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(54) **Title**: BATTERY PACK,TOOL BATTERY AND BATTERY OPERATED TOOL

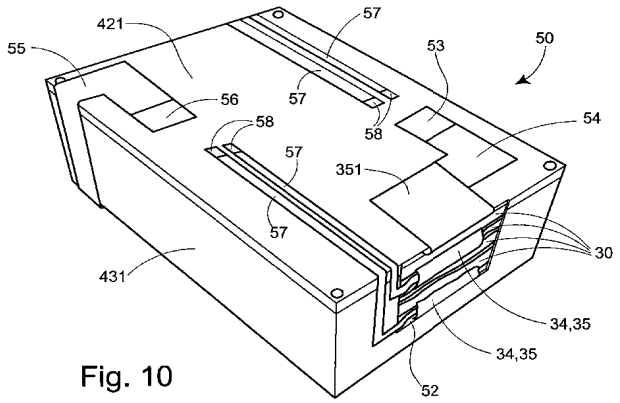


Fig. 10

(57) **Abstract**: A lithium-polymer based battery pack for power a hand held power tool or a garden tool,the battery pack has a plurality of battery cells located within housing that is selectively connectable to and supportable by a hand held power tool or a garden tool. The battery cells have a lithium- polymer based chemistry and a nominal charged internal impedance of less than or equal to approximately 5 milliohms.In one embodiment the cells are think cells are stacked within the housing such that each sell is layered over or under an adjacent cell and a resiliently deformable substrate located between adjacent battery cells.In another embodiment the cells may be interconnected to have a combined output voltage of at least 9 volts and to produce a combined average discharge current of greater than 20 amps.A lithium-polymer tool battery and a battery powered tool are also part of the invention.

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BATTERY PACK, TOOL BATTERY AND BATTERY OPERATED TOOL

Field of the Invention

The present invention relates to battery packs, and to tool batteries and battery operated tools. In particular, the invention relates to a battery pack suitable for powering a hand held cordless power tool.

Background to the invention

Power tools and in particular hand held power tools are increasingly relying on cordless rechargeable battery packs as a powering energy source. Such battery packs are preferably compact and lightweight, but must still deliver relatively high current and voltage for powering the tool motor.

Summary of the Invention

The present invention provides a lithium-polymer based battery pack, a lithium-polymer based tool battery and a lithium-polymer based battery operated tool as set forth in any one of the appended claims.

In particular, in a first aspect of the invention there is provided a lithium-polymer based battery pack for powering a hand held power tool or garden tool, the battery pack comprises a housing selectively connectable to and supportable by a hand held power tool or a garden tool, at least one battery cell located within the housing, the cell having an output voltage of at least 4 volts and producing an average discharge current of greater than 10 amps, wherein the battery cell has a lithium-polymer based chemistry and a nominal charged internal impedance of less than or equal to approximately 10 milliohms. Preferably there is a plurality of battery cells located within the housing, the plurality of cells being interconnected to have a combined output voltage of at least 4 volts and a combined average discharge current of greater than 10 amps, wherein each cell has a lithium-polymer based chemistry and a nominal charged internal impedance of less than or equal to approximately 10 milliohms.

In a second particular aspect of the invention there is provided a lithium-polymer based tool battery comprising a battery housing selectively connectable to and supportable by a hand held

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power tool or a garden tool, a plurality of substantially flat battery cells stacked within the housing such that each sell is layered with an adjacent cell, and a resiliently deformable substrate located between the adjacent battery cells, wherein each battery cell has a lithium-polymer based chemistry and a nominal charged internal impedance of less than or equal to approximately 10 milliohms.

In a third particular aspect of the invention there is provided a lithium-polymer battery powered tool comprising a tool housing, an electrical motor in the tool housing, a motor controller for controlling power supplied to the motor from an electrical energy source, a battery housing selectively connectable to and supportable by the tool housing, and a battery within the battery housing for supplying power to the motor controller and motor when the battery housing is connected with the power tool housing, the battery comprising one or more battery cells, the cell or cells being having a combined output voltage of at least 4 volts and producing a combined average motor supply current of at least 10 amps, wherein each battery cell has a lithium-polymer based chemistry and a nominal charged internal impedance of less than or equal to approximately 10 milliohms.

Further aspects of the invention will become apparent from the following description which is given by way of example only to illustrate the invention.

Description of the Drawings

Various embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 illustrates a power tool battery,

Figure 2 illustrates a cordless power tool,

Figure 3 illustrates a lithium-polymer based battery cell according to the invention,

Figure 4 illustrates a cell pouch for a lithium-polymer based battery,

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Figure 5 illustrates a string of the five battery cells having terminals welded in series prior to forming into a stack of Figure 4,

Figure 6 illustrates a stack of five interconnected lithium-polymer based battery cells forming a tool battery according to the invention,

Figure 7 illustrates a battery cell according to the invention and a resiliently deformable cradle for the battery cell,

Figure 8 illustrates a second view of the battery cell and cradle,

Figure 9 illustrates an explored view of a battery comprising a polarity of lithium-polymer battery cells,

Figure 10 illustrates a first perspective view of a battery case for a lithium-polymer based battery according to the invention,

Figure 11 illustrates a second perspective view of the battery case for a lithium-polymer based battery according to the invention, and

Figure 12 illustrates different connection arrangements for a stack of lithium-polymer battery cells.

Detailed Description of Preferred Embodiments of the Invention

The following description is given by way of example only to illustrate embodiments of the invention. The terminology used is for illustrative purpose only and is not intended to limit the scope or use of the invention, unless the text clearly and explicitly requires otherwise.

Figures 1 and 2 illustrate a typical tool battery 10 and a cordless (battery power) tool 20. The illustrated tool 20 is a drill or driver having a tool housing 21 and a pistol type handle 24. A

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motor 23 (indicated by broken lines) is located within the housing for driving a tool output 22. A battery 10 is connectable to a supported by the tool handle 24. A tool controller such as a trigger 25 is located adjacent the junction between the housing 21 and handle 24 for coupling energy from the battery 10 to the motor 23. This is, however, not intended to limit the scope of use of a battery according to the invention. Such a battery could be used in other types of cordless tools and in particular in hand-held cordless tools or in cordless lawn and garden equipment such as lawn mowers, hedge trimmers and the like. Such a battery could also be used in floor care products such as vacuum cleaners, hand-vacs and cordless sweepers.

A preferred embodiment of a battery for such types of cordless tools has a battery pack housing 11 have a mating face 12 for connecting to the tool. The battery housing 11 is selectively receivable with and supportable by the tool housing via battery connection features, and may be selectively separated from the tool for charging in a separate charger (not shown). One typical embodiment of battery mating features is illustrated in Figures 1. In the illustrated embodiment the battery connection features are a terminal post 13 and battery terminals 14, 15 on the post 13 for connecting the battery energy sources with the tool controller or trigger 25. In alternative embodiments the battery connection features may be slide-type connection features or any other type of battery connection features known in the art. The type of battery connection features in not an essential feature of the invention.

Figures 3 to 11 show details of a battery 40 for location within the battery pack housing 11. The battery 40 comprises a plurality of substantially flat lithium-polymer battery cells 30. Each lithium-polymer cell 30 comprises a first electrode sheet 31 and a second electrode sheet 32 laminated to respective sides of a polymer based separator substrate 33. Connection tabs/tapes 34 and 35 are connected to the respective first and second electrodes sheets 31, 32. The first and second electrode sheets 31, 32 may be any of the lithium-polymer cell anode and cathode combinations known in the art. The polymer separator 33 may be a dry solid polymer electrolyte or porous or micro-porous polymer substrate holding a lithium based electrolyte. The particular anode, cathode and lithium-polymer separator chemistry of the cell is chosen to provide a nominal charged internal cell impedance of less than or equal to approximately 10 milliohms. Each cell 30 may have a typical nominal cell voltage of between 2 volts and 4.2 volt and a

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nominal amp-hour capacity of greater than 1.5 amp-hours. Each cell is preferably, although not exclusively enclosed in a flexible and lightweight pouch 301. The pouch 301 is formed from, for example, an Aluminum laminate film that is folded around the cell 30 and sealed along the three adjoining sides 302, 303, 304. The connection tabs/tapes 34 and 35 protrude from the pouch between the sealed edges of the film.

A substantially flat cell 30 according the invention has a cell length L, cell width W and cell height or thickness H. In the preferred embodiment the cell thickness H is less than 10% of the cell width W. This provides a substantially flat lithium-polymer cell which can be stacked in interconnected groups, as illustrated in Figures 5 to 11 for example, to form a tool battery. For use a tool battery a plurality of the stacked battery cells 30 should have a combined output voltage of at least 4 volts and as high as 40 volts or more. Tool batteries are typically available in stepped voltages of, for example, 4, 9, 12, 18, and as high as 40 volts for some lawn and garden type tools such as lawn mowers. In order to provide sufficient torque in the tool motor the combine average discharge current provide by the plurality of battery cells 30 should be greater than 10 amps, but more preferably 20 amps, although different tools and tool motors will produce different average battery discharge currents.

The tabs 34, 35 from respective ones of the stacked plurality of battery cells 30 are connect together in series and/or parallel in order to provide the required average discharge current and combine output voltage of the battery 40. The connection between the respectively terminal tabs 34, 35 of adjacent cells 30 must be of a lower resistance than the internal resistance of the cells 30 and preferably of a very low resistance so as to prevent heating in the interconnection joint between the cells 30. It is typical in battery manufacturing to interconnect adjacent battery cells by welding respective cell tabs at a weld joint 38. In the preferred embodiment of the invention each battery cell 30 has its respectively pair of tabs 34, 35 on different edges of the cell 30 and preferably on symmetrically opposite edges of the cell 30. This arrangement allows the plurality of cells to be easily interconnected in a string of cells 30 by jointing respective tabs 34, 35 of adjacent cells 30 with a weld joint 38. As the terminal tabs 34, 35 of the cells extend from opposite ends of the cell 30 the weld joint can be quickly and easily formed by a weld between

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adjacent cells 30 without potential for bridging or shorting adjacent terminal tabs of the same cell which in prior art battery designs may be along a same edge of the cell.

After electrical interconnection of the cell tabs 34, 35 the interconnected cells 30 are formed into a vertical stack of cells 30 as shown in Figure 6, for example. In a vertical stack of cells each cell 30 is lying over or under an adjacent one of the cells 30. Although in the illustrated embodiment the cells are stacked vertically with reference to the horizontal plane this is for illustrative and descriptive purposes only and the stack of individual cell 30 may be stacked with each cell lying in a vertical, or any other, plane where each cell 30 is layered with an adjacent one of the cells 30. For the purpose of describing the invention, stacked means each cell lying in adjacent parallel planes. During charge and discharges cycles of the battery the thickness H of each cell 30 may very normally by up to 5% of the cell thickness H. In order to accommodate this variation in cell thickness during charge and discharges cycles the cell stack includes a resiliently deformable substrate 37 interposed between each adjacent battery cell 30. The thickness of the resiliently deformable substrates 37, and thus the distance between adjacent cells, is preferably between 5% and 10% of the normal cell thickness H in order to accommodate for variation in individual cell thickness up to 5%. In some embodiments the resiliently deformable substrate 37 between cells 30 may be provided with a thermally conductive characteristic for conducting heat away from the cells during charge and discharge cycles. For example, the substrate may be resiliently deformable and thermally conductive, or the substrate may be porous, such as a spongy material, and impregnated with a thermally conductive substance.

The cell interconnection tabs 34, 35 extended between adjacent stacked cells 30. To support and protect the interconnection tabs 34, 35 from mechanical damage in some embodiments of the invention a guide member 36 is provided at respective locations adjacent the edge of the stacked cells 30 to abut the interconnected tabs 34, 35 between adjacent cells 30. The guide member 36 has a convex guiding surface that abuts the joined tabs 34, 35 extending between the adjacent cells and supports the joined tabs about a smooth radius between the adjacent cells 30.

The interconnected stack of cells 30 forming battery 40 is located within a battery pack housing such as housing 11 of the battery of Figure 1. It will be appreciated by a skilled person that the

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battery 40 constructed of pouch cells must be physically and mechanically supported within the battery housing 11 against mechanical vibrations and shocks that might be experienced during use of the tool to which a battery pack 10 is connected. Figures 6 to 10 show a cradle and shell arrangement for mechanically supporting a stack of battery cells 30 within the battery housing 11 in some embodiments. Figure 7 shows an individual battery cradle 39 for supporting a substantially flat lithium-polymer battery cell 30. The cradle 39 is a flat substrate of resiliently deformable material such as EVA foam or the like and has a wide cell-channel extending through one face of the substrate. An individual battery cell 30 locates within the cell-channel for support by the cradle. The cradle 39 has side edges 40 to provide mechanical protection for the sides of the battery cell 30 and integrally combines the resiliently deformable cell spacer substrate 37, below the cell-channel, and cell tab guide 36 into a single protective cradle for an individual battery cell 30. Figure 9 shows a stack of battery cells 30 each held within its own individual resiliently deformable cradle 39. The cradled stack of battery cell 30 locates within a cradle frame 43 and is fitted with a cover 42 in order to mechanically hold the stack of battery cells 30 together. A printed circuit board assembly (PCBA) 44 can optionally be attached to or incorporated with the cover 42. The PCBA can contain battery pack electronics and protection circuits. The cradle frame 43 supporting the battery 40 is located within a battery housing 11. The cradles 39 and cradle frame 42, 43 are preferably a "friction fit" within the battery housing 11 such that the battery 40 is mechanically supported against and variations and shocks experienced during use of the battery on a power tool.

