



(51) International Patent Classification:

H02H 7/18 (2006.01) *H02H 3/06* (2006.01)
H02H 3/08 (2006.01)

(21) International Application Number:

PCT/CN2012/085298

(22) International Filing Date:

26 November 2012 (26.11.2012)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

201120476562.5 25 November 2011 (25.11.2011) CN

(71) Applicants: **SHENZHEN BYD AUTO R&D COMPANY LIMITED** [CN/CN]; Part B, 1/F, Bldg # B2, Yucan Industrial Area, Lanzhu Road, Shenzhen Export Processing Zone, Shenzhen Grand Industrial Zone, Shenzhen, Guangdong 518118 (CN). **BYD COMPANY LIMITED** [CN/CN]; No. 3009, BYD Road, Pingshan, Shenzhen, Guangdong 518118 (CN).

(72) Inventors: **HE, Long**; No. 3009, BYD Road, Pingshan, Shenzhen, Guangdong 518118 (CN). **ZHU, Jianhua**; No. 3009, BYD Road, Pingshan, Shenzhen, Guangdong 518118 (CN). **LAI, Qing**; No. 3009, BYD Road, Pingshan, Shenzhen, Guangdong 518118 (CN). **TONG, Zhiwei**; No. 3009, BYD Road, Pingshan, Shenzhen, Guangdong 518118 (CN). **LU, Zhipei**; No. 3009, BYD Road, Pingshan, Shenzhen, Guangdong 518118 (CN).

(74) Agent: **TSINGYIHUA INTELLECTUAL PROPERTY LLC**; Room 301, Trade Building, Zhaolanyuan, Tsinghua University, Qinghuayuan, Haidian District, Beijing 100084 (CN).

(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, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, 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, 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.

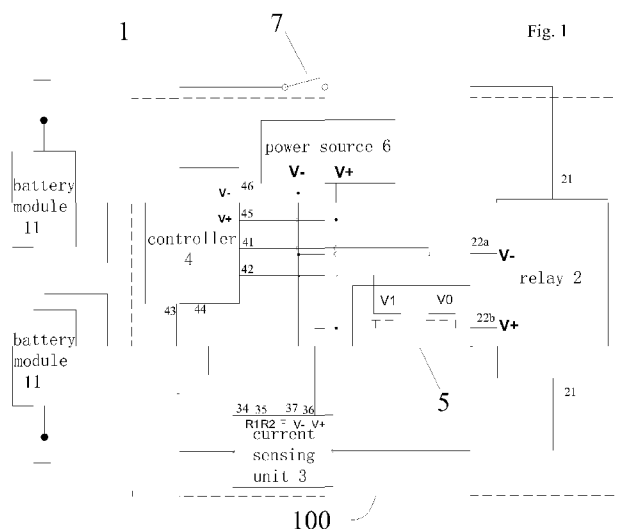
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, 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, ML, MR, NE, SN, TD, TG).

Published:

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

[Continued on next page]

(54) Title: POWER BATTERY ASSEMBLY AND ELECTRIC VEHICLE COMPRISING THE SAME



(57) Abstract: A power battery assembly (1) comprises a battery circuit and a circuit protecting unit (100). The circuit protecting unit (100) is connected in series with the battery unit. The circuit protecting unit (100) comprises a relay (2) and a current sensing unit (3) connected in series with the battery circuit, a switching unit (5) connected with the relay (2) for controlling the switching of the relay (2), and a controller (4) connected with the switching unit (5) and the current sensing unit (3) to control the switching on or switching off the switching unit (5) based on comparison of the current value detected by the current sensing unit (3) and sent to the controller (4) with a first predetermined current value. An electric vehicle is also provided.



-
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

POWER BATTERY ASSEMBLY AND ELECTRIC VEHICLE
COMPRISING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

5 This application claims priority to and benefits of Chinese Patent Application Serial No. 201120476562.5, filed with the State Intellectual Performance Office (SIPO) of P. R. China on November 25, 2011, the entire contents of which are incorporated herein by reference.

