring unit
303

METHOD AND DEVICE FOR DETECTING STATE OF OVERCURRENT PROTECTOR FOR BATTERY

TECHNICAL FIELD

[0001] The disclosure relates to the technical field of electrics, in particular to a method and device for detecting a state of an overcurrent protector for a battery.

BACKGROUND

[0002] In a common load supply system, as backup power of the system, a battery realizes that a load continues to function properly in the case of a main power supply source failure, which ensures the stable and reliable operation of the system. Overcurrent protection for a battery is implemented by cascading an overcurrent protector at a battery input port. When the battery is overly charged/discharged, or the temperature thereof is too high, the overcurrent protector can disconnect automatically so as to protect a load equipment and the battery. The state of the overcurrent protector for the battery is of vital importance, which describes the charging/discharging state of the battery and reflects whether the overcurrent protector is damaged and connected. In the load supply system, the location of the overcurrent protector for battery protection in the whole system is shown in FIG. **1**, wherein the system includes a main power supply, the overcurrent protector, the battery, the load and the like.

[0003] In general, there are two methods for deciding a state of an overcurrent protector. One is to decide the state of the overcurrent protector according to a state of an auxiliary contact of the overcurrent protector. As shown in FIG. **2**, disconnection of the overcurrent protector will lead to jump of the auxiliary contact of the overcurrent protector, the jump of the auxiliary contact is detected via a hardware circuit, thus deciding the state of the overcurrent protector; the other is to decide the state of the overcurrent protector for the battery according to a voltage difference between a battery voltage and a system voltage, namely, voltage difference across the overcurrent protector for the battery. As shown in FIG. **3**, when the overcurrent protector is disconnected (OFF), the battery voltage and the system voltage are not the same, the voltage difference across the overcurrent protector is compared, and then the voltage difference is converted to a numerical quantity, via which the state of the overcurrent protector is decided.

[0004] The detecting method to decide the state of the overcurrent protector according to the state of the auxiliary contact of the overcurrent protector has the following disadvantages: in general, the auxiliary contact adopts a mechanical transmission, which will often lead to the ineffectiveness of the auxiliary contact, thereby making the detection unreliable; compared with the overcurrent protector without the auxiliary contact, the overcurrent protector with the auxiliary contact is higher in price, and has no advantage in terms of costs; and the method requires that a system monitoring equipment must have a hardware detecting circuit for the auxiliary contact, which increases monitoring hardware costs.

[0005] The method for deciding the state of the overcurrent protector for the battery according to the voltage difference between the battery voltage and the system voltage has the following disadvantages: the voltage difference between the battery voltage and the system voltage is associated with the quality and extent of charging/discharging of the battery, when the quality of the battery is good and the extent of charging/discharging is low, this voltage difference will be very small. And the voltage difference decision will usually be based on one fixed criterion, in the case of a low voltage difference across the overcurrent protector, this will thus inevitably lead to the misjudgement of the state of the overcurrent protector. In addition, the method requires that a DC power monitoring equipment must have a voltage interface circuit and a voltage comparing and distinguishing circuit, which increases monitoring hardware costs.

SUMMARY

[0006] The technical problem to be solved by the disclosure is to provide a method and device for detecting a state of an overcurrent protector for a battery, so as to solve the problem of low reliability or misjudgement when deciding the state of the overcurrent protector in the prior art.

[0007] To solve the aforementioned technical problem, on one hand, the disclosure provides a method for detecting a state of an overcurrent protector for a battery, which includes:

[0008] acquiring a voltage U_{out} of a power supply and a voltage U_{bat} of a battery connected to the power supply via an overcurrent protector, and calculating U, wherein $U=|U_{out}-U_{bat}|$;

[0009] when $U_L \le U \le U_H |I_{bat}| \le I_{min}$, adjusting the voltage of the power supply to be U'_{out}, wherein U_L is a minimum value of a difference between the voltage of the power supply and the voltage of the battery, U_H is a maximum value of the difference between the voltage of the power supply and the voltage of the battery, I_{bat} is a current of the battery, and I_{min} is a current detecting precision of an equipment for detecting the current of the battery;

[0010] acquiring the voltage of the battery U'_{bat} after adjusting the voltage of the power supply, and calculating U', wherein $U'=|U'_{out}-U'_{bat}|$; and

[0011] determining a state of the overcurrent protector for the battery.