In some embodiments further mechanical protection of the pouch cell battery is provided by enclosing the stack of battery cells 30 within a shell or case 50 as shown in Figures 10 and 11. The case 50 comprises a case enclosure 431 having a base and four surrounding side walls defining a cavity into which the stacked battery cells 30 are located. A cover 421 is fixed to the tops of the four surrounding side walls to enclose the cavity and stacked battery cells 30. An opening 51, 52 is provided in each of the opposed end side walls of the case enclosure 431 to allow space for and accommodate connection access to the interconnected terminal tabs 34, 35 of adjacent cells 30. The free end terminal tabs 341 and 251 of the stack of cells 30 pass though respective end openings 51, 52 and are folded through substantially 180-degrees to lie substantially flat with respective upper and lower surfaces of the case 50. The first free terminal

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tab 351 of the stacked cells 30 is folded back against a first surface of the case 50 and electrically connected with one end of a conductive lead strap 54. The second end of the first conductive lead strap 54 has a first exposed connection terminal 53 of copper or other electrically conductive terminal material. The conductive lead strap 54 is preferably a copper strap having an insulated coating such as a polyurethane insulating varnish. The terminal end 53 of the strap is free of the insulating varnish to allow for electrical connection to the strap. The second free terminal tab 341 of the stacked cells 30 is folded back against the second opposite surface of the case 50 and electrically connected with one end of a second conductive lead strap 55. The second conductive lead strap 55 extends flat with the case surface around the side of the case to the first surface of the case 50 where it is provided with a second exposed connection terminal 56 of copper of other electrically conductive terminal material. The second conductive lead strap 55 is preferably a copper strap having an insulated coating such as a polyurethane insulating varnish. The terminal end 56 of the strap is free of the insulating varnish to allow for electrical connection to the strap. In some embodiments auxiliary conductive straps 57 of a type the same or similar to first and second conductive straps 54, 55 are provided for providing addition signal connections to the stack of cells 30. For example, auxiliary conductive straps 57 are preferably provided for each of the interconnected terminal tabs 34, 35 between stacked cells for providing means for measuring individual cell voltages. Each auxiliary conductive strap 57 has a connection terminal 58 at its distal end. Auxiliary conductive straps 57 may also be provided to temperature and other sensors associated with the stack of cells 30. A printed circuit board assembly (PCBA) can optionally be attached to or incorporated with the enclosure cover 421 or within the case 50. The PCBA can contain battery pack electronics and protection circuits.

Within some embodiment a small PCBA is attached to the tabs 34, 35 of the battery cells. Such a PCBA can comprises a sensor for transmitting a voltage dependent sensor signal to the battery controller 44, or a battery charger controller for determining cell voltages for using in, for example, cell balancing operations. In a further embodiment of the invention one or more sensor elements can be located between adjacent cells for measuring temperature and other cell characteristics. In one embodiment a pressure sensor is provided between adjacent cells for detecting expansion in cell thickness during charge and discharge cycles. If pressure or deformation of the substrate between adjacent cells exceeds a threshold this may indicate an

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abnormal and possibly dangerous cell condition. Signals from such sensors are transmitted to the battery controller 44, or a battery charger controller.

Traditional lithium ion cells used in tool batteries are mechanically contained in a strong cylindrical metal can. These cans are grouped together to form a battery and located in a battery pack housing. The interior of the housing has a first housing volume and the grouped cell cans defines a combined battery volume. The fill-factor of a cylindrical body in a substantially square or rectangular housing is at best Pi divided by 4 (Π/4) or 78%. The stacked flat cells of the present invention provides a ratio of the combined battery volume to housing volume (fill ration) of greater than 80%, allowing for a smaller more light weight battery.

In the various embodiments described above the battery comprises a plurality of interconnected cells. In at least one alternative embodiment the battery may comprises just one lithium polymer based chemistry cell. In other alternative embodiment the battery may comprises between 2 and 20 interconnected cells, or more preferably between 2 and 10 interconnected cells. In yet another embodiment the battery may comprises between 3 and 5 cells interconnected in series. In the various embodiments the cells may be interconnected in series, in parallel, or groups of series cells may be interconnected in parallel in order to obtain a desired output voltage and combined average discharge current.

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CLAIMS

1. A lithium-polymer based battery pack for powering a hand held power tool or a garden tool, the battery pack comprising:

a housing selectively connectable to and supportable by a hand held power tool or a garden tool,

a battery cell located within the housing, the cell having an output voltage of at least 4 volts and producing an average discharge current of greater than 10 amps, wherein the battery cell has a lithium-polymer based chemistry and a nominal charged internal impedance of less than or equal to approximately 10 milliohms.

2. The lithium-polymer based battery pack of claim 1 further comprising a plurality of the battery cells located within the housing, the plurality of cells being interconnected to have a combined output voltage of at least 4 volts and a combined average discharge current of greater than 10 amps, wherein each cell has a lithium-polymer based chemistry and a nominal charged internal impedance of less than or equal to approximately 10 milliohms.

3. The lithium-polymer based battery pack of claim 2 wherein the plurality of the battery cells comprises between 2 and 20 cells interconnected in series.

4. The lithium-polymer based battery pack of claim 2 wherein the plurality of the battery cells comprises between 2 and 10 cells interconnected in series.

5. The lithium-polymer based battery pack of claim 2 wherein the plurality of the battery cells comprises between 3 and 5 cells interconnected in series.

6. The lithium-polymer based battery pack of any preceding claim wherein each of the battery cells has a nominal amp-hour capacity of greater than 1.5 amp-hours.

7. The lithium-polymer based battery pack of any preceding claim wherein each of the battery cells has a nominal cell voltage of between 2 volts and 4.2 volts.

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8. The lithium-polymer based battery pack of any preceding claim wherein the battery cells have a combined output voltage of between 4 volts and 40 volts.

9. The lithium-polymer based battery pack of any preceding claim wherein each of the battery cells comprises an anode electrode sheet, a cathode electrode sheet and a lithium-polymer based substrate lamented between the anode and cathode electrode sheets.

10. The lithium-polymer based battery pack of any preceding claim wherein each of the battery cells is generally flat and has a cell width and a cell thickness, the cell thickness being less than 15% of the cell width.

11. The lithium-polymer based battery pack of any one of claims 2 to 10 wherein the plurality of battery cells are layered within the housing such that each cell is lying adjacent another one of the cells, and further including a resiliently deformable substrate between the adjacent cells.

12. The lithium-polymer based battery pack of claim 11 wherein a distance between the adjacent cells in greater than 5% of the cell width.

13. The lithium-polymer based battery pack of claim 11 wherein the resiliently deformable substrate is thermally conductive or contains a thermally conductive component.

14. The lithium-polymer based battery pack of claim 11 including at least one sensor element located between at least two adjacent ones of the cells, said sensor element providing a sensor signal to a battery controller.

15. The lithium-polymer based battery pack of claim 14 wherein the sensor element comprises a temperature sensor.

16. The lithium-polymer based battery pack of claim 14 wherein the sensor element comprises a temperature sensor, and wherein a second pressure sensing element is located

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between at least two adjacent ones of the cells and provides a pressure sensor signal to a battery controller

17. The lithium-polymer based battery pack of any one of claims 2 to 16 wherein the housing defines a housing volume and the plurality of cells provides a combined battery volume, and wherein a ratio of the combined battery volume to the housing volume is greater than 80%.

18. The lithium-polymer based battery pack of any preceding claim wherein each of the battery cells comprises a first connection lead connected with an anode sheet of the cell and a second connection lead connected with a cathode sheet of the cell, the first connection lead extending from a first edge of the cell and the second connection lead extending from a second edge of the cell, the second edge being a different edge to the first edge of the cell.

19. The lithium-polymer based battery pack of claim 18 wherein the second edge is symmetrically opposite the first edge.

20. The lithium-polymer based battery pack of claim 18 or 19 wherein the plurality of battery cells is stacked within the housing such that each cell is lying adjacent another one of the cells, at least one of the connection leads joined with a connection lead of an adjacent cell.

21 The lithium-polymer based battery pack of claim 20 further including a guide member having a convex guiding surface abutting the joined connection leads extending between adjusted cells.

22. The lithium-polymer based battery pack of claim 21 wherein the guide member supports the joined connection leads about a smooth radius between the adjusted cells.

23. The lithium-polymer based battery pack of claim 21 or 22 further including a resiliently deformable substrate between adjacent cells.

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24. The lithium-polymer based battery pack of claim 23 wherein the guide member and resiliently deformable substrate between adjacent cells is a single integral member.

25. The lithium-polymer based battery pack of any preceding claim wherein the plurality of battery cells is supported within the housing in a resiliently deformable cradle surrounding at least a part of each cell.

26. The lithium-polymer based battery pack of claim 25 wherein the resiliently deformable cradle comprises two or more resiliently deformable members each abutting at least one battery cell.

27. A lithium-polymer tool battery comprising:

a housing selectively connectable to and supportable by a hand held power tool or a garden tool,

a plurality of substantially flat battery cells stacked within the housing such that each sell is layered over or under an adjacent cell and a resiliently deformable substrate located between adjacent battery cells, wherein each battery cell has a lithium-polymer based chemistry and a nominal charged internal impedance of less than or equal to approximately 10 milliohms.

28. The lithium-polymer tool battery of claim 27 further including the lithium-polymer battery based pack features of any one of claims 3 to 26.

29. A lithium-polymer battery powered tool comprising:

a power tool housing

an electrical motor in the housing,

a motor control circuit for controlling power supplied to the motor from an electrical energy source,

a battery housing selectively connectable to and supportable by the power tool housing,

a battery within the battery housing for supplying power to the motor control circuit and motor when the battery housing is connected with the power tool housing,

the battery comprising at least one battery cell having an output voltage of at least 4 volts

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and producing a combined average motor supply current of at least 10 amps, wherein each battery cell has a lithium-polymer based chemistry and a nominal charged internal impedance of less than or equal to approximately 10 milliohms.

30. The lithium-polymer tool of claim 29, further including the lithium-polymer battery based pack features of any one of claims 2 to 26.

31. The lithium-polymer tool of claim 29 or 30, wherein the tool is one of a hand held power tool such as a drill or saw, a lawn or garden care tool such as a lawn mower or edge trimmer, or a floor cleaner such as a vacuum cleaner.

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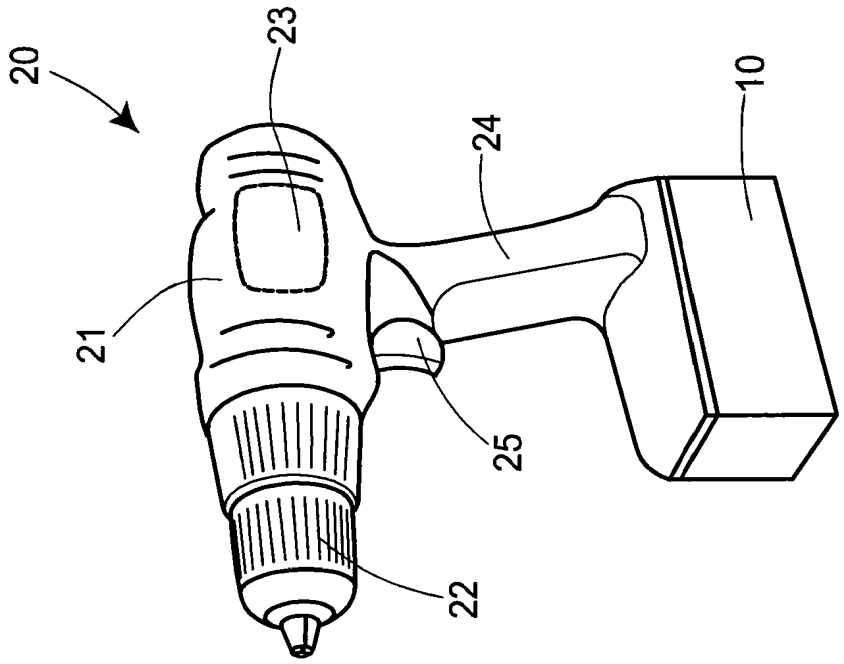


Fig. 2

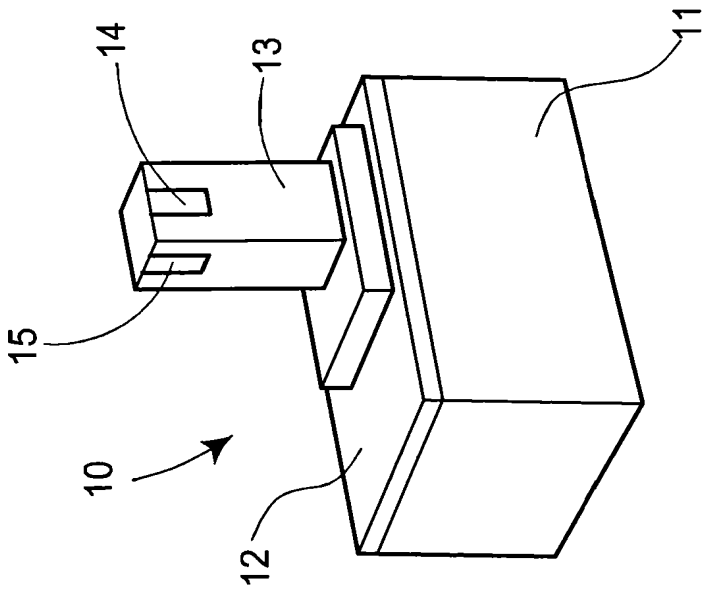


Fig. 1

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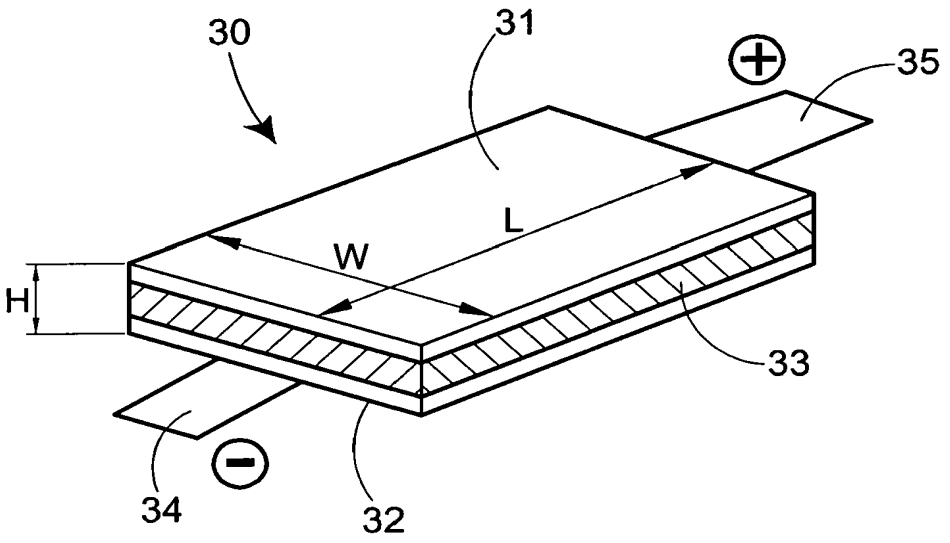