FIELD

10 The present disclosure relates to the field of vehicle, more particularly to a power battery assembly and an electric vehicle comprising the same.

BACKGROUND

15 The statements in this section merely provide background information related to the present disclosure and may not constitute prior art.

20 With an improved requirement to protect environment, electric vehicles or hybrid vehicles represent future direction in substitution of conventional gasoline vehicles, and as a core component, a power battery is becoming ever more important. The in-vehicle battery requires excellent high rate discharge property and safety performance, since the in-vehicle power battery has to survive in harsh environment or adverse conditions.

25 Short circuit and unremitting overload may bring negative impact to battery lifespan, even render grave accident. Currently, rapid type fuse may be adopted inside a power battery assembly with the characteristic of rapid responsiveness, and under some conditions, a slow type fuse may also be used. However, harmonic waves and pulse currents may accompany work current fluctuation in the power battery assembly, which may cause error in operation and shorten the lifespan of the fuses. In addition, the fuse has to be replaced before the power battery assembly may be run again for driving, for example, an electric car, which may need additional maintenance time with increased cost.

30 SUMMARY

 This summary is provided to introduce a selection of concepts in a simplified form that are

further described below in the Detailed Description. This summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

In viewing thereof, the present disclosure is directed to solve at least one of the problems existing in the art. Accordingly, a power battery assembly may need to be provided, which may reduce maintenance time as well as costs.

According to an aspect of the present disclosure, a power battery assembly may be provided, comprising: a battery circuit having a plurality of battery modules connected in series and/or in parallel; a circuit protecting unit connected in series with the battery circuit having: a relay and a current sensing unit connected in series with the battery circuit, with the current sensing unit detecting a value of a current passing through the relay; a switching unit connected with the relay for controlling on/off of the relay; and a controller connected with the switching unit and the current sensing unit to control the switching on or switching off of the switching unit based on comparison of the value of the current which is detected by the current sensing unit and sent to the controller with a first predetermined current value, and if the current has the value larger than the first predetermined current value and lasts for a first predetermined time period, the switching unit is switched off under the control of the controller, so that the relay is switched off.

With the power battery assembly according to an embodiment of the present disclosure, predetermined currents may be preset in the controller, achieving current overload and short-circuit protection whereas avoiding uncontrollability of a conventional fuse. In addition, when the working current is restored to a normal value, the switching circuit may be switched on under the controlling of the controller, so that the relay in the power battery assembly may be closed to restore the power battery assembly in normal use very quickly, without even any component substitution or the cost relating thereto.

According to an embodiment of the present disclosure, an electric vehicle comprising the power battery assembly may be provided.

Other advantages and features of the disclosure are described below.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects and advantages of the disclosure will become apparent and more

readily appreciated from the following descriptions taken in conjunction with the drawings in which:

Fig. 1 is a schematic diagram of a power battery assembly according to an embodiment of the present disclosure.

5 Fig. 2 is a perspective view of a power battery assembly according to an embodiment of the present disclosure.

Fig. 3 is an enlarged partial view of a part indicated by P shown in Fig. 2; and

Fig. 4 is a schematic perspective view of a current sensor in a power battery assembly according to an embodiment of the present disclosure. .

10

DETAILED DESCRIPTION

Embodiments of the present disclosure will be described in detail in the following descriptions, examples of which are shown in the accompanying drawings, in which the same or similar elements and elements having same or similar functions are denoted by like reference numerals throughout the descriptions. It is to be understood that, the embodiments described herein are merely used to generally understand the present disclosure, but shall not be construed to limit the present disclosure.

15 In the following, a power battery assembly 1 which may be protected from current overload or short-circuit may be explained for illustration with reference to accompanying figures, in which like figure numerals represent like components or parts in the following context. Fig. 1 is a schematic diagram of the power battery assembly 1. And Fig. 2 is a perspective view of the power battery assembly 1.