[0012] Furthermore, when $U_{out}>U_{bat}$, $U_{out}=U'_{out}+\Delta u$; when $U_{out} \le U_{bat}$, $U'_{out}=U_{out}-\Delta u$, wherein Δu is an adjustment value of the voltage of the power supply.

[0013] Furthermore, the determining a state of the overcurrent protector for the battery may include: when $U' \le U_H$, the state of the overcurrent protector for the battery is ON; when $U'>U_H$, the state of the overcurrent protector for the battery is OFF.

[0014] Furthermore, the determining a state of the overcurrent protector for the battery may include: when $U<U_L$ or $|I_{bat}|>I_{min}$, the state of the overcurrent protector for the battery is ON.

[0015] Furthermore, the determining a state of the overcurrent protector for the battery may include: when $U>U_H$ and $|I_{bat}| \le I_{min}$, the state of the overcurrent protector for the battery is OFF.

[0016] On the other hand, the disclosure further provides a device for detecting a state of an overcurrent protector for a battery, which includes:

[0017] an initial voltage difference acquiring unit, which is configured to acquire a voltage U_{out} of a power supply and a voltage U_{bat} of a battery connected to the power supply via an overcurrent protector, and to calculate U, wherein $U=|U_{out}-U_{bat}|$;

[0018] a power supply voltage adjusting unit, which is configured to adjust, when $U_L \le U \le U_H$ and $|I_{bat}| \le I_{min}$, the voltage of the power supply to be U'_{out}, wherein U_L is a minimum value of a difference between the voltage of the power supply and the voltage of the battery, U_H is a maximum value of the difference between the voltage of the power supply and the voltage of the battery, I_{bat} is a current of the battery, and I_{min} is a current detecting precision of an equipment for detecting the current of the battery;

[0019] a post-adjustment voltage difference acquiring unit, which is configured to acquire the voltage of the battery ^{U}bat after adjusting the voltage of the power supply, and to calculate U', wherein $U'=|U'_{out}-U'_{bat}|$; and

[0020] a state determining unit, which is configured to determine a state of the overcurrent protector for the battery.

[0021] Furthermore, when out $U_{out}>U_{bat}$, $U'_{out}=U_{out}+\Delta u$; when $U_{out}\leq U_{bat}$, $U'_{out}=U_{out}-\Delta u$, wherein Δu wherein Δu is an adjustment value of the voltage of the power supply.

[0022] Furthermore, when $U'\leq U_H$, the state determining unit may determine that the state of the overcurrent protector for the battery is ON; when $U'>U_H$, the state determining unit may determine that the state of the overcurrent protector for the battery is OFF.

[0023] Furthermore, when $U<U_L$ or $|I_{bat}|>I_{min}$, the state determining unit may determine that the state of the overcurrent protector for the battery is ON.

[0024] Furthermore, when $U>U_H$ and bad $|I_{bat}|\leq I_{min}$, state determining unit may determine that the state of the overcurrent protector for the battery is OFF.

[0025] The beneficial effect of the disclosure is as follows.

[0026] With the disclosure, in the case that the difference between the battery voltage and the supply voltage is small, by regulating the supply voltage and comparing the voltage difference across the overcurrent protector again, accurate detection of the state of the overcurrent protector for the battery is enabled, with a high reliability and a low possibility of misjudgement. In addition, the state of the overcurrent protector for the battery is decided just by using existing detect data, without the need for additional extpansion of a circuit for detecting the state of the overcurrent protector, thereby reducing detecting costs.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] FIG. **1** is a schematic diagram of the structure of a load supply system containing an overcurrent protector for a battery in the prior art;

[0028] FIG. **2** is a schematic diagram of a circuit for deciding a state of an overcurrent protector according to a state of an auxiliary contact of an overcurrent protector in the prior art;

[0029] FIG. **3** is a schematic diagram of a circuit for deciding a state of an overcurrent protector according to a voltage difference between a battery voltage and a supply voltage in the prior art;

[0030] FIG. **4** is a flowchart of a method for detecting a state of an overcurrent protector for a battery in an embodiment of the disclosure;

[0031] FIG. **5** is a schematic diagram of a circuit for detecting a state of an overcurrent protector for a battery in an embodiment of the disclosure;

[0032] FIG. **6** is a diagram of zones for deciding a state of an overcurrent protector for a battery in an embodiment of the disclosure;

[0033] FIG. **7** is a schematic diagram of the variation of a power supply voltage with time during voltage adjustment of the power supply in an embodiment of the disclosure;

[0034] FIG. **8** is a flowchart of another method for detecting a state of an overcurrent protector for a battery in an embodiment of the disclosure; and

[0035] FIG. **9** is a schematic diagram of the structure of a device for detecting a state of an overcurrent protector for a battery in an embodiment of the disclosure.