Fig. 3

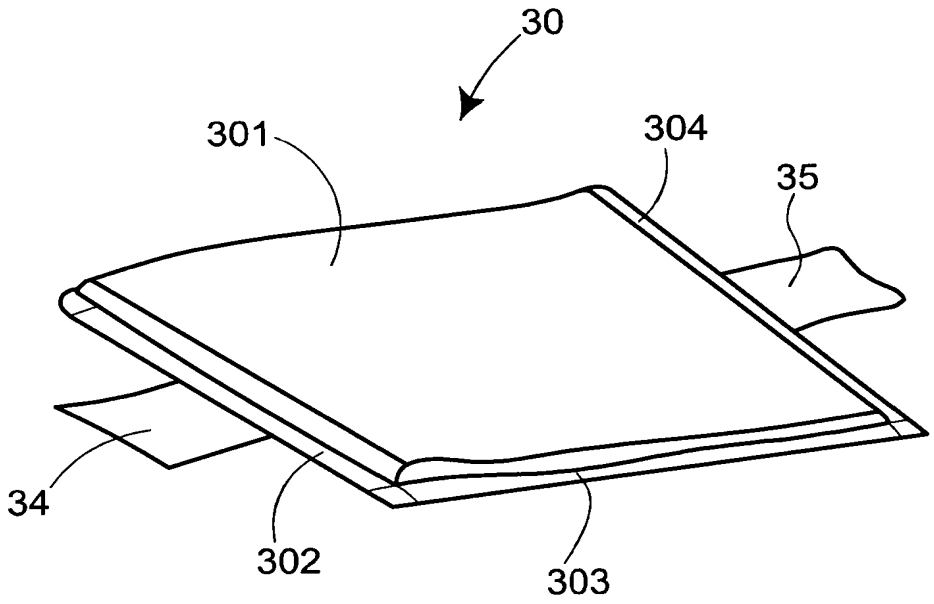


Fig. 4

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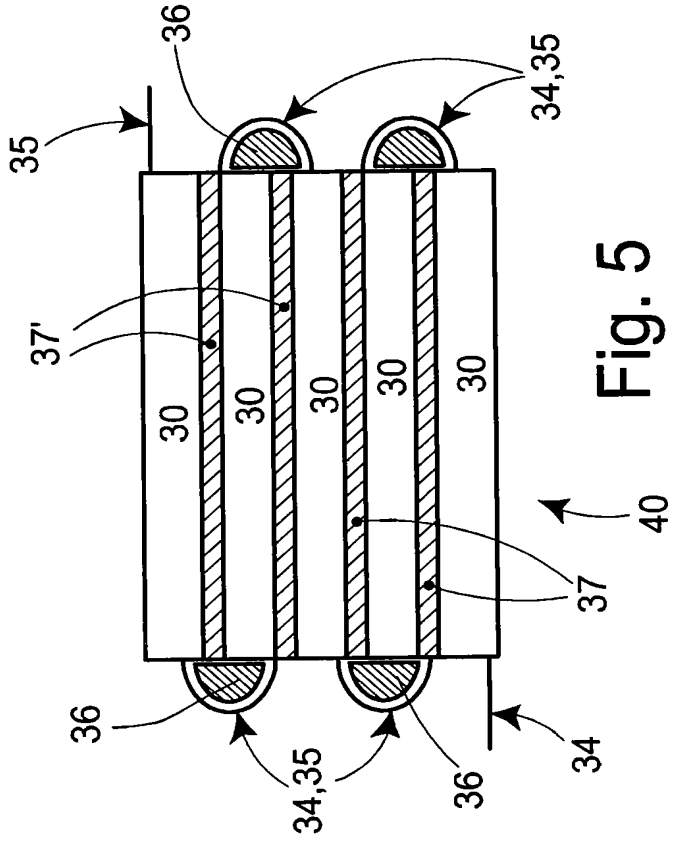


Fig. 5

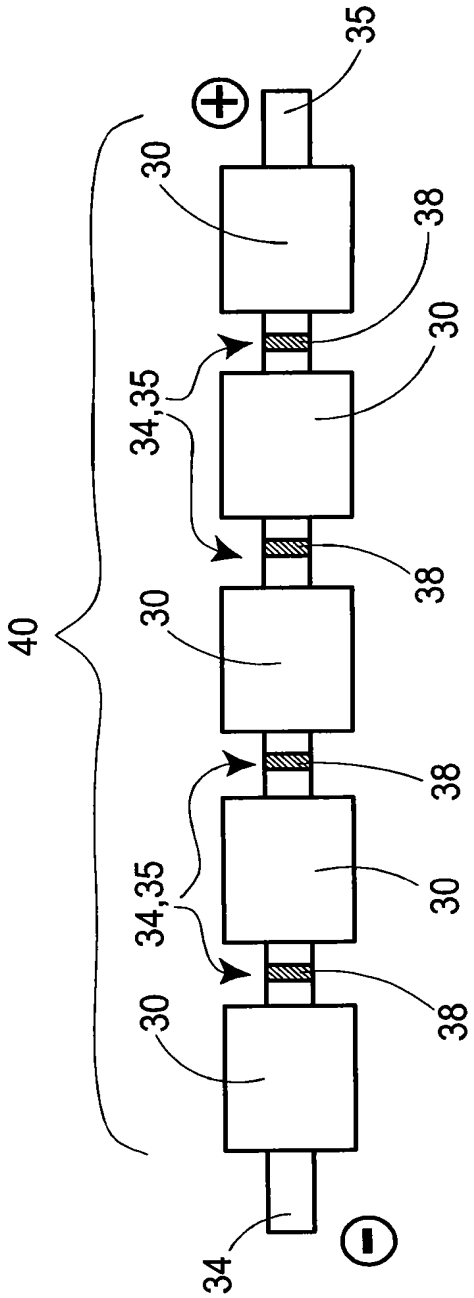


Fig. 6

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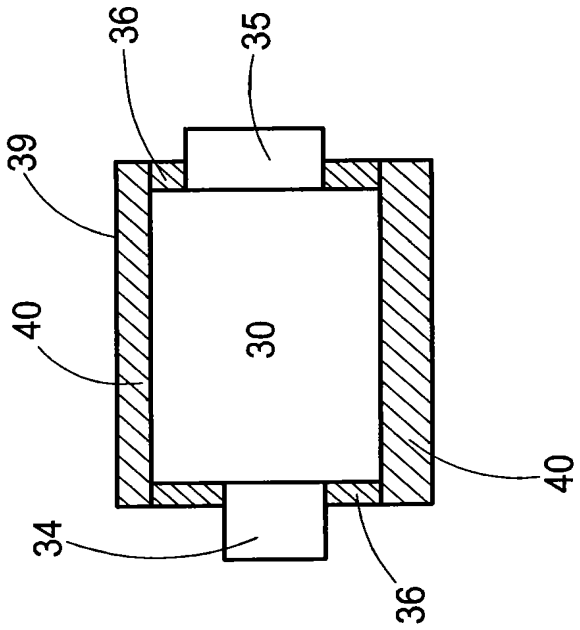


Fig. 8

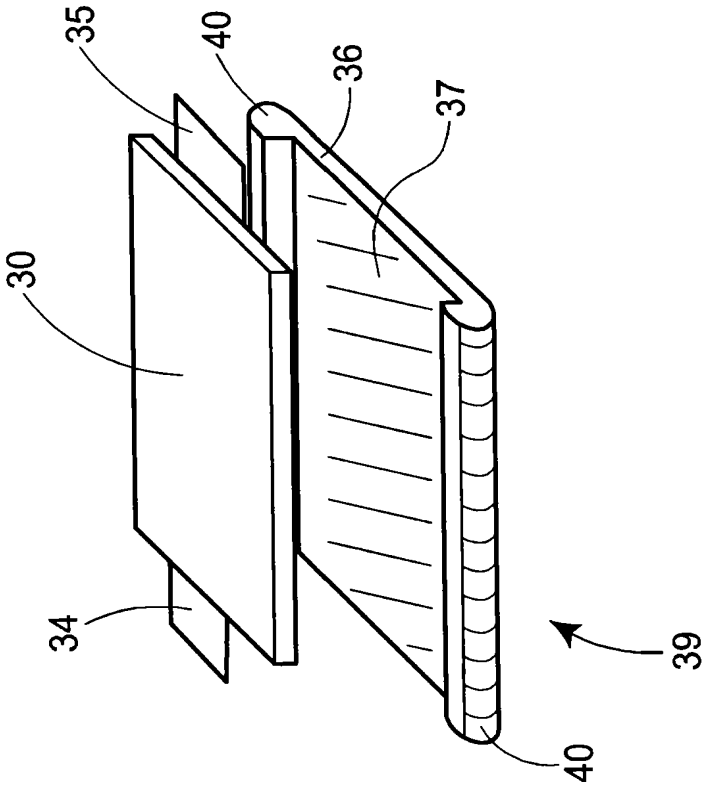


Fig. 7

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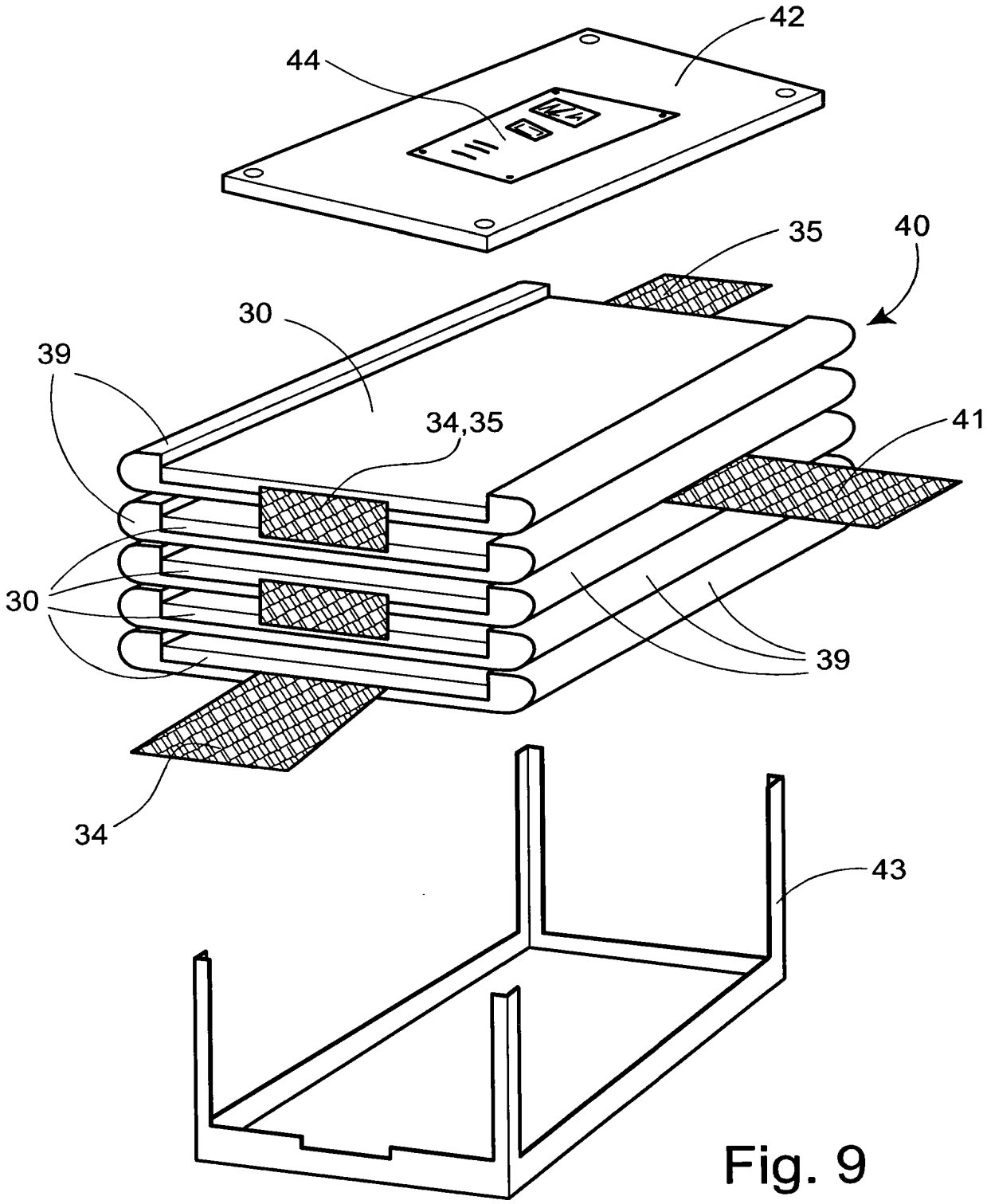