25 As shown in Fig. 1, the power battery assembly 1 may comprise a battery circuit having a plurality of battery modules 11 connected in series and/or in parallel and a circuit protecting unit 100. The circuit protecting unit 100 may be connected in series with the battery circuit, and may have a relay 2, a current sensing unit 3, a switching unit 5, and a controller 4. The relay 2 and the current sensing unit 3 may be connected in series with the battery circuit, with the current sensing unit 3 detecting a value of a current passing through the relay 2. In one embodiment, the switching unit 5 may be connected with the relay 2 for controlling the relay 2. That is, when the current falls within the normal value, the switching unit 5 is switched on and the relay 2 is switched on. When the current is abnormal, the switching unit 5 is switched off, and the relay 2 is shut down. The

30

controller 4 may be connected with the switching unit 5 and the current sensing unit 3 to control the switching on or switching off of the switching unit 5 based on comparison of the value of the current, detected by the current sensing unit 3 and sent to the controller 4, with a first predetermined current value. And if the current has the value larger than the first predetermined current value and lasts for a first predetermined time period, the switching unit 5 may be switched off under the control of the controller 4. In one embodiment, the switching unit 5 may be switched off under the control of the controller 4 if the current detected by the current sensing unit 3 may have a value larger than a second predetermined current value which is larger than the first predetermined current value and lasts for a second predetermined time period. In one embodiment, the first predetermined current value may be an overload protecting current value of the power battery assembly 1, and the second predetermined current value may be a short-circuit current value of the power battery assembly 1. Alternatively, in another embodiment, the current value detected by the current sensing unit 3 may be an average value within a predetermined time duration.

With the power battery assembly 1 according to an embodiment of the present disclosure, predetermined currents may be preset in the controller 4, achieving overcurrent and short-circuit protection whereas avoiding uncontrollability of a conventional fuse. In addition, when the working current is restored to a normal value, the switching circuit 5 may be switched on under the controlling of the controller 4, so that the relay 2 in the power battery assembly 1 may be closed to restore the power battery assembly 1 in normal use very quickly, without even any component substitution or the cost relating thereto.

Referring to Fig. 2, the battery modules connected in series and/or in parallel may be provided on a battery supporting tray 12, and a positive terminal 13 and a negative terminal 14 may be lead out from the power battery assembly 1. It should be noted that the battery module is commonly practiced in the art, therefore, the detailed description thereof may be omitted herein for clarity purpose.

Alternatively, in one embodiment, the relay 2, the controller 4 and the current sensing unit 3 may be powered by at least one of the plurality of the battery modules 11 with the switching unit 5 being connected in series between the at least one of the plurality of the battery modules 11 and the relay 2.

Referring to Figs. 1 and 3, a normally open contact 21 of the relay 2 may be connected in series with the battery circuit, and coil windings 22 of the relay 2 may be connected with the switching unit 5 in series to form a sensing circuit. In one embodiment, a power source 6 for powering the relay 2, the controller 4 and the current sensing unit 3 may be provided in the power battery assembly 1, with the switching unit 5 being connected in series between the power source 6 and the relay 2. An end 22a of the coil windings 22 in the relay 2 may be connected with a negative electrode of the power source 6, and the other end 22b may be connected with the positive electrode of the power source 6 via the switching unit 5. In one embodiment, the relay 2 may be high-voltage DC relay with high power, such as Product Model GER-400 distributed by LSIS Co. Ltd, Korea with a rated working current of 400A. And the rated current of the relay 2 may be larger than an upper limit of the normal working current of the power battery assembly 1. And the relay 2 may possess proper dimension accuracy and temperature etc. as conditions may require.

As shown in Fig. 3, the relay 2 may comprise a base 23 formed with mounting holes 24, and the base 23 may be fixed with the battery supporting tray 12 via, for example, screws to avoid physical displacement. In one embodiment, the current sensing unit 3 may be a Hall sensor, and the Hall sensor 3 may comprise a first lead supporting member 31 formed with a via-hole 36 through which a first lead 16 connecting the relay 2 with the battery circuit via the Hall sensor 3 may pass, and a first elastic washer 32 may be provided between the via-hole 36 and the first lead 16 passing therethrough to prevent the first lead 16 from being damaged by the first lead supporting member 31 via frequent friction. The first elastic washer 32 may be formed, for example, by materials with excellent insulation and weather adaptability such as PP, PET, rubber etc.