DETAILED DESCRIPTION

[0036] To solve the problem of low reliability or misjudgement when deciding a state of an overcurrent protector in the prior art, the disclosure provides a method and device for detecting a state of an overcurrent protector for a battery, and is further elaborated below with reference to the drawings and embodiments. It should be understood that, a specific embodiment described herein is merely intended to explain the disclosure, and is not intended to limit the disclosure.

[0037] FIG. **4** is a flowchart of a method for detecting a state of an overcurrent protector for a battery in an embodiment of the disclosure; FIG. **5** is a schematic diagram of a circuit for detecting a state of an overcurrent protector for a battery in an embodiment of the disclosure; as shown in FIG. **4** and FIG. **5**, an embodiment of the disclosure relates to a method for detecting a state of an overcurrent protector for a battery, which includes the following steps:

[0038] Step **S101**: a voltage ^{U}out of a power supply and a voltage U_{bat} of a battery connected to the power supply via an overcurrent protector are acquired, and a difference between the voltage of the power supply and the voltage of the battery $U=|U_{out}-U_{bat}|$is calculated;

[0039] Step **S102**: first, the minimum value U_L of and the maximum value U_H of the difference between the voltage of the power supply and the voltage of the battery, a current I_{bat} of the battery to be detected, and a current detecting precision I_{min} of an equipment for detecting the current of the battery are to be set up beforehand; U_L and U_H are associated with the hardware detecting circuit and a detecting precision. A user may sets up U_L, U_H according to an empirical value, or may eventually obtain a proper value through multiple tests and adjustments after the setup. I_{min} is associated with factors such as the precesion of a battery current detecting circuit, a battery capacity and the like, and may be measured by a detecting instrument.

[0040] When $|I_{bat}|>I_{min}$, namely, when an absolute value of a battery current exceeds I_{min}, a charging or discharging current of the battery shows that the battery is still coupled to a system output, it thus may be decided that the overcurrent protector for the battery is normal, namely, the state of the overcurrent protector is ON, in which case a deciding area is an ON2 area of the overcurrent protector in FIG. **6**.

[0041] When $|I_{bat}|\leq I_{min}$ and $U<U_L$, namely, when an absolute value of a voltage difference across the overcurrent protector for the battery is smaller than U_L, the battery should be connected to a system output end via the overcurrent protector for the battery, so there is substantially no voltage difference between the two, thus the state of the overcurrent protector for the battery is normal, namely, the state of the overcurrent protector is ON, in which case the deciding area is an ON**1** area of the overcurrent protector for the battery in FIG. **6**.

[0042] when $|I_{bat}|\leq I_{min}$ and $U>U_H$, namely, when the absolute value of the voltage difference across the overcurrent protector for the battery is greater than U_H, the battery should be disconnected from the system output end, thus the state of the overcurrent protector for the battery is OFF. In which case, the deciding area is an OFF area of the overcurrent protector for the battery in FIG. **6**.