Fig. 9

RECTIFIED SHEET (RULE 91) ISA/CN

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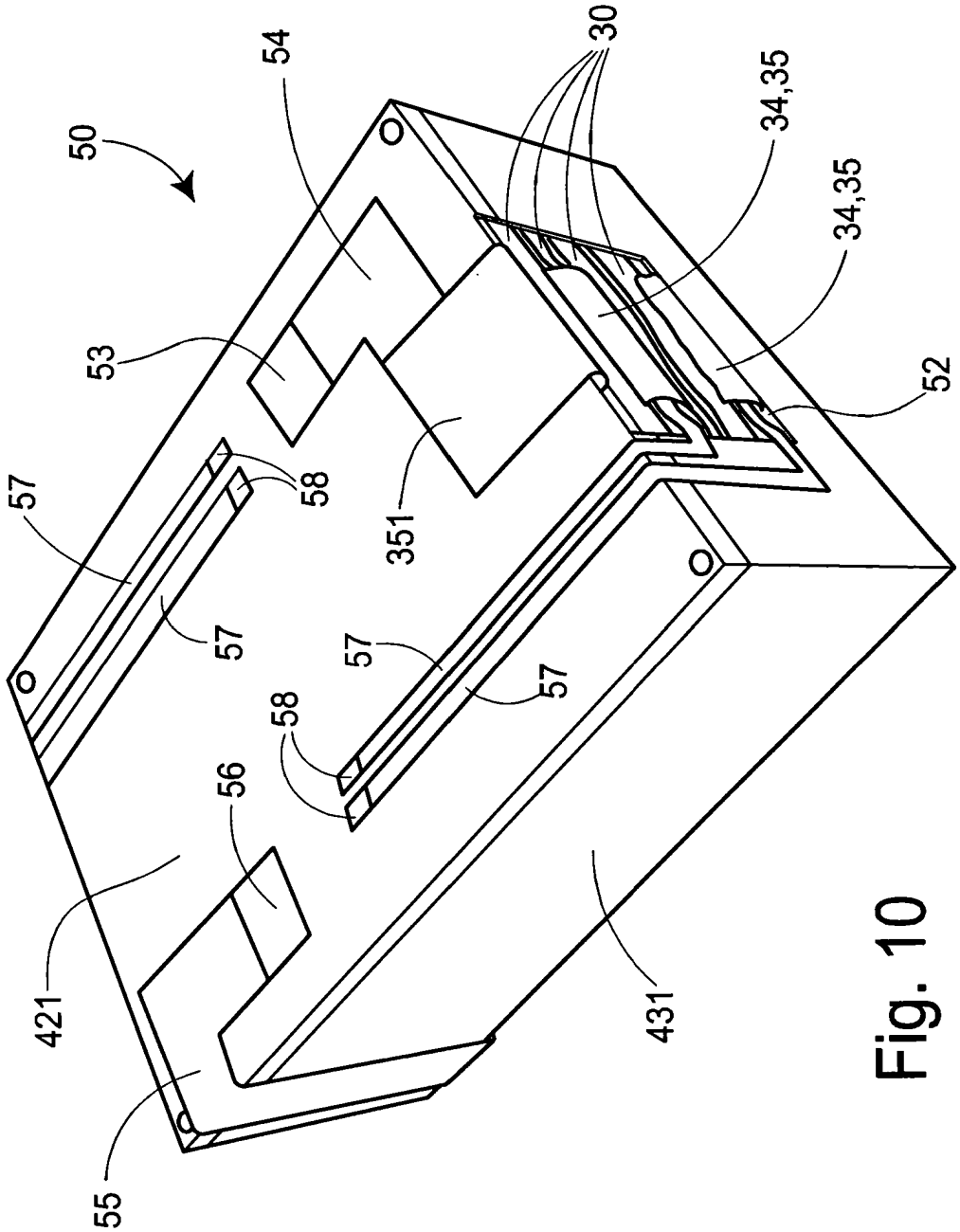


Fig. 10

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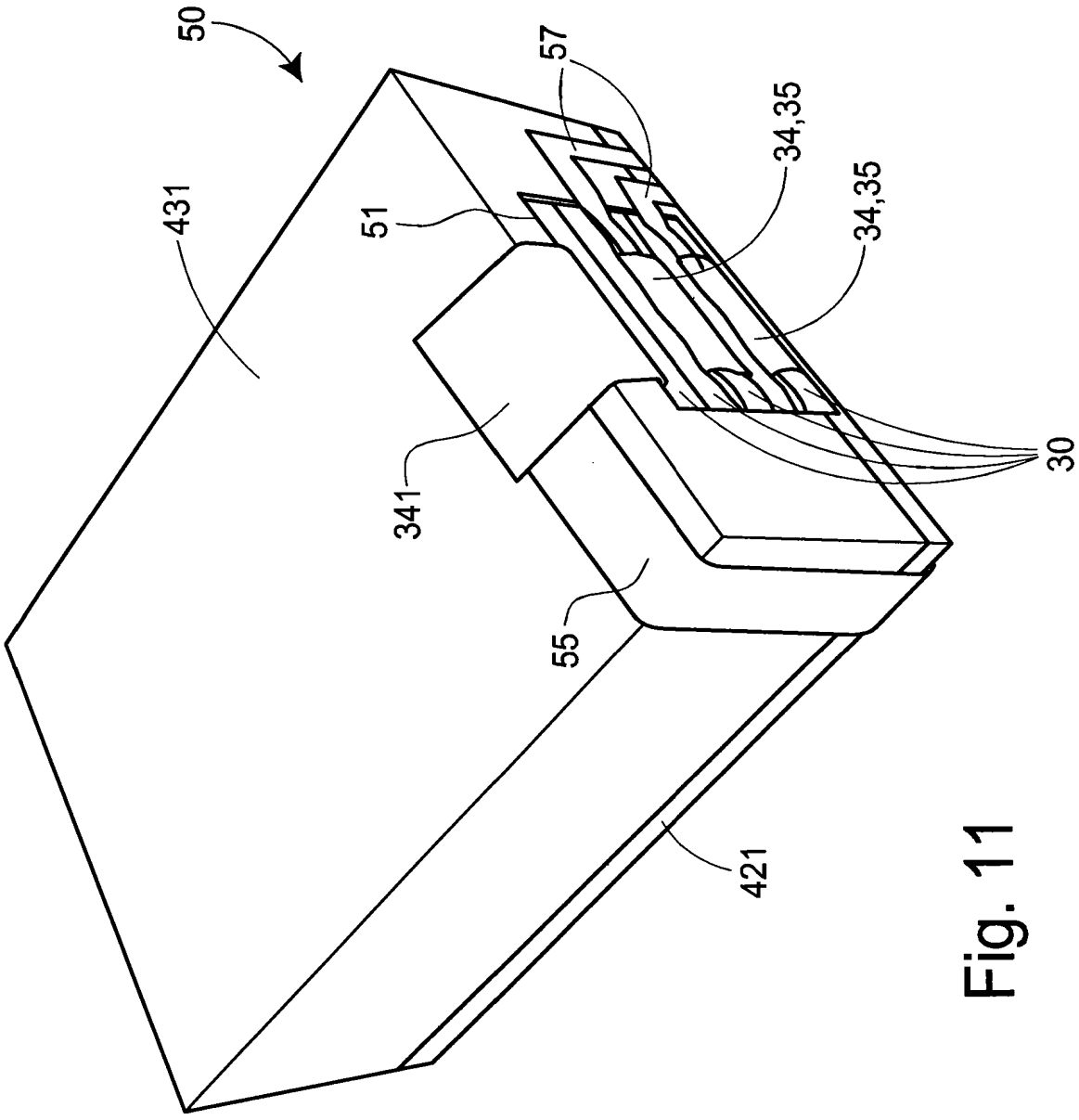


Fig. 11

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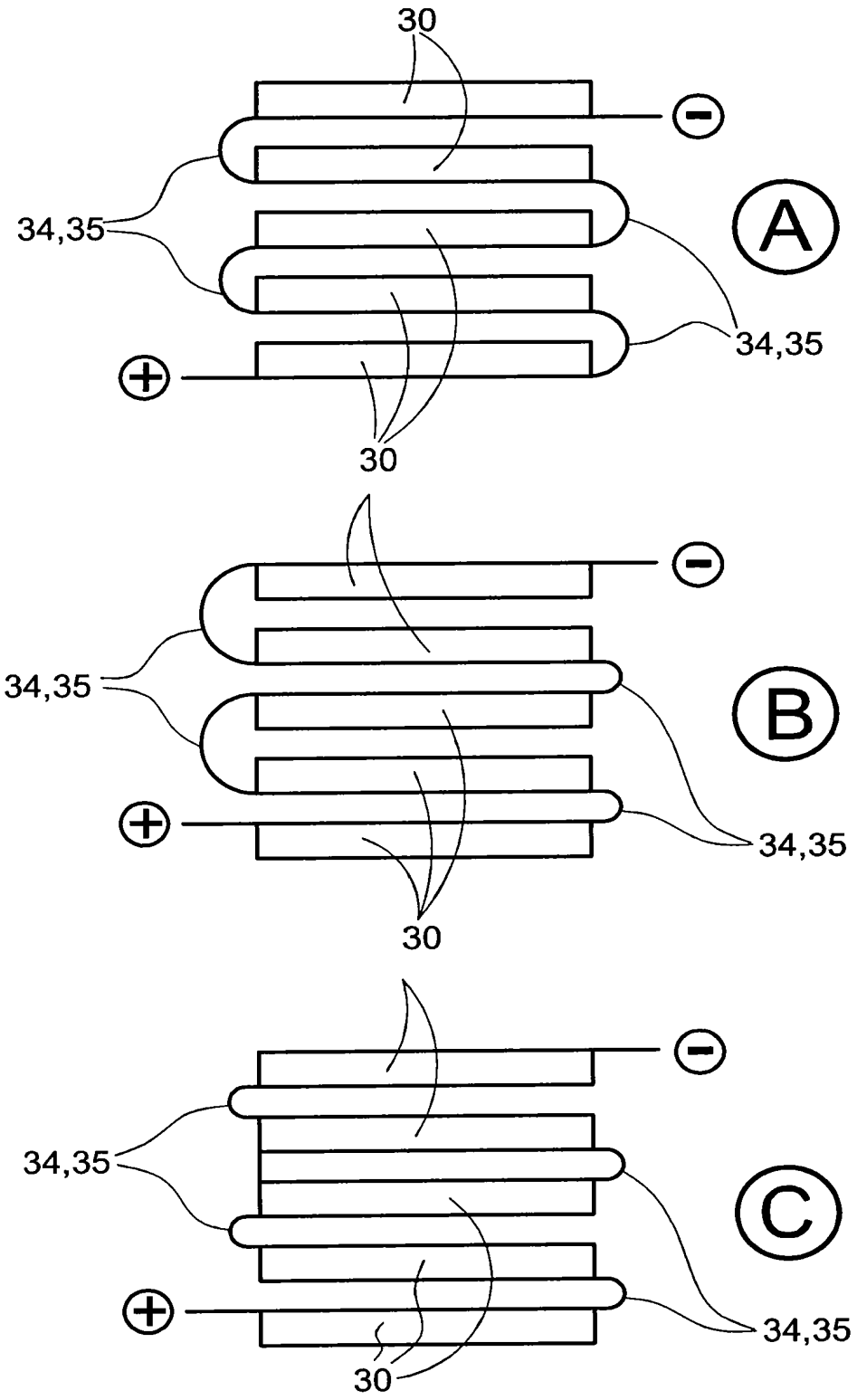


Fig. 12

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2014/080868

A. CLASSIFICATION OF SUBJECT MATTER

H01M 10/36(2010.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01M H02K B25F

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,CNABS,CNTXT,CNKI:battery,cell,motor,tool,selective+,detachable,elastic+,spacer

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008211327 A1 (SCHLEGEL, ANDREAS ET AL.) 04 September 2008 (2008-09-04) abstract, description,paragraphs [0022]-[0027] and figure 1	1-10,17,25-26,29-31
Y	US 2008211327 A1 (SCHLEGEL, ANDREAS ET AL.) 04 September 2008 (2008-09-04) abstract, description,paragraphs [0022]-[0027] and figure 1	11-16,18-24,27-28
Y	US 2009297936 A1 (NEMOTO, SEIJI ET AL.) 03 December 2009 (2009-12-03) description,paragraphs [0089]-[0097] and figures 6-7	11-16,18-24,27-28
X	CN 202952236 U (NINGBO YOUNGSUN ENTERPRISE CO., LTD.) 29 May 2013 (2013-05-29) description,paragraphs [0010]-[0012] and figure1	1-10,17,25-26,29-31
Y	CN 202952236 U (NINGBO YOUNGSUN ENTERPRISE CO., LTD.) 29 May 2013 (2013-05-29) description,paragraphs [0010]-[0012] and figure1	11-16,18-24,27-28
A	US 2008003505 A1 (WUENSCH, STEFFEN ET AL.) 03 January 2008 (2008-01-03) the whole document	1-31

☐ 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

"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

"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

"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	Date of mailing of the international search report
29 August 2014	**28 September 2014**

Name and mailing address of the ISA/	Authorized officer
STATE INTELLECTUAL PROPERTY OFFICE OF THE P.R.CHINA(ISA/CN) **6,Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088 China**	**XIONG,Yue**
Facsimile No. **(86-10)62019451**	Telephone No. **(86-10)82245487**

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2014/080868

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
US	2008211327	A1	04 September 2008	DE	102004036588	A1	23 March 2006
				EP	1774607	A2	18 April 2007
				WO	2006010676	A3	12 October 2006
				WO	2006010676	A2	02 February 2006
				CN	1989635	A	27 June 2007
				JP	2008507421	A	13 March 2008
US	2009297936	A1	03 December 2009	WO	2008007767	A1	17 January 2008
				CN	101490870	B	26 October 2011
				CN	101490870	A	22 July 2009
CN	202952236	U	29 May 2013		Non	e	
US	2008003505	A1	03 January 2008	CN	101115587	A	30 January 2008
				CN	101115587	B	05 October 2011
				EP	1848570	A1	31 October 2007
				WO	2006081894	A1	10 August 2006
				DE	102005005553	A1	10 August 2006

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Espacenet

CN204516832U The multi-functional sampling end minor structure of group battery

Applicants: CONTEMPORARY AMPEREX TECHNOLOGY LTD

Inventors: CHEN YONG,GE JINBO,WANG DERONG,ZHAO BIN

Classifications:
IPC ***H01M2/30;***

CPC Y02E60/10 (EP);

Priorities: CN201520093747U 2015-02-10

Application: CN204516832U·2015-02-10

Publication: CN204516832U·2015-07-29

Published as: CN204516832U

The multi-functional sampling end minor structure of group battery

Abstract

The utility model belongs to the technical field of the battery pack, in particular to the multi-functional sampling end minor structure of battery pack, including the insert in the electrode manner piece insert soon linkage segment, parcel temperature sensor probe the temperature sampling section and with the voltage sample section of voltage sample conductor compression jointing, the voltage sample section through the temperature sampling section with insert the linkage segment soon and be connected. It is integrated structural to the one terminal with battery pack temperature sampling and voltage sample through above-mentioned structure, can only realize temperature sampling or voltage sample as required, also can realize sampling simultaneously. The utility model discloses when realizing battery voltage and temperature sampling, both simplified technology, reduced manufacturing cost again, be suitable for batch production.