As shown in Fig. 4, the first lead supporting member 31 may comprise an upper ring 311 and a lower ring 312 with semi-annular shapes, and the upper ring 311 and the lower ring 312 may be hinged with each other via a connecting lug 33, with the other ends being detachably connected via bolts which is easy for assembly and disassembly.

In one embodiment, the Hall sensor 3 may comprise output terminals 34, 35 for connecting with the controller 4 and power terminals 36, 37. The current signal detected by the Hall sensor 3 may be transmitted to the controller 4 via the output terminals 34, 35, and the Hall sensor 3 may be

powered by the power source 6 via the power terminals 36, 37.

As shown in Fig. 3, a mounting bracket 15 for supporting the current sensing unit 3 may be provided on the battery supporting tray 12, and the Hall sensor 3 may be fixed to the mounting bracket 15 via screws.

5 In one embodiment, the circuit protecting unit 100 may further comprise a lead supporting bracket 8 for supporting and fixing a second lead 86 connecting the relay 2 with the battery circuit (i.e. battery module 11). The lead supporting bracket 8 may be supported on the battery supporting tray 12. In one embodiment, the lead supporting bracket 8 may comprise: a base 81 fixed on the battery supporting tray 12, a lower semi-ring 82 fixed on the base 81, an upper semi-ring 83 mated
10 with the lower semi-ring 82 via flanges 84 formed on the upper and lower semi-rings 82, 83 respectively. A second elastic washer 85 may be provided between the second lead 86 and an opening formed by the mated lower and upper semi-rings 82, 83. In one embodiment, the upper and lower semi-rings 82, 83 may be hinged at the flanges 84 and fixed with each other at the other flanges (not shown) opposite to the flanges 84 via screws. In one embodiment, a second elastic
15 washer 85 may be provided between the upper and lower semi-rings 82, 83 and the second lead 86.

In one embodiment, as shown in Fig. 1, the switching unit 5 may comprise: a first MOSFET V0 and a second MOSFET V1 connected in series, with grid electrodes of the first MOSFET V0 and the second MOSFET V1 being connected with output terminals 41, 42 of the controller 4 respectively. A drain electrode of the MOSFET V1 may be electrically connected with the source
20 electrode of the MOSFET V0, and a source electrode of the MOSFET V1 may be electrically connected with the positive electrode of the power source 6, a drain electrode of the MOSFET V0 may be electrically connected with the input terminal 24, as shown in Fig. 3. In one embodiment, the controller 4 performs the current overload and short-circuit protection independently, which will be described in detail in the following. And the switching may be controlled by the MOSFET
25 V0 and the MOSFET V1 respectively. Only when the MOSFET V0 and the MOSFET V1 are switched on at the same time, may the coil windings 22 of the relay 2 be energized with the normally open contact 21 being switched on, thus the power battery assembly 1 may enter into a normal working state.

In one embodiment, the controller 4 may be an IC controller having input terminals 43, 44,
30 output terminals 41, 42 and power terminals 45, 46. The input terminals 43, 44 may be connected

to output terminals of the Hall sensor 3 respectively. As explained hereinabove, the output terminals 41, 42 may be connected with the grid electrodes of the MOSFET V0 and the MOSFET V1 respectively. And the power terminals 45, 46 may be connected with the positive and negative electrodes of the power source 6 respectively to be powered by the power source 6.