[0043] When $|I_{bat}|\leq I_{min}$ and $U_{L\leq U\leq UH}$ namely, the voltage difference across the overcurrent protector for the battery exists between U_L and U_H, and the absolute value of the battery current is smaller than I_{min}, in which case the deciding of the state of the overcurrent protector for the battery decide enters a detection dead zone shown in FIG. **6**, in which case, due to the constraint of the detecting precision of the hardware circuit and the extent of battery charging/discharging, it is impossible to decide distinctly the state of the overcurrent protector for the battery, thereby easily leading to a misjudgement. In this case, it is possible to decide whether there is a following relation between the battery voltage and the voltage of the power supply, and to decide the state of the overcurrent protector, by deciding whether the battery voltage changes after a system voltage adjustment. Thus, when $U_L\leq U\leq U_H$ and $|I_{bat}|\leq O_{min}$, regulation of the system voltage (the voltage of the main power supply) U_{out} is implemented by regulating the voltage of the main power supply, the voltage of the power supply is adjusted to be U'_{out}; the adjustment value of the voltage of the power supply is Δu , wherein Δu is associated with $(U_{out}-U_{bat})$, U_H, and voltage stability. the range for selecting Δu is $[U_{out}U_{bat}, U_H]$, when $U_{out}>U_{bat}$, $U'_{out}=U_{out}+\Delta u$; when $U_{out}\leq U_{bat}$, $U'_{out}=U_{out}-\Delta u$, such an adjusting range both satisfies a stability requirement of the system output voltage, and can promptly push the deciding area from the dead zone to a distinct area.

[0044] A process for regulating the system voltage (the voltage of the power supply) is as shown in FIG. **7**; a stable-voltage period T_2 and a voltage adjusting period T_1 for the system are associated with a voltage adjusting mode of the system and the stability requirement of the system. After a voltage recovering period T_3 for the system lapses, the system voltage returns to normal, and the state of the overcurrent protector for the battery at this moment is the state determined in the end.

[0045] Step S**103**: the voltage of the battery U'_{bat} after adjustment of the voltage of the power supply is acquired, that is, the voltage of the battery is detected after a main power supply system voltage is adjusted, then the difference between the voltage of the power supply and the voltage of the battery $U'=|U'_{out}-U'_{bat}|$ is calculated after the main power supply system voltage is adjusted; and

[0046] Step S**104**: the state of the overcurrent protector for the battery is determined according to the relation between U' and U_H. If the voltage difference U' is greater than U_H, it showns that the overcurrent protector for the battery is disconnected; if the voltage difference U' is smaller than or equal to U_H, it means that the overcurrent protector is normal, namely, in the ON state.

[0047] Taking a certain communication base station as an example, the AC input of the DC power for communication of the base station is 220V, and a single phase 220V rectifying module is adopted, with a DC output of −48V; the battery capacity is 500 Ah, and the overcurrent protector for the battery adopts a fuse. I_{min} is set to be 0.6 A, U_H is set to be 0.6V, and U_L is set to be 0.3V; the flowchart of a method for deciding the state of the overcurrent protector for the battery is as shown in FIG. **8**, and includes the following steps:

[0048] Step S**201**: begin;

[0049] Step S**202**: first, decide whether $|I_{bat}|$ is greater than I_{min}; if yes, go to step S**210**; otherwise, go to step S**203**. The reason the present step is carried out first is because, as shown in FIG. **6**, when $|I_{bat}|$ is greater than I_{min}, the overcurrent protector for the battery is in the ON state, the state of the overcurrent protector for the battery may be obtained straightforwardly.

[0050] Step S**203**: acquire a battery voltage U_{bat} and a system voltage U_{out}, then get an absolute value of a voltage difference U between the two, namely, the absolute value of the voltage difference across the overcurrent protector for the battery U, $U=|U_{out}-U_{bat}|$;

[0051] Step S**204**: decide whether U is greater than U_H, namely, decide whether U is greater than 0.6V; if yes, go to step S**209**; otherwise, go to step S**205**;

[0052] Step S**205**: decide whether U is smaller than U_L, namely, decide whether U is smaller than 0.3V; if yes, go to step S**210**; otherwise, go to step S**206**;

[0053] Step S**206**: when $0.3V\leq U\leq 0.6V$, and $|I_{bat}|\leq 0.6A$, it is impossible to decide the ON/OFF state of the overcurrent protector, in which case a deciding by voltage adjustment is required. If $U_{out}>U_{bat}$, a system voltage after regulation $U'_{out}=U_{out}+0.6$; if $U_{out}<U_{bat}$, the system voltage after regulation $U'_{out}=U_{out}-0.6$; the voltage difference across the overcurrent protector for the battery is acquired again, wherein the voltage of the battery is U'_{bat} after the voltage of the power supply is adjusted; $U'=|U'_{out}-U'_{bat}|$ is calculated;