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(19)中华人民共和国国家知识产权局

(12)实用新型专利

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(51)Int.Cl.
H01M 2/30(2006.01)

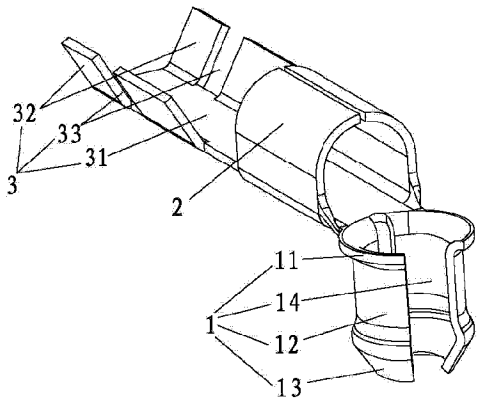
权利要求书1页 说明书3页 附图2页

(54)实用新型名称

电池组的多功能采样端子结构

(57)摘要

本实用新型属于电池组技术领域，特别涉及电池组的多功能采样端子结构，包括插设于电极连接片的快插连接段、包裹温度传感器探头的温度采样段及与电压采样导线压接的电压采样段，电压采样段通过温度采样段与快插连接段连接。通过上述结构将电池组温度采样和电压采样集成到一个端子结构上，可以根据需要只实现温度采样或者电压采样，也可以实现同时采样。本实用新型在实现电池组电压和温度采样的同时，既简化了工艺，又降低了生产成本，适合于批量生产。



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1. 电池组的多功能采样端子结构，其特征在于：包括插设于电极连接片的快插连接段、包裹温度传感器探头的温度采样段及与电压采样导线压接的电压采样段，所述电压采样段通过所述温度采样段与所述快插连接段连接。

2. 根据权利要求 1 所述的电池组的多功能采样端子结构，其特征在于：所述快插连接段包括连接头部、连接中部和连接尾部，所述连接头部通过所述连接中部与所述连接尾部连接为一体。

3. 根据权利要求 2 所述的电池组的多功能采样端子结构，其特征在于：所述快插连接段还包括开槽，所述连接头部、所述连接中部和所述连接尾部通过所述开槽形成“C”形或“U”形结构的弹簧体。

4. 根据权利要求 3 所述的电池组的多功能采样端子结构，其特征在于：当所述连接头部、所述连接中部和所述连接尾部为圆形结构时，所述连接头部和所述连接尾部的最大直径均大于所述连接中部的直径。

5. 根据权利要求 1 所述的电池组的多功能采样端子结构，其特征在于：所述温度采样段设置为“U”形、“C”形或“O”形结构。

6. 根据权利要求 1 所述的电池组的多功能采样端子结构，其特征在于：所述电压采样段包括搁置板及设置于所述搁置板两侧的侧板，所述侧板与所述搁置板形成为“V”形、“U”形或“C”形结构。

7. 根据权利要求 6 所述的电池组的多功能采样端子结构，其特征在于：所述侧板设置为两组，每组的数量为两个，且每组的两个所述侧板均沿所述搁置板对称设置。

8. 根据权利要求 7 所述的电池组的多功能采样端子结构，其特征在于：两组所述侧板之间设置有间隙。

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电池组的多功能采样端子结构

技术领域

[0001] 本实用新型属于电池组技术领域，特别涉及电池组的多功能采样端子结构。

技术背景

[0002] 在当前全球能源日益紧张及环境日益恶化的巨大挑战下，发展电动汽车、实现汽车能源动力系统的零排放和推动电动汽车的普及在国际上已经形成了广泛共识，在这样的背景下，动力电池有了越来越广泛的应用。在将动力电池用作电动汽车的供能元件时，整车控制系统必须监控电池的电压，温度等参数，所以电池组采样的设计是电池包结构设计中基础且重要的一环，其电池组采样设计和工艺的可靠性将会对电动汽车的安全性产生重要影响。

[0003] 现有技术中，电池组的电压采样结构和温度采样结构是各自分开实现的。如图 1 所示，导线 1’剥皮后，通过超声波将导线 1’的裸铜线芯 2’焊接到电极连接片 3’上，从而形成电压采样结构；将温度传感器探头 4’通过涂胶固定在一种金属端子 5’里面，然后金属端子 5’通过超声波焊接到电极连接片 3’，从而形成温度采样结构。上述结构的实现需要经过多道工序，不利于简化工艺（在现有技术中，实现电压采样需运用导线裁剪工艺、导线整形工艺和导线超声波焊接工艺；实现温度采样需运用胶水粘接工艺和超声波焊接工艺。），而且生产成本较高、不利于批量生产。

实用新型内容

[0004] 本实用新型的目的在于：针对现有技术的不足，而提供电池组的多功能采样端子结构，该结构将电池组温度采样和电压采样集成到一起，在实现电池组电压和温度采样的同时，既简化了工艺，又降低了生产成本，适合于批量生产。

[0005] 为实现上述目的，本实用新型采用如下技术方案：电池组的多功能采样端子结构，包括插设于电极连接片的快插连接段、包裹温度传感器探头的温度采样段及与电压采样导线压接的电压采样段，所述电压采样段通过所述温度采样段与所述快插连接段连接。

[0006] 作为本实用新型电池组多功能采样端子结构的一种改进，所述快插连接段包括连接头部、连接中部和连接尾部，所述连接头部通过所述连接中部与所述连接尾部连接为一体。

[0007] 作为本实用新型电池组多功能采样端子结构的一种改进，所述快插连接段还包括开槽，所述连接头部、所述连接中部和所述连接尾部通过所述开槽形成一“C”形或“U”形结构的弹簧体。

[0008] 作为本实用新型电池组多功能采样端子结构的一种改进，当所述连接头部、所述连接中部和所述连接尾部为圆形结构时，所述连接头部和所述连接尾部的最大直径均大于所述连接中部的直径。

[0009] 作为本实用新型电池组多功能采样端子结构的一种改进，所述温度采样段设置为“U”形、“C”形或“O”形结构。

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[0010] 作为本实用新型电池组多功能采样端子结构的一种改进，所述电压采样段包括搁置板及设置于所述搁置板两侧的侧板，所述侧板与所述搁置板形成为“V”形、“U”形或“C”形结构。

[0011] 作为本实用新型电池组多功能采样端子结构的一种改进，所述侧板设置为两组，每组的数量为两个，且每组的两个所述侧板均沿所述搁置板对称设置。

[0012] 作为本实用新型电池组多功能采样端子结构的一种改进，两组所述侧板之间设置有间隙。

[0013] 本实用新型的有益效果在于：本实用新型提供的端子结构包括插设于电极连接片的快插连接段、包裹温度传感器探头的温度采样段及与电压采样导线压接的电压采样段，电压采样段通过温度采样段与快插连接段连接。通过上述结构将电池组温度采样和电压采样集成到一个端子结构上，可以根据需要只实现温度采样或者电压采样，也可以实现同时采样。本实用新型在实现电池组电压和温度采样的同时，既简化了工艺(仅应用了胶水粘接工艺、导线裁剪工艺和导线压接工艺)，又降低了生产成本，适合于批量生产。

附图说明

[0014] 图 1 为现有技术的结构示意图。

[0015] 其中：1’- 导线，2’- 裸铜线芯，3’- 电极连接片，4’- 温度传感器探头，5’- 金属端子。

[0016] 图 2 为本实用新型的结构示意图。

[0017] 图 3 为本实用新型与电极连接片连接的结构示意图。

[0018] 其中：1- 快插连接段，

[0019] 11- 连接头部，12- 连接中部，13- 连接尾部，14- 开槽；

[0020] 2- 温度采样段；

[0021] 3- 电压采样段，

[0022] 31- 搁置板，32- 侧板，33- 间隙；

[0023] 4- 电极连接片；

[0024] 5- 温度传感器探头；

[0025] 6- 电压采样导线。

具体实施方式

[0026] 下面结合具体实施方式和说明书附图，对本实用新型作进一步详细的描述，但本实用新型的实施方式不限于此。

[0027] 如图 1~3 所示，电池组的多功能采样端子结构，包括插设于电极连接片 4 的快插连接段 1、包裹温度传感器探头 5 的温度采样段 2 及与电压采样导线 6 压接的电压采样段 3，电压采样段 3 通过温度采样段 2 与快插连接段 1 连接。快插连接段 1 为端子结构与电极连接片 4 的接触结合部分，通过快插连接段 1 传递采样信号给温度采样段 2 和电压采样段 3 进而完成采样；温度采样段 2 为包裹温度传感器探头 5 的部分，而且在温度传感器探头 5 和温度采样段 2 之间涂有导热胶，导热胶的胶水固化后既能达到强度的要求，也能满足导热要求，从而保证了温度采样的及时性；电压采样段 3 与电压采样导线 6 进行压接，实现了可

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靠的电连接，既工艺简单，又保证了电压采样的有效性。快插连接段 1、温度采样段 2 和电压采样段 3 的材质为铜镍硅合金或铍铜合金，因为这样的材质在温度和电压采样时传导性更好，可以有效地快速地对温度和电压进行采样。

[0028] 优选地，快插连接段 1 包括连接头部 11、连接中部 12 和连接尾部 13，连接头部 11 通过连接中部 12 与连接尾部 13 连接为一体。快插连接段 1 还包括开槽 14，连接头部 11、连接中部 12 和连接尾部 13 通过开槽 14 形成一“C”形或“U”形结构的弹簧体，其中开槽 14 是为实现快插连接段 1 伸缩功能而设置的。电极连接片 4 与上述弹簧体结合时，通过弹簧体产生的反弹力和电极连接片 4 的圆孔实现紧密配合，从而将快插连接段 1 固定在电极连接片 4 的圆孔内，该弹簧体为一中空结构，弹簧体过盈配合安装有 TPA 材质的弹性柱塞。该弹性柱塞具有的弹性保持能力可以进一步保证快插连接段 1 与电极连接片 4 可靠接触。当连接头部 11、连接中部 12 和连接尾部 13 为圆形结构时，连接头部 11 和连接尾部 13 的最大直径均大于连接中部 12 的直径，使得快插连接段 1 与电极连接片 4 不会发生相对移动，实现可靠配合。

[0029] 优选地，温度采样段 2 设置为“U”形、“C”形或“O”形结构，以满足温度采样段 2 能包裹温度传感器探头 5 为标准，具体结构可根据温度传感器探头 5 的形状而确定。

[0030] 优选地，电压采样段 3 包括搁置板 31 及设置于搁置板 31 两侧的侧板 32，侧板 32 与搁置板 31 形成为“V”形、“U”形或“C”形结构，这样的结构是为容纳电压采样导线 6 而设置的，侧板 32 与搁置板 31 还可以形成其他结构，这里不作具体限定。侧板 32 设置为两组，每组的数量为两个，且每组的两个侧板 32 均沿搁置板 31 对称设置，两组侧板 32 之间设置有间隙 33，两组侧板 32 一前一后排列。其中前一组与电压采样导线 6 的导体压接实现电连接，后一组与电压采样导线 6 的绝缘线皮压接固定连接。

[0031] 需要说明的是：本实用新型的端子结构与电极连接片也可以通过焊接连接为一体，不一定是弹性接触实现连接。本实用新型可以应用在镍氢电池和镍镉电池中，同时也适用于具有电池的电动车、混合电动车和储能等项目中。

[0032] 根据上述说明书的揭示和教导，本实用新型所属领域的技术人员还能够对上述实施方式进行变更和修改。因此，本实用新型并不局限于上述的具体实施方式，凡是本领域技术人员在本实用新型的基础上所作出的任何显而易见的改进、替换或变型均属于本实用新型的保护范围。此外，尽管本说明书中使用了一些特定的术语，但这些术语只是为了方便说明，并不对本实用新型构成任何限制。

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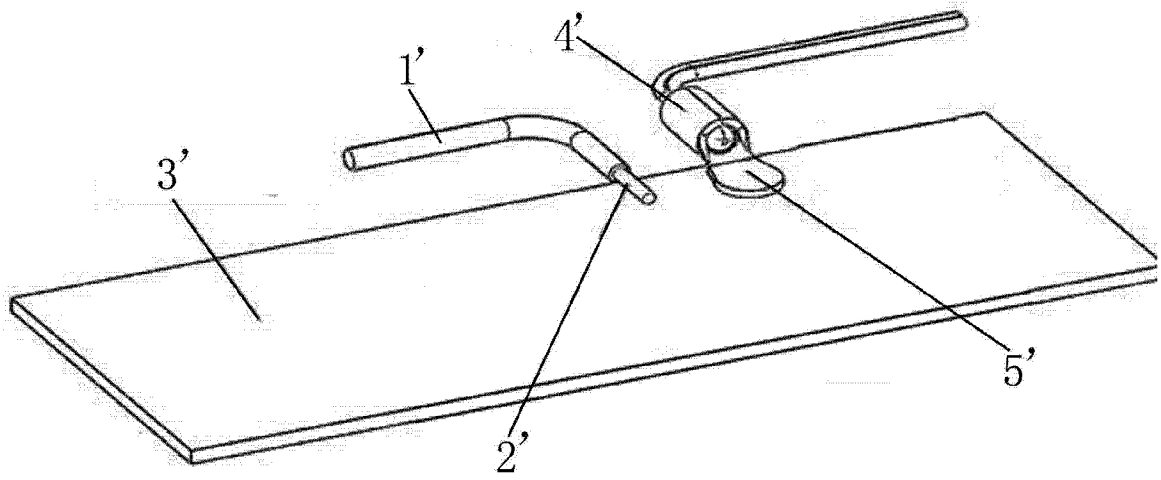