5 As stated above, the first predetermined current value may be stored in the controller 4 for the determination of normal working of the power battery assembly 1. For example, the power battery assembly 1 may have a working current of 250A with a continuous working current of 450A, and the power battery assembly 1 may have an overload protecting current of 300A, i.e., the first predetermined current value, with a first duration, i.e. the first predetermined time period, less than
10 5min. And the power battery assembly 1 may have a short-circuit protecting current of 600A, i.e., the second predetermined current value with a maximum lasting duration, i.e., the second predetermined time period, of 30 seconds. Then the current in the battery module 11 is less than 250A, the current value is detected by the Hall sensor 3 and sent to the controller 4. And the controller 4 compares the current value detected with the first predetermined current value, and
15 outputs an up level resulting the switching on of the MOSFETs V0 and V1, and the coil windings 22 of the relay 2 is energized with the normally open contact 21 being closed, and the battery module 11 is switched on and the power battery assembly 1 enters into a normal working state. When the current in the power battery assembly 1 is larger than 250A, the current value detected by the Hall sensor 3 may be sent to the controller 4, and the current value is compared with the
20 first predetermined current value, and if the average value of the current within the first predetermined time period is larger than the first predetermined current value, the output terminal 41 corresponding to the overload protection outputs a low level, and the MOSFET V0 is switched off, the coil windings 22 of the relay 2 is de-energized, the normally open contact 21 is switched off, and the battery module 11 is switched off correspondingly to trigger the current overload
25 protection.

When the current value in the power battery assembly 1 is larger than 450A, the Hall sensor 3 detects the current value and send the current value to the controller 4, and the controller 4 compares the value of the current detected with the second predetermined current value, if the average value of the current detected within the second predetermined time period, for example,
30 30 seconds as mentioned above, is larger than the second predetermined current value, the output

terminal 42 corresponding to the short-circuit protection outputs a lower level, and the MOSFET V1 is switched off, and the coil windings 22 of the relay 2 is de-energized, the normally open contact 21 is switched off, the battery module 11 is switched off correspondingly, triggering the current short-circuit protection.

5 For maintenance purpose, a switch 7 is electrically connected in series between the circuit protecting unit 100 and the battery circuit, as shown in Fig. 1, so that the power battery assembly 1 may be serviced when maintenance is necessary.

10 In the following, the working principles of the power battery assembly 1 will be described in brief. As shown in Fig. 1, when the battery modules 11 run in normal state, an up level is output by the controller 4, and the switching unit 5 is switched on, so that the coil windings 22 of the relay 2 is energized, resulting the close or switching on of the normally open contact 21 and ensuring the switching on of the battery modules 11.

15 When current overload or current short circuit occurs in any one of the battery modules 11, the controller 4 outputs a lower level, the switching unit 5 is switched off, and the coil windings 22 of the relay 2 is de-energized, the normally open contact 21 is switched off, the battery module 11 is switched off correspondingly, triggering the current overload or short-circuit protection accordingly.

20 When faults in the power battery assembly 1 are repaired, the power battery assembly 1 may enter into normal usage under the control of the controller 4, and there is no need for any component substitution, such as the conventional fuse, thus saving time and avoiding additional costs.

In one embodiment, an electric vehicle comprising the power battery assembly 1 as described above may also be provided.

25 Although explanatory embodiments have been shown and described, it would be appreciated by those skilled in the art that changes, alternatives, and modifications may be made in the embodiments without departing from spirit and principles of the disclosure. Such changes, alternatives, and modifications all fall into the scope of the claims and their equivalents.

WHAT IS CLAIMED IS:

1. A power battery assembly, comprising:

a battery circuit having a plurality of battery modules connected in series and/or in parallel;

5 a circuit protecting unit connected in series with the battery circuit having:

a relay and a current sensing unit connected in series with the battery circuit, with the current sensing unit detecting a value of a current passing through the relay;

a switching unit connected with the relay for controlling the relay; and

10 a controller connected with the switching unit and the current sensing unit to control the switching on or off of the switching unit based on comparison of the value of the current detected by the current sensing unit with a first predetermined current value, and if the current has the value larger than the first predetermined current value and lasts for a first predetermined time period, the switching unit is switched off under the control of the controller, so that the relay is switched off.