[0054] Step S**207**: decide whether $|I_{bat}|$ is greater than I_{min}; if yes, go to step S**210**; otherwise, go to step S**208**; wherein $|I'_{bat}|$ is the current of the battery after the voltage of the power supply is adjusted;

[0055] Step S**208**: decide whether U' is greater than U_H, namely, decide whether U' is greater than 0.6V; if yes, go to step S**209**; otherwise, go to step S**210**;

[0056] Step S**209**: decide that the state of the overcurrent protector for the battery is OFF;

[0057] Step S**210**: decide that the state of the overcurrent protector for the battery is normal, namely, the state of the overcurrent protector for the battery is ON;

[0058] Step S**211**: recover the power supply DC output voltage to U_{out}, display the state of the overcurrent protector, and complete the detection; and

[0059] Step S**212**: end.

[0060] As shown in FIG. **9**, the disclosure further relates to a device for implementing the aforementioned method, namely, a device for detecting a state of an overcurrent protector for a battery, which includes:

[0061] an initial voltage difference acquiring unit **301** configured to acquire a voltage U_{out} of a power supply and a voltage U_{bat} of a battery connected to the power supply via an overcurrent protector, and to calculate U, wherein $U=|U_{out}-U_{bat}|$;

[0062] a power supply voltage adjusting unit **302** configured to adjust, when $U_{L\leq U\leq UH\ and\ |Ibat}|\leq I_{min}$, the voltage of the power supply to be U'_{out}, wherein U_L is the minimum value of the difference between the voltage of the power supply and the voltage of the battery, U_H is the maximum value of the difference between the voltage of the power supply and the voltage of the battery, I_{bat} is a current of the battery, and I_{min} is a current detecting precision of an equipment for detecting the current of the battery;

[0063] a post-adjustment voltage difference acquiring unit **303** configured to acquire the voltage of the battery U'_{bat} after adjusting the voltage of the power supply, and to calculate U', wherein $U'=|U'_{out}-U'_{bat}|$; and

[0064] a state determining unit **304** configured to determine a state of the overcurrent protector for the battery according to the relation of U' and U_H.

[0065] Wherein, when $U_{out}>U_{bat}$, $U'_{out}=U_{out}+\Delta u$; when $U_{out}\leq U_{bat}$, $U'_{out}=U_{out}-\Delta u$, wherein Δu is the adjustment value of the voltage of the power supply.

[0066] Wherein, when $U<U_L$ or $|I_{bat}|>I_{min}$, the state of the overcurrent protector for the battery is ON.

[0067] Wherein, when $U'\leq U_H$, the state of the overcurrent protector for the battery is ON; when $U'>U_H$, the state of the overcurrent protector for the battery is OFF.

[0068] Wherein, when $U>U_H$ and $|I_{bat}|\leq I_{min}$, the state of the overcurrent protector for the battery is OFF.

[0069] It can be seen from the aforementioned embodiments that, the disclosure may decide the state of the overcurrent protector for the battery just by using existing detect data, without the need for increasing or extpanding a circuit for detecting the state of the overcurrent protector, thereby reducing monitoring hardware costs. Moreover, in the case of a small voltage difference between the battery voltage and the system voltage, by regulating the system voltage and comparing the voltage difference across the overcurrent protector again, accurate detection of the state of the overcurrent protector for the battery is enabled, enhancing the sensitivity in detecting the state of the overcurrent protector. In addition, the battery current is introduced as an additional basis for deciding, accelerating the speed in deciding the state of the overcurrent protector for the battery, which is in better accordance with a real-time requirement.

[0070] Although a preferred embodiment of the disclosure is disclosed for purpose of illustration, a skilled person in the art will be aware of various improvements as well as possible additions and replacements; thus, the scope of the disclosure should not be limited to the aforementioned embodiments.

INDUSTRIAL APPLICABILITY

[0071] With the disclosure, in the case that the difference between the voltage of the battery and the supply voltage is small, by regulating the supply voltage and comparing the voltage difference across the overcurrent protector again, accurate detection of the state of the overcurrent protector for the battery is enabled, with a high reliability and a low possibility of misjudgement. In addition, the state of the overcurrent protector for the battery is decided just by using existing detect data, without the need for additional extpansion of a circuit for detecting the state of the overcurrent protector, thereby reducing detecting costs.