图 1

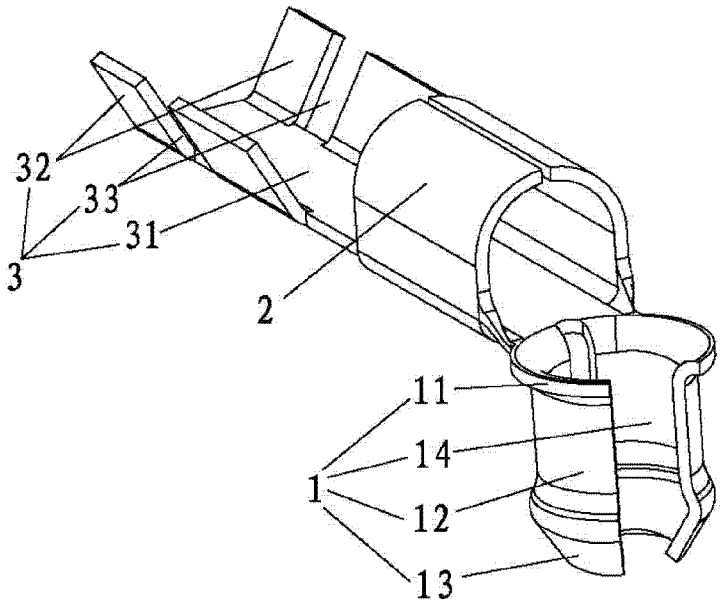


图 2

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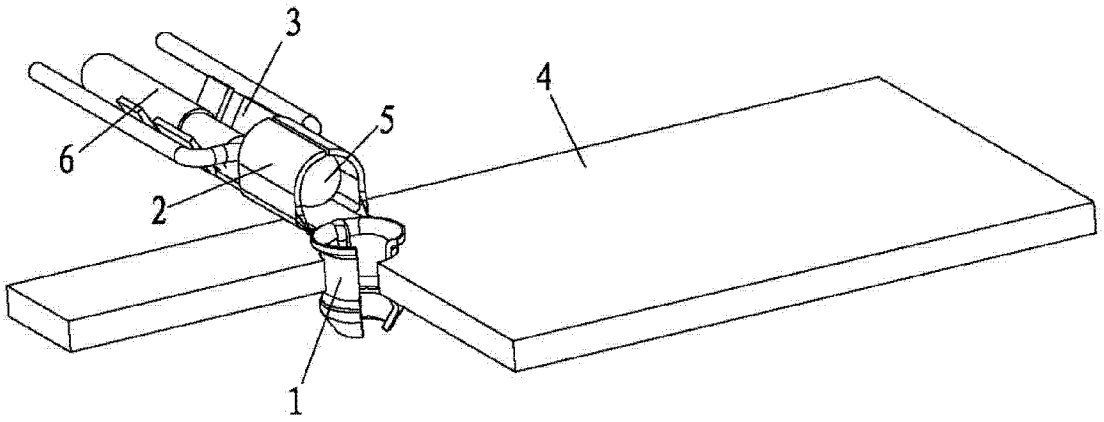


图 3

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Espacenet

CN202696190U Intelligent emergent start power source with self-equipped voice prompt function

Applicants: GUANGWEI AMERICA LINE ELECTRICAL APPLIANCE CO LTD,SHANGHAI GREATWAY TUOPU POWER SUPPLY CO LTD,SHANGHAI GUANGWEI ELECTRIC & TOOLS CO LTD

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IPC ***G01R19/165; G01R31/02; H02J7/00;***

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Intelligent emergent start power source with self-equipped voice prompt function

Abstract

The utility model discloses an intelligent emergent start power source with a self-equipped voice prompt function. The intelligent emergent start power source comprises a battery pack, wherein the power supply end of the battery pack is connected with an alternation switch which is connected with an output electric clip through a direct current (DC) contactor. The intelligent emergent start power source further comprises a central processing unit (CPU) main control circuit, wherein an output end of the CPU main control circuit is connected with an audio broadcast system. An input end of the CPU main control circuit is connected with a sampling and driving control circuit which is connected with the alternation switch, the DC contactor and the output electric clip. The battery pack is connected with a charge port through a power source control circuit, and the power source control circuit and the charge port are connected with the CPU main control circuit. The output electric clip and the alternation switch are respectively connected with the power source control circuit. The output end of the CPU main control circuit also is connected with a display circuit, and the sampling and driving control circuit is connected with a force started button. The emergent start power source can timely and accurately send relative operation information to users under different environments.

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CN202696190U

Intelligent emergent start power source with self-equipped voice prompt function

Abstract

The utility model discloses an intelligent emergent start power source with a self-equipped voice prompt function. The intelligent emergent start power source comprises a battery pack, wherein the power supply end of the battery pack is connected with an alternation switch which is connected with an output electric clip through a direct current (DC) contactor. The intelligent emergent start power source further comprises a central processing unit (CPU) main control circuit, wherein an output end of the CPU main control circuit is connected with an audio broadcast system. An input end of the CPU main control circuit is connected with a sampling and driving control circuit which is connected with the alternation switch, the DC contactor and the output electric clip. The battery pack is connected with a charge port through a power source control circuit, and the power source control circuit and the charge port are connected with the CPU main control circuit. The output electric clip and the alternation switch are respectively connected with the power source control circuit. The output end of the CPU main control circuit also is connected with a display circuit, and the sampling and driving control circuit is connected with a force started button. The emergent start power source can timely and accurately send relative operation information to users under different environments.

Claims

1.

An intelligent emergency starting power supply with a voice prompt function, including a battery pack, the battery pack The power supply terminal is connected with a transfer switch, and the transfer switch is connected to the output clamp through a DC contactor. Its characteristics is that

It also includes a CPU master control circuit. The output of the CPU master control circuit is connected with an audio playback system. System

The input end of the CPU master control circuit is connected with a sampling and driving control circuit, the sampling and driving The control circuit is connected with the transfer switch, DC contactor and output electric clamp;

The battery pack is connected to the charging interface through a power control circuit, and the power control circuit is connected to the charging interface Connect to the CPU master control circuit;

The output electric clamp and the changeover switch are respectively connected with the power control circuit;

The output terminal of the CPU master control circuit is also connected with a display circuit;

The sampling and driving control circuit is connected with a forced start button.

2.

An intelligent emergency start power supply with a voice prompt function according to claim 1, which

The feature is that the audio playback system includes a voice storage control circuit, the voice storage control circuit The input terminal is connected to the CPU master control circuit, and the output terminal is connected to the audio control circuit, the audio control circuit Connect with speakers.

3.

The intelligent emergency start power supply with its own voice prompt function according to claim 1, which

It is characterized in that, the display circuit includes an LED digital tube display and LED indicators of different colors.

DESCRIPTION CN202696190U

An intelligent emergency starting power supply with voice prompt function Technical field

The utility model relates to an emergency starting power supply, in particular to an intelligent emergency starting power supply with a voice prompt function.

Background technique

12 The V/24V conversion emergency start power supply is difficult to be 100% correct under different operating environments. Without any protection and prompts, any misoperation may cause permanent damage to the product, or even cause the battery to explode in severe cases, endangering the personal and property safety of the user. Although some of the existing products are equipped with operating instructions and some simple sound and light alarm functions, the simple buzzer alarm and the wear and tear of the operation cause the defect or blur of the operation prompt content, so that the emergency start power supply lacks the necessary safety instructions , At the same time, the user is confused when the user cannot find the cause in time after the problem occurs. If you add necessary voice prompts and photoelectric instructions for each operation of the user at the same time, it can not only reduce the impact of different environments on the user, but also directly inform the user of the real-time operating status in time, which can more effectively prevent mistakes The generation of, allows users to operate more directly and clearly. Therefore, it is necessary to optimize the structure of the existing emergency power supply.

Utility model content

The purpose of the utility model is to provide an intelligent emergency starting power supply with its own voice prompt function, which uses voice to prompt the user's current operation to reduce misoperations, so that the emergency starting power supply can be safely protected during operation and extend its use life.

The technical scheme adopted by the utility model to solve its technical problems is:

An intelligent emergency starting power supply with a voice prompt function, including a battery pack, the power supply end of the battery pack is connected with a transfer switch, the transfer switch is connected to the output clamp through a DC contactor, and it also includes a CPU master control circuit, The output terminal of the CPU master control circuit is connected with an audio playback system, the audio playback system includes a voice storage control circuit, the input terminal of the voice storage control circuit is connected to the CPU master control circuit, and the output terminal is connected to the audio control circuit. The circuit is connected to the speaker;

The input end of the CPU master control circuit is connected with a sampling and driving control circuit, which is connected with the changeover switch, the DC contactor and the output electric clamp; the battery pack is connected with the charging interface through the power control circuit, and the power supply The control circuit and the charging interface are connected to the CPU master control circuit; the output clip and the switch are respectively connected to the power control circuit; the output end of the CPU master control circuit is also

connected to a display circuit, which includes an LED digital tube display And LED indicators of different colors; the sampling and driving control circuit is connected with a forced start button.

The advantage of the utility model is that the emergency start power supply can provide safety protection for gear selection, correct connection, wrong connection, and low voltage or high voltage, and at the same time, it can select charging gear, battery low voltage warning, output overcurrent protection, Electric clip output short-circuit protection and man-made forced start safety prompts are added with corresponding voice prompts and photoelectric prompts; in different use environments, they can promptly and accurately deliver relevant operating information to users, so that users can use sound, light, etc. The type of prompt method to obtain operating information allows users to more intuitively understand the real-time operating conditions and the reasons for use errors, facilitate better next operations or timely and effective corrective measures, ensure the personal safety of users, and make the entire product better Humanized and intelligent.

Description of the drawings

Figure 1 is an electrical schematic diagram of the emergency starting power supply proposed by the utility model;

Figure 2 is a power control circuit diagram;

Figure 3 is a circuit diagram of the CPU master control circuit and LED digital tube display;

Figure 4 is a circuit diagram of voice storage and audio control;

Figure 5 is a sampling and drive control circuit diagram.

Detailed ways

In order to make the technical means, creative features, goals and effects of the utility model easy to understand, the following figures and specific embodiments are combined to further explain the utility model.

As shown in Figure 1, the intelligent emergency starting power supply with its own voice prompt function proposed by the present invention includes a battery pack, the power supply end of the battery pack is connected with a switch, and the switch is connected to the output clip through a DC contactor. It also includes a CPU master control circuit. The output of the CPU master control circuit is connected to an audio playback system. The audio playback system includes a voice storage control circuit. The input of the voice storage control circuit is connected to the CPU master control circuit. The terminal is connected to the audio control circuit, and the audio control circuit is connected to the speaker;

The input end of the CPU master control circuit is connected with a sampling and driving control circuit, which is connected with the changeover switch, the DC contactor and the output electric clamp; the battery pack is connected with the charging interface through the power control circuit, and the power supply The control circuit and the charging interface are connected to the CPU master control circuit; the output clip and the switch are respectively connected to the power control circuit; the output end of the CPU master control circuit is also connected to a display circuit, which includes an LED digital tube display And LED indicators of different colors; the sampling and driving control circuit is connected with a forced start button.

At present, car batteries are mainly divided into two types: 12V and 24V. In the circuit design, the default is 12VDC battery within 0VDC～15.5VDC; the default is 24VDC battery within 15.5～30.0VDC. The switch connects the two batteries in parallel or in series, so that it can realize the function of two voltage outputs in one machine. At the same time, two small linkage switches are embedded in the transfer switch. The linkage switch is synchronized with the 12V and 24V gears, that is, when the transfer switch is in the 12V or 24V gear, the linkage opening is also closed synchronously, and the linkage switch is automatically turned off when the switch is in the OFF position. Open, used to realize the judgment of input or disconnection of external connection signal.

The emergency starting power supply uses a high-power DC contactor as an automatic control electronic switch, and controls its on and off states through a circuit. At the same time, the circuit judges the voltage drop across

the DC contactor after it is pulled in to determine whether the output clip appears One of the conditions for short circuit.

The emergency start power supply samples from the two ends of the battery pack, the small teeth of the electric clamp, the output end of the transfer switch, the two ends of the DC contactor, the charging interface, the internal voltage test reset switch, the forced start button and other key points to be sent to the CPU master control circuit. After processing and judging, and knowing the user's operating information, the corresponding pulse signal is sent to the voice storage control circuit, and the pre-stored voice content is retrieved, and after the power of the audio control circuit is amplified, the field sounder emits the corresponding voice message. The emergency start power supply can provide safety protection for gear selection, correct connection, wrong connection, and low or high voltage. At the same time, it can be used for charging gear selection, battery low voltage warning, output overcurrent protection, electric clip output short circuit protection, and artificial force The corresponding voice prompts and photoelectric prompts are added in aspects such as starting safety prompts. The voice is clear, loud, and standard pronunciation. In a 40dB noise environment, the effective sound transmission distance is more than 5 meters. In addition to the standard English prompts, two other languages are prepared for voice types, namely French and Spanish. Users can switch directly with simple buttons to improve the versatility of the product.

In one embodiment, the circuit configuration of the emergency start power supply is shown in Figure 2, Figure 3, Figure 4, and Figure 5. In this embodiment, the main key components used in the emergency start power supply are: IC1-7805 three-terminal integrated voltage regulator, IC2-MC96F32Q microcontroller, IC3-BLA4208 voice storage integrated chip, IC4-TDA2822 integrated audio power amplifier, LS1-full frequency band Speaker 2W/8 ohm, LED-LG5631AH seven-segment digital tube display, IC5 (IC6)-PC817 optocoupler, IC7-LM358 integrated operational amplifier, high-power DC contactor, high-current conversion switch (for 12/24V gear switching), linkage Switch, forced start button, output positive and negative electric clamp.

In this embodiment, the main functions that the emergency power supply can realize are:

1、

The 12V/24V gear position is automatically recognized and prompted when the emergency start power switch is operated, the corresponding gear position voice prompt and LED3/LED4 light up indication;

2、

Emergency start power supply battery low voltage automatic alarm prompt, when the battery voltage is lower than 8.0≤U＜10.0V, the voice automatic alarm prompt;

3、

The emergency start power supply battery voltage is too low automatic shutdown protection and prompts, when the battery voltage is continuously lower than 8V, the emergency start power supply automatically shuts off the output circuit of the electric clamp, and at the same time, the low-voltage shutdown protection voice prompt is issued;

4、

The output electric clamp is connected correctly to prompt the conduction, and it will automatically be turned on when it is correctly connected, with voice prompts and LED4 lights to prompt;

5、

The output electric clamp connection polarity is reversed wrongly to shut off protection and prompt. When the output electric clamp polarity is reversed, the DC contactor will produce shut-off protection. At the same time, the corresponding voice information prompt and reverse connection indication LED7 light will be lit to prompt. The nixie tube flashes and displays the error code "Er1";

6、

Output electric clamp connection voltage error shutdown protection and prompt, that is, the internal and external connection battery voltage does not match, generally means that the 12V and 24V battery are connected incorrectly or the 24V is connected to an external battery with a voltage higher than 30.0V, and the emergency start power supply automatically emits a wrong connection voice information prompt and wrong connection indicator LED6 lights up, and the digital tube flashes to display the error code "Er2" information;

7、

Output electric clamp overload shutdown protection and prompt. When the output electric clamp has excessive current, it will automatically shut down for protection. The emergency power supply will send out corresponding voice information prompts and the digital tube flashes to display the overload protection code "P1" information;

8、

The output clip is short-circuited and automatically cut off protection and prompts. When the output clip is short-circuited again, the output is automatically turned off for protection, and the corresponding voice information prompts and the digital tube flashes to display the short-circuit protection code. "P2" information;

9、

Charging gear prompt and charging status indicator, the emergency start power charging of the conversion model is only charging at the 12V gear, that is, the two batteries must be connected in parallel and then charged together to ensure that the charging voltage of the two batteries is balanced, that is, after the charger is inserted, such as When the switch is not in the 12V position, the emergency start power supply will automatically send out a voice message prompt, and the charging indicator will not light up until the gear is selected correctly, the charging indicator LED2 will light up, and LED1 will light up when the charging is completed;

10、

Forced start output function, when there is no external battery voltage input or the input voltage signal is too low, the emergency start power can not be automatically recognized normally, after human judgment and correct and reliable connection, press the forced start button to force the emergency start power to pull in Conduction.