15 2. The power battery assembly of claim 1, further comprising:

a power source for powering the relay, the controller and the current sensing unit, with the switching unit being connected in series between the power source and the relay.

20 3. The power battery assembly of claim 1, wherein the relay, the controller and the current sensing unit are powered by at least one of the plurality of the battery modules with the switching unit being connected in series between the at least one of the plurality of the battery modules and the relay.

4. The power battery assembly of claim 1, wherein the switching unit comprises:

25 a first MOSFET and a second MOSFET connected in series, with grid electrodes thereof being connected with output terminals of the controller respectively.

5. The power battery assembly of claim 1, wherein the current sensing unit is a Hall sensor.

30 6. The power battery assembly of claim 5, wherein the Hall sensor comprises a first lead

supporting member formed with a via-hole through which a first lead connecting the relay with the battery circuit via the Hall sensor passes, and a first elastic washer is provided between the via-hole and the first lead passing therethrough.

- 5 7. The power battery assembly of claim 1, further comprising:
a battery supporting tray where the battery modules are supported, and
a lead supporting bracket for supporting and fixing a second lead connecting the relay with
the battery circuit, wherein
the lead supporting bracket is supported on the battery supporting tray.

10

8. The power battery assembly of claim 7, wherein the lead supporting bracket comprises:
a base fixed on the battery supporting tray;
a lower semi-ring fixed to the base; and
an upper semi-ring mated with the lower semi-ring via flanges formed on the upper and lower

15 semi-rings respectively, wherein

a second elastic washer is provided between the second lead and an opening formed by the mated lower and upper semi-rings.

9. The power battery assembly of claim 1, wherein a switch is electrically connected in series
20 between the circuit protecting unit and the battery circuit.

10. The power battery assembly of claim 1, wherein the switching unit is switched off under
the control of the controller if the current detected by the current sensing unit has a value larger
than a second predetermined current value larger than the first predetermined current value and
25 lasts for a second predetermined time period.