What is claimed is:

1. A method for detecting a state of an overcurrent protector for a battery, comprising:

acquiring a voltage U_{out} out of a power supply and a voltage U_{bat} of a battery connected to the power supply via an overcurrent protector, and calculating U, wherein $U=|U_{out}-U_{bat}$**51** ;

when $U_L\leq U\leq U_H$ and $|I_{bat}|\leq I_{min}$ and adjusting the voltage of the power supply to be U'_{out}, wherein U_L is a minimum value of a difference between the voltage of the power supply and the voltage of the battery, U_H is a maximum value of the difference between the voltage of the power supply and the voltage of the battery, I_{bat} is a current of the battery, and I_{min} is a current detecting precision of an equipment for detecting the current of the battery;

acquiring the voltage of the battery U'_{bat} after adjusting the voltage of the power supply, and calculating U', wherein $U'=|U'_{out}-U'_{bat}|$; and

determining a state of the overcurrent protector for the battery.

2. The method for detecting a state of an overcurrent protector for a battery according to claim **1**, wherein when $U_{out}>U_{bat}$, $U'_{out}=U_{out}+\Delta u$; when $U_{out}\leq U_{bat}$, $U'_{out}=U_{out}-\Delta u$, wherein Δu is an adjustment value of the voltage of the power supply.

3. The method for detecting a state of an overcurrent protector for a battery according to claim **1**, wherein the determining a state of the overcurrent protector for the battery comprises: when $U'\leq U_H$, the state of the overcurrent protector for the battery is ON; when $U'>U_H$, the state of the overcurrent protector for the battery is OFF.

4. The method for detecting a state of an overcurrent protector for a battery according to claim **1**, wherein the determining a state of the overcurrent protector for the battery comprises: when $U<U_L$ or $|I_{bat}|>I_{min}$, the state of the overcurrent protector for the battery is ON.

5. The method for detecting a state of an overcurrent protector for a battery according to claim **1**, wherein the determining a state of the overcurrent protector for the battery comprises: when $U>U_H$ and $I_{bat}|\leq I_{min}$, the state of the overcurrent protector for the battery is OFF.

6. A device for detecting a state of an overcurrent protector for a battery, comprising:

an initial voltage difference acquiring unit, which is configured to acquire a voltage U_{out} of a power supply and a voltage U_{bat} of a battery connected to the power supply via an overcurrent protector, and to calculate U, wherein $U=|U_{out}-U_{bat}|$;

a power supply voltage adjusting unit, which is configured to adjust, when $U_L\leq U\leq U_H$ and $|I_{bat}|\leq I_{min}$, the voltage of the power supply to be U'_{out}, wherein U_L is a minimum value of a difference between the voltage of the power supply and the voltage of the battery, U_H is a maximum value of the difference between the voltage of the power supply and the voltage of the battery, I_{bat} is a current of the battery, and I_{min} is a current detecting precision of an equipment for detecting the current of the battery;

a post-adjustment voltage difference acquiring unit, which is configured to acquire the voltage of the battery U'_{bat} after adjusting the voltage of the power supply, and to calculate U', wherein $U'=|U'_{out}-U'_{bat}|$; and

a state determining unit, which is configured to determine a state of the overcurrent protector for the battery.

7. The device for detecting a state of an overcurrent protector for a battery according to claim **6**, wherein when $U_{out}>U_{bat}$, $U'_{out}=U_{out}+\Delta u$; when $U_{out}\leq U_{bat}$, $U'_{out}=U_{out}-\Delta u$, wherein Δu is an adjustment value of the voltage of the power supply.

8. The device for detecting a state of an overcurrent protector for a battery according to claim **6**, wherein when $U'\leq U_H$, the state determining unit determines that the state of the overcurrent protector for the battery is ON; when $U'>U_H$, the state determining unit determines that the state of the overcurrent protector for the battery is OFF.

9. The device for detecting a state of an overcurrent protector for a battery according to claim **6**, wherein when $U<U_L$ or $|I_{bat}|>I_{min}$, the state determining unit determines that the state of the overcurrent protector for the battery is ON.

10. The device for detecting a state of an overcurrent protector for a battery according to claim **6**, wherein when $U>U_H$ and $|I_{bat}|\leq I_{min}$, the state determining unit determines that the state of the overcurrent protector for the battery is OFF.

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