When the forced start button is pressed, the emergency start power supply will automatically send out a safety warning message voice and the digital tube will simultaneously display "10----9----8----.....0" countdown time counting prompt information to the user, reminding the user to pay attention to the external connection The polarity of the load and the safe working voltage need to be pressed continuously for 10 seconds before the emergency power supply is automatically turned on to ensure that the user has enough time to confirm the connection safely.

In this embodiment, the voice content stored in the voice storage control circuit is as follows (take the English version as an example):

A.12V

B.24V

C. Low voltage, recharging recommended

D. Power is connected

E. Wrong Voltage

F. Wrong Polarity

G. Recharging ON, Turn the switch at back to 12V

H.charge immediately

I. Overload

J. Short Circuit

The specific working process is as follows:

1、When the switch is switched from the OFF position to the 12V or 24V position, the switch will send the parallel or series voltage of the battery pack to the input terminal of the DC contactor, and the "OUT+" terminal has a high level (OUT+ sampling point is actually connected At the input end of the DC contactor, "BAT/External" is connected to the output end of the DC contactor), and after the voltage is limited by the diode D1, the current limiting resistor R1 and the Zener diode DW1, the switch Q1 is driven by the resistor R2 to make Relay JK1 is turned on; the battery BAT+ voltage is added to the input terminal of the three-stable integrated voltage regulator 7805 through the diode D4, so that pin 3 outputs a stable 5VDC voltage to supply power to the CPU and other circuits;

When the external electric clamp is correctly connected and the voltage is greater than 1.5V, after the voltage of the "BAT/external" terminal passes through the diode D6, it is also added to the base of the switch tube Q1 to turn on the relay, so that the 7805 enters the normal working state; Similarly, when the charging port "CH+" is connected to the power source, the 7805 also enters the normal working state.

2、After the MCU is powered on, it first detects whether the transfer switch is turned on. When the voltage at the "OUT+" terminal is detected to be less than 15.5VDC, then it is compared with the voltage from the positive terminal "BAT1+" of the single battery. When the voltage at the two reference points is basically the same At the same time, the CPU defaults that the switch has been placed in the 12V position at this time; on the contrary, when the voltage at this point is greater than or equal to 15.5V and the voltage value of the "BAT1+" terminal is significantly different, the CPU defaults that the switch has been placed in the 24V position; confirm the good gear After the position, the single-chip microcomputer outputs a high level from the P52 port or the P53 port to drive the corresponding gear indicator LED3 or LED4 to light up; at the same time, a pulse signal is output from the P21 port or the P23 port to drive the voice chip, and the corresponding voice information is extracted through the power amplifier , Speakers and other devices report the corresponding gear information to the user;

When the MCU detects that the voltage of "OUT+" is too low, and the voltage of the 12V file is lower than 10.0VDC (the voltage of the 24V file is lower than 20.0VDC), the emergency power supply automatically defaults to the battery is broken and should not be used anymore. The battery should be refilled in time ; The P16 pin of the single-chip microcomputer will automatically cycle the output pulse signal to the voice memory chip, extract the low-voltage alarm prompt voice, and promptly report the low-voltage information to the user through the speaker; at the same time, it will automatically shut off all loads, that is, turn off the cigarette lighter and DC contactor Output;

When the MCU detects that the voltage of "UOT+" is 0V and at the same time detects a certain positive voltage at the "OUT+/external" terminal, it means that the emergency start power switch is not turned on, but the user has correctly connected the output clamp to the external battery Connected; at this time, the emergency start power supply defaults that the user wants to test the external battery voltage through the JS digital display voltmeter, that is, the microcontroller will automatically display the actual voltage value read from the "OUT+/external" terminal through the digital tube;

When the microcontroller detects that the voltage of "UOT+" is 0V, and at the same time detects that the charger is connected to the "CH+" terminal, it means that the switch is not turned on at this time, but the charger is connected, and the microcontroller will automatically output a Pulse signal to the voice memory chip, extract the charging position limit prompt voice, and tell the user to place the switch at 12V when charging. If the switch is in other gears, the microcontroller will automatically output the trigger signal in a cycle until the user switches the switch Turn to the correct 12V gear position; when the emergency start power supply enters normal charging, the single-chip computer judges by detecting the voltage drop on the sampling resistor R31. When the charging current is less than 300mA, the voltage drop on the resistor is 0.03V, indicating the end of charging Otherwise, it means charging. When LED2 is on, it means charging, and when LED1 is on, it means charging is over.

3、Start, its working principle is as follows:

3.1、12V file is correctly connected, conduction and prompt: switch and start production and set it to 12V file. When the MCU detects that the voltages of "OUT+" point and "BAT1+" point are both within the range of 12V file, the emergency power supply will automatically report the 12V file prompt voice; At the same time, the voltage at both ends of the external 12V battery is sampled in two ways, one is connected to the output terminal of the DC contactor, so that the single-chip microcomputer can detect the effective voltage value within the range of 12V in the "BAT+/external" point; the other is sampled by the small teeth of the electric clamp 、Connect the internal

wire of the electric clamp wire to the "J1" port of the control board, and after the positive signal is converted through R5, D8 and IC5, the external positive signal "RIGHT-Ctrl" is sent to the P13 port of the MCU, and the MCU determines the emergency power supply It has switched to the 12V gear, and the electric clamp has been correctly and reliably connected. At this time, the single-chip microcomputer outputs a high level to the DC contactor control circuit to turn it on, and sends a pulse signal to the voice chip to extract the correct connection and conduction prompt Voice, promptly inform the user of the correct connection information; other indications: the 12V gear indicator is on; the corresponding correct connection indicator is on; the digital tube automatically displays the integrated voltage value of the internal and external batteries in parallel.

3.2、12V-range polarity reverse connection protection and prompt: the switch is turned to 12V, the corresponding gear detection and prompt content are the same as above; at the same time, the voltage at both ends of the external 12V (or 24V) battery is sampled by the small teeth of the electric clamp, and the electric clamp is inside The wire is connected to the "J1" port of the control board, after the reverse signal is converted through D9, IC6 and R5, the external reverse signal "Reverse-Ctrl" is sent to the P12 port of the single-chip microcomputer, and the single-chip microcomputer judges that the emergency start power has been transferred At the 12V gear, when the polarity of the external battery is detected to be reversed, the DC contactor will remain disconnected at this time, and continuously send pulse signals to the voice chip to extract the reverse connection prompt voice information, and inform the user of the reverse connection information in time; other indication: The 12V gear indicator is on; the reverse connection alarm indicator LED7 is on; the digital tube displays the reverse connection error code "Er1" and flashes.

3.3、12V-range external voltage is too high error protection and prompt: the switch is turned to 12V, the corresponding detection and prompt content is the same as above; at the same time, the electric clamp is connected to the output terminal of the DC contactor from the voltage of both ends of the external battery, so that the MCU is in the "BAT+/ When "External" detects that the voltage of the connected battery at this time has exceeded the safety range of "12V", the microcontroller directly defaults that the voltage of the external battery does not match the gear selected by the emergency power supply, and the DC contactor remains closed for protection; The chip continuously sends pulse signals to extract the voltage error connection prompt voice information, and promptly informs the user of the error connection information; other indications: the 12V gear indicator lights up; the voltage error connection alarm indicator LED6 lights up; the digital tube displays reverse connection error The code "Er2" flashes.

3.4、24

The V file is connected correctly, and the prompt: Switch to the 24V file. The MCU detects that the voltage between the "OUT+" point and the "BAT1+" point is relatively related, and should belong to the 24V range.

The emergency start power supply automatically reports the 24V gear to prompt the voice; at the same time, the voltage at both ends of the external 24V battery is sampled in two ways, and one is connected to the output terminal of the DC contactor, so that the single-chip microcomputer can detect the validity within the range of 24 gears at the "BAT+/external" point Voltage value; No. 1 is sampled by the small teeth of the electric clamp, and the internal wire of the electric clamp is connected to the "J1" port of the control board. After the positive signal is converted through R5, D8 and IC5, the external positive signal "RIGHT-Ctrl" Send to the P13 port of the microcontroller, the microcontroller judges that the emergency start power has been turned to 24V, and the electrical clamps have been correctly and reliably connected. At this time, the microcontroller outputs a high level to the DC contactor control circuit to make it pull in and turn on, and voice The chip sends a pulse signal to extract the correct connection and conduction prompt voice, and promptly informs the user of the correct connection information; other instructions: the 24V gear indicator lights up; the corresponding correct connection indicator lights up; the digital tube automatically displays , The comprehensive voltage value after the external battery is connected in parallel.

3.5、24V-range polarity reverse connection protection and prompt: the switch is turned to 24V, and the corresponding gear detection and prompt content are the same as above; at the same time, the voltage at both ends of the external 24V (or 12V) battery is sampled by the small teeth of the electric clamp, and the electric clamp is internal After the wire is connected to the "J1" port of the control board, the reverse signal is converted through D9, IC6 and R5, and then the external reverse signal "Reverse-Ctrl" is sent to the P12 port of the single-chip microcomputer. The single-chip microcomputer judges that the emergency start power has been transferred When it reaches the 24V position, when the polarity of the external battery is detected to be reversed, the DC contactor will remain disconnected at this time, and continuously send pulse signals to the voice chip to extract the reverse connection prompt voice information, and inform the user of the reverse connection information in time; Other indications: the 24V gear indicator is on; the reverse connection alarm indicator LED7 is on; the digital tube displays the reverse connection error code "Er1" flashing.

3.6、24

V-range external voltage is too low (or too high, when it exceeds 30.0V) error protection and prompt: the switch is turned to 24V, the corresponding gear detection and prompt content are the same as above; at the same time, the electric clamp is connected to the DC voltage from both ends of the external battery The output terminal of the contactor makes the single-chip microcomputer detect at the "BAT+/external" point that the voltage of the connected battery at this time has exceeded the safety range of "24V". If the external voltage is lower than 15.5V or higher than 30.0V, the single-chip microcomputer directly The default external battery voltage does not match the gear selected by the emergency power supply, and the DC contactor remains closed for protection.

And continuously send pulse signals to the voice chip to extract the voltage error connection prompt voice information, and inform the user of the error connection information in time; other instructions: 24V gear indicator lights; voltage error connection alarm indicator LED6 lights up; digital tube display The reverse connection error code "Er2" flashes.

4、Start-up overload automatic shutdown protection: When the emergency start-up power supply is started, a large current is generated in the start-up system. The emergency start-up power supply takes a sample from the small teeth of the black electric clamp and reads the big tooth of the black electric clamp to the internal battery The voltage drop between the negative poles is sent to the "J1" port through the small teeth of the black electric clip and the internal signal line, and then amplified by the circuit such as D0, IC7, and the overcurrent signal "OVERLOAE-TEST" is sent to the P11 port of the microcontroller. When the voltage value is continuously higher than a set value for a certain period of time (the resistance between the big teeth of the black electric clip and the negative terminal of the battery is tested in advance, the reference voltage of the overcurrent protection is calculated by referring to the maximum discharge capacity of the battery of the emergency starter Value), the emergency start power supply defaults to the externally connected load being too heavy, and when the maximum endurance range of the entire system is exceeded, the microcontroller cuts off the DC contactor control signal to force the DC contactor to shut off the output; the microcontroller simultaneously extracts the corresponding The over-current protection prompts voice information and informs the user in time; other instructions: the digital tube displays the over-current protection code "P1" flashing.

5、Electric clamp output short circuit automatic shutdown protection: When the emergency start power supply is short-circuited after the electric clamp is turned on, a large current will be generated in the starting system. The emergency start power supply also takes samples from the small teeth of the black electric clamp, and read Take the voltage drop between the big tooth of the black electric clip and the negative electrode of the internal battery, and send it to the "J1" port through the small tooth of the black electric clip and the internal signal line, and then after the D0, IC7 and other circuits amplify, the overcurrent signal "OVERLOAE" -TEST" is sent to the P11 port of the MCU; at the same time, the MCU judges the voltage difference between the two points "OUT+" and "BAT/outside" at both ends of the DC contactor. When these two voltage values are continuously higher than a certain value for a certain period of time When the setting value is set, the emergency start power supply defaults that the external electric clamp connection has a short-circuit fault; the microcontroller will immediately cut off the DC contactor control signal to force the DC contactor to shut off the output; the microcontroller will simultaneously extract the corresponding short-circuit protection prompt voice to the voice memory Information and inform the user in time; other instructions: the digital tube displays the overcurrent protection code "P2" flashing.

6、Forced start output: When the external battery voltage is too low or there is no battery, the user can first turn on the switch to the required voltage range (the corresponding range detection and prompt content is the same as above), and then clamp the positive and negative electrodes Respectively connect to the positive and negative terminals of the input power supply of the load, pay attention to the reliable connection of the large and small teeth of the electric clamp at the same time, and confirm that the power required by the load is consistent with the voltage range selected by the emergency start power switch; press and hold the forced start switch, The forced start switch will short-circuit the "J3" port so that the internal 5V power supply will be sampled by the resistors R15 and R16, and then sent to the P25 port of the microcontroller. The microcontroller will automatically start timing and extract the forced start voice safety prompt from the voice chip. After continuously pressing for 10s, the MCU will automatically issue a switch-on command to force the DC contactor to be turned on; when the emergency start power supply is connected before the automatic pull-in (within 10s), there is an abnormal connection (such as reverse connection, high voltage misconnection)), the single chip microcomputer will automatically determine that the forced start operation is invalid, and it needs to be restored after troubleshooting; to ensure the safety of the user's operation; other tips: after pressing this switch, the digital tube will display "10s countdown timer" flashing within 10s, and the pull-in guide After the power is turned on, the emergency power supply will give a voice prompt for correct conduction, and at the same time, the correct connection indicator LED5 will light up.