11. An electric vehicle, comprising a power battery assembly of any one of claims 1-10.

1/2

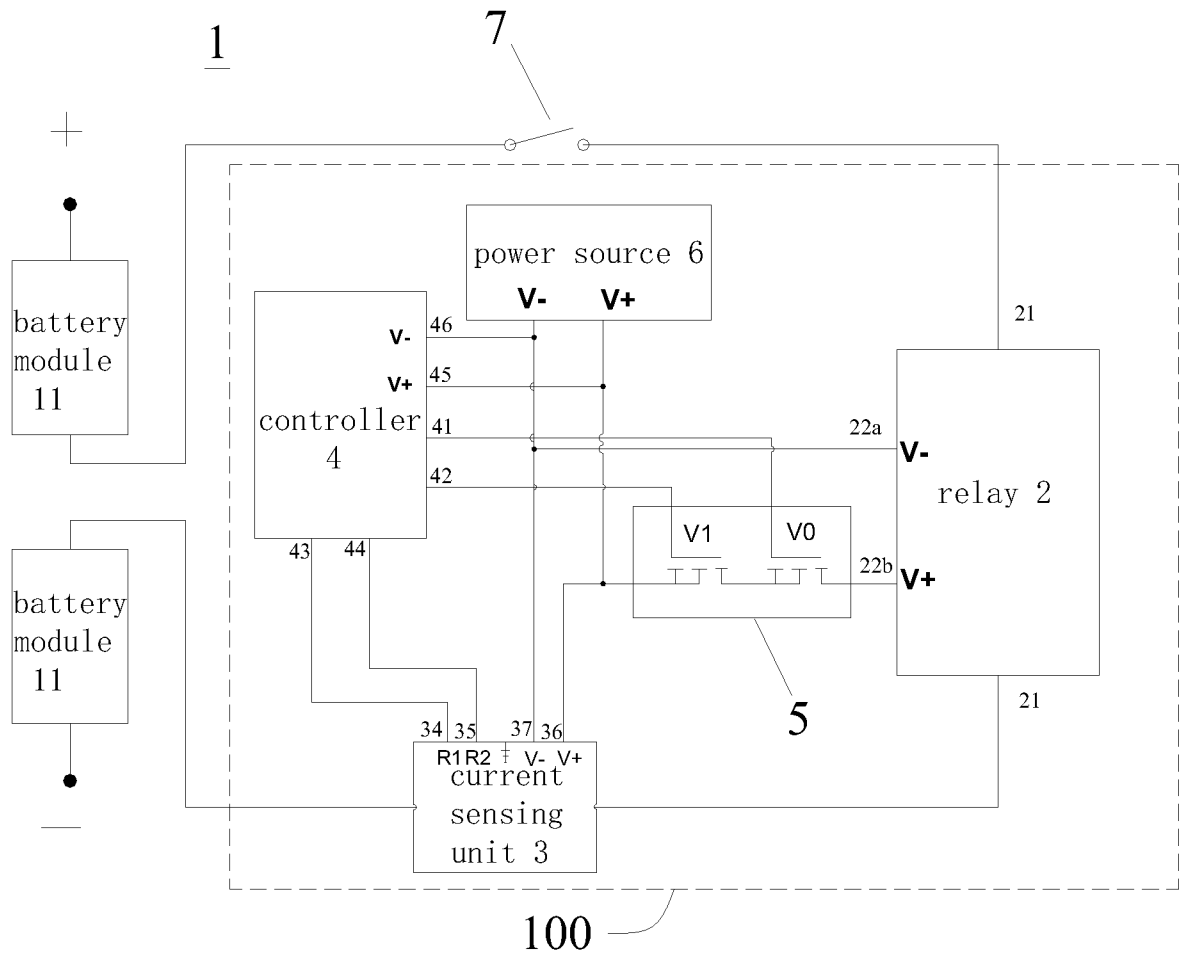


Fig. 1

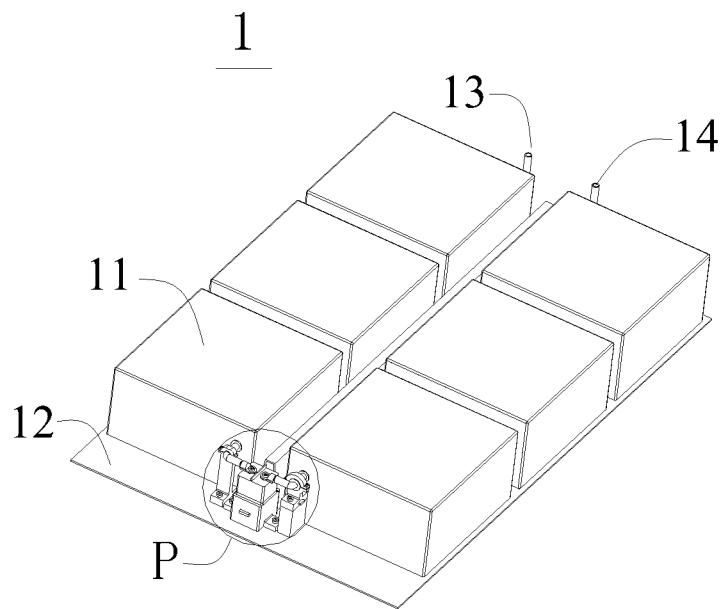


Fig. 2

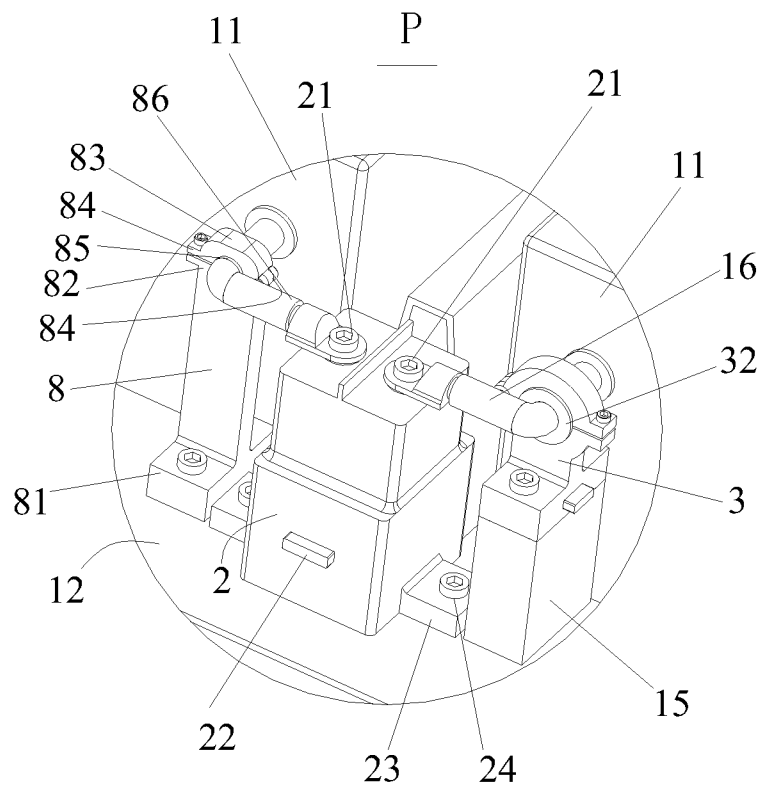


Fig. 3

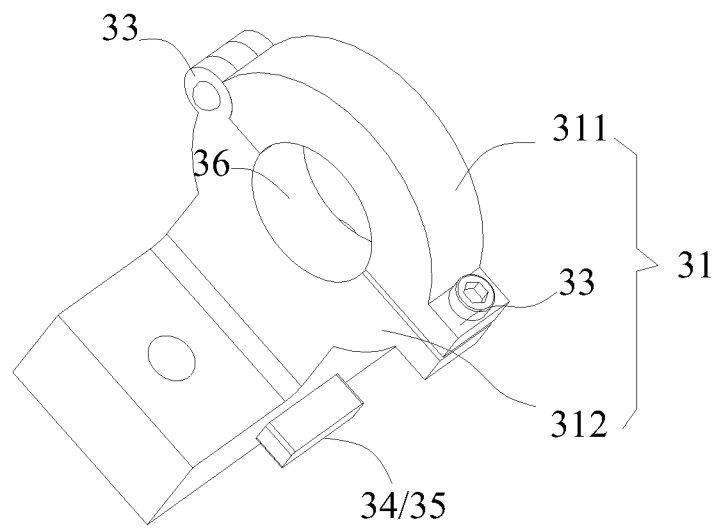


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2012/085298

A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet

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: H01M; H02H

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

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

WPI, EPODOC, CNPAT, CNKI: power, battery, short circuit, short, protect+, circuit, sensor, relay, switch+ circuit

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN202455044U(BIYADI LITHIUM CELL CO LTD SHE) 26 Sep. 2012(26.09.2012) the whole document	1-11
A	CN101740840A(Zhang, He)16 Jun. 2010(16.06.2010) the whole document	1-11
A	CN101741121A(SHANGHAI DLG BATTERY CO LTD)16 Jun. 2010(16.06.2010) the whole document	1-11
A	JP9009514 A(MORIYAMA TAKASHI, et al)10 Jan. 1997(10.01.1997) the whole document	1-11

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

☒ See patent family annex.

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

Date of the actual completion of the international search 01 Feb. 2013 (01.02.2013)	Date of mailing of the international search report 21 Mar. 2013 (21.03.2013)
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer WU, Junxia Telephone No. (86-10)62411619

International application No.
PCT/CN2012/085298

Form PCT/ISA /210 (patent family annex) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2012/085298

Continuation of CLASSIFICATION OF SUBJECT MATTER:

H02H 7/18 (2006.01) i

H02H 3/08 (2006.01) i

H02H 3/06 (2006.01) i