7、The working principle of the voice control circuit: First, all the functional voices are stored in the voice storage chip in PCM compression mode. The voice chip uses the BLA4206 chip of the BLA series. The chip supports a total voice length of 42s and can store up to 30 different voice content. ; Voice reading is controlled by a total of 8 separate trigger pins S1-S8, and it also supports different pins for triggering in different combinations, so that it can support the needs of 30-segment voice triggering; then arbitrary extraction is controlled by the CPU For each segment of voice content, the voice signal is output through the 8th pin. After being amplified by the audio power amplifier IC4, it directly drives the speaker SL1 to pronounce; the voice trigger signal is active at high level. Each time the microcontroller sends out a pulse trigger signal, the voice chip will automatically extract the corresponding When the trigger is a continuous high level, the chip will automatically broadcast the same voice content in a loop.

8、Working principle of sampling circuit and control circuit: as shown in Figure 5, J1 is the positive and negative electric clamp small tooth sampling signal input terminal. When the external positive connection is connected, the voltage is converted through resistors R5, D8 and IC5, and the AD signal is sent to The P31 port of the stand-alone device is used as the basis for judging whether the external electric clamp is connected or disconnected; when the polarity of the external battery voltage is reversed, the microcontroller cannot directly read the negative pressure of the "BAT/external" terminal, but through J1, D9, IC6 After the conversion of R5, the reverse connection signal is sent to the P12 port of the single-chip microcomputer as a basis for judging the polarity of the external electric clamp connection; when the output electric clamp line has excessive load current, the large current will be in the negative electric clamp A certain voltage drop is generated on the line. This voltage will be taken out through the small teeth of the negative electric clip and sent to D0, R11 and IC7 for amplification and then sent to the P11 pin of the microcontroller for judgment. When it is detected that the voltage is continuously greater than a certain setting within 1s When setting the value, the single-chip microcomputer defaults that the external load is too heavy, and immediately shuts off the DC contactor for protection; in the same way, when it is detected that the voltage value is higher than the other set value in an instant, and the two DC contactors are separated from each other. When the voltage drop detected by the terminal is also greater than a certain set value, the emergency start power supply will automatically default to the short circuit of the output clamp, and immediately turn off the DC contactor for protection;

J5 is the charging power input terminal; J6 is the input terminal for internal output voltage detection and external voltage detection, as well as the sampling point of the voltage drop across the DC contactor; J7 is the DC contactor control coil interface; among them are the main components R25, R26 , Q2, JK2, and RT1 constitute the cigarette lighter output control circuit; the main components R29, R30, Q3 constitute the buzzer alarm control circuit; the main components R27, R28, Q3 constitute the DC contactor control circuit; the main components R17, R18, R31, C25, and C21 constitute the charging power sampling and charging current sampling circuit, which is used to judge the connection of the charger and the detection of the charging state; the main components are R19, R20, R21, R22, R23, R24, C22, C23, C20 constitutes the internal and external battery voltage sampling circuit and the conversion switch gear judgment sampling circuit; the main components LED, Q5, Q6, Q7, etc. constitute a digital display control circuit.

The above shows and describes the basic principles, main features and advantages of the present invention.

Those skilled in the industry should understand that the present utility model is not limited by the foregoing embodiments. The foregoing embodiments and descriptions only illustrate the principles of the present utility model, and the present utility model does not deviate from the spirit and scope of the present utility model. There will be various changes and improvements, and these changes and improvements fall within the scope of the claimed utility model.

The scope of protection claimed by the utility model is defined by the appended claims and their equivalents.

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(12)实用新型专利

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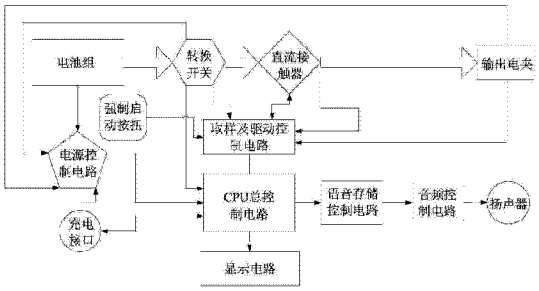
权利要求书 1 页 说明书 7 页 附图 4 页

(54)实用新型名称

一种自带语音提示功能的智能型应急启动电源

(57)摘要

本实用新型公开一种自带语音提示功能的智能型应急启动电源，包括有电池组，电池组的供电端连接有转换开关，转换开关通过直流接触器连接至输出电夹，还包括有 CPU 总控制电路，该 CPU 总控制电路的输出端连接有音频播放系统；CPU 总控制电路的输入端连接有取样及驱动控制电路，该取样及驱动控制电路与转换开关、直流接触器及输出电夹相连；电池组通过电源控制电路与充电接口相连，电源控制电路与充电接口连接至 CPU 总控制电路；输出电夹及转换开关分别与电源控制电路相连；CPU 总控制电路的输出端还连接有显示电路；取样及驱动控制电路连接有强制启动按钮。该应急启动电源在不同的使用环境下，都能够及时准确地向用户传递相关操作信息。



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1. 一种自带语音提示功能的智能型应急启动电源，包括有电池组，该电池组的供电端连接有转换开关，转换开关通过直流接触器连接至输出电夹，其特征在于，

还包括有 CPU 总控制电路，该 CPU 总控制电路的输出端连接有音频播放系统；

所述 CPU 总控制电路的输入端连接有取样及驱动控制电路，该取样及驱动控制电路与转换开关、直流接触器及输出电夹相连；

所述电池组通过电源控制电路与充电接口相连，电源控制电路与充电接口连接至 CPU 总控制电路；

所述输出电夹及转换开关分别与电源控制电路相连；

所述 CPU 总控制电路的输出端还连接有显示电路；

所述取样及驱动控制电路连接有强制启动按钮。

2. 根据权利要求 1 所述的一种自带语音提示功能的智能型应急启动电源，其特征在于，所述音频播放系统包括语音存储控制电路，该语音存储控制电路的输入端连接于 CPU 总控制电路，其输出端连接于音频控制电路，音频控制电路与扬声器相连。

3. 根据权利要求 1 所述的一种自带语音提示功能的智能型应急启动电源，其特征在于，所述显示电路包括 LED 数码管显示器和不同颜色的 LED 指示灯。

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一种自带语音提示功能的智能型应急启动电源

技术领域

[0001] 本实用新型涉及应急启动电源，尤其涉及一种自带语音提示功能的智能型应急启动电源。

背景技术

[0002] 12V/24V 转换应急启动电源在不同的使用环境下，单靠人为控制操作难以做到百分之百正确。在没有任何保护和提示的前提下，任何出现一次误操作都将可能给产品带来永久损坏，严重时甚致可导致电池爆炸，危及到用户的人身财产安全。虽然现有的部分产品设有操作指导说明和一些简单的声光报警功能，但由于简单的蜂鸣器报警和使用的磨损导致操作提示内容的缺损或模糊，使应急启动电源缺少必要的安全指示，同时也给用户操作出现问题后却无法及时找到原因而困惑。如果在用户每一项操上同时增加必要的语音提示和光电指示，这样既能减少不同环境给用户带来的影响，同时也能及时地直接告知用户实时的操作状况，更能有效地预防失误的产生，让用户操作更直接、更清楚。因此，有必要对现有应急启动电源的结构进行优化。

实用新型内容

[0003] 本实用新型的目的是提供一种自带语音提示功能的智能型应急启动电源，用语音对用户的当前操作给予提示，以减少误操作，使应急启动电源在操作时得到安全防护，延长其使用寿命。

[0004] 本实用新型为解决其技术问题所采用的技术方案是，

[0005] 一种自带语音提示功能的智能型应急启动电源，包括有电池组，该电池组的供电端连接有转换开关，转换开关通过直流接触器连接至输出电夹，还包括有 CPU 总控制电路，该 CPU 总控制电路的输出端连接有音频播放系统，该音频播放系统包括有语音存储控制电路，语音存储控制电路的输入端连接于 CPU 总控制电路，其输出端连接于音频控制电路，音频控制电路与扬声器相连；

[0006] 所述 CPU 总控制电路的输入端连接有取样及驱动控制电路，该取样及驱动控制电路与转换开关、直流接触器及输出电夹相连；所述电池组通过电源控制电路与充电接口相连，电源控制电路与充电接口连接至 CPU 总控制电路；所述输出电夹及转换开关分别与电源控制电路相连；所述 CPU 总控制电路的输出端还连接有显示电路，该显示电路包括 LED 数码管显示器和不同颜色的 LED 指示灯；所述取样及驱动控制电路连接有强制启动按钮。

[0007] 本实用新型的优点在于，该应急启动电源可对档位选择、正确连接、错误连接和电压过低或电压过高等进行安全保护，同时在充电档位选择、电池低压预警、输出过流保护、电夹输出短路保护以及人为强制启动安全提示等方面都加入相应的语音提示和光电提示；在不同的使用环境下，都能够及时准确地向用户传递相关操作信息，使用户通过声、光等不同类型的提示方式获取操作信息，使用户更加直观地了解实时的操作情况及使用错误的原因，便于更好地进行下一步操作或及时有效地纠正措施，确保使用者的人身安全，使整个产

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品更具人性化、智能化。

附图说明

[0008] 图 1 是本实用新型提出的应急启动电源的电气原理图；

[0009] 图 2 是电源控制电路图；

[0010] 图 3 是是 CPU 总控制电路及 LED 数码管显示器电路图；

[0011] 图 4 是语音存储及音频控制电路图；

[0012] 图 5 是取样及驱动控制电路图。

具体实施方式

[0013] 为了使本实用新型实现的技术手段、创作特征、达成目的与功效易于明白了解，下面结合图示与具体实施例，进一步阐述本实用新型。

[0014] 如图 1 所示，本实用新型提出的自带语音提示功能的智能型应急启动电源包括有电池组，该电池组的供电端连接有转换开关，转换开关通过直流接触器连接至输出电夹，还包括有 CPU 总控制电路，该 CPU 总控制电路的输出端连接有音频播放系统，该音频播放系统包括有语音存储控制电路，语音存储控制电 路的输入端连接于 CPU 总控制电路，其输出端连接于音频控制电路，音频控制电路与扬声器相连；

[0015] 所述 CPU 总控制电路的输入端连接有取样及驱动控制电路，该取样及驱动控制电路与转换开关、直流接触器及输出电夹相连；所述电池组通过电源控制电路与充电接口相连，电源控制电路与充电接口连接至 CPU 总控制电路；所述输出电夹及转换开关分别与电源控制电路相连；所述 CPU 总控制电路的输出端还连接有显示电路，该显示电路包括 LED 数码管显示器和不同颜色的 LED 指示灯；所述取样及驱动控制电路连接有强制启动按钮。

[0016] 目前汽车电池主要分为 12V 和 24V 两种，在电路设计中以 0VDC ～ 15.5VDC 以内默认为是 12VDC 电池；以 15.5 ～ 30.0VDC 内默认为是 24VDC 电池。转换开关将两个电池实现并联或串联两种方式，使之能够实现一机两个电压输出的功能。同时在转换开关上镶入两个联动小开关，联动开关与 12V 档和 24V 档保持同步，即转换开关在 12V 或 24V 档时，联动开也同步闭合，在 OFF 档时，联动开关也自动断开，用于实现外部连接信号的输入或断开等判断。

[0017] 该应急启动电源利用大功率直流接触器作为自动控制电子开关，通过电路进行控制其通和断两种状态，同时电路在吸合后判断直流接触器两端电压降，作为判断输出电夹是否出现短接的条件之一。

[0018] 应急启动电源分别从电池组两端、电夹小齿、转换开关输出端、直流接触器两端、充电接口、内部电压测试复位开关、强制启动按扭等关键点分别取样送至 CPU 总控制电路处理、判断，从而得知用户的操作信息后，将对应的脉冲信号发到语音存储控制电路，调取预先保存好的语音内容，再经过音频控制电路功率放大后，由场声器发出相应的语音信息。该应急启动电源可对档位选择、正确连接、错误连接和电压过低或过高等进行安全保护，同时在充电档位选择、电池低压预警、输出过流保护、电夹输出短路保护以及人为强制启动安全提示等方面都加入相应的语音提示和光电提示。语音清晰、响亮，发音标准，在 40dB 噪声环境下，声音有效传输距离在 5 米以上。语音种类除了标准的英语提示外还预备另外两个

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语种，即法语和西班牙语，用户可直接通过简单的按键任意切换，提高产品的通用性。

[0019] 在一个实施例中，该应急启动电源的电路构成如图2、图3、图4、图5所 示。本实施例中，该应急启动电源采用的主要关键器件有：IC1-7805 三端集成稳压器、IC2-MC96F32Q 单片机、IC3-BLA4208 语音存储集成芯片、IC4-TDA2822 集成音频功放、LS1- 全频段扬声器 2W/8 欧、LED-LG5631AH 七段数码管显示器、IC5（IC6）-PC817 光耦、IC7-LM358 集成运放、大功直流接触器、大电流转换开关（12/24V 档切换用）、联动开关、强制启动按钮、输出正、负极电夹。

[0020] 本实施例中，该应急启动电源可实现的主要功能有：

[0021] 1、应急启动电源转换开关操作时 12V/24V 档位自动识别提示，对应的档位语音提示及 LED3/LED4 点亮指示；

[0022] 2、应急启动电源电池低压自动报警提示，当电池电压低于 8.0 ≤ U ＜ 10.0V 时，语音自动报警提示；

[0023] 3、应急启动电源电池电压过低自动关断保护及提示，当电池电压持续低于 8V 时，应急启动电源自动关断电夹输出回路，同时发出低压关断保护语音提示；

[0024] 4、输出电夹正确连接导通提示，正确连接时自动吸合导通，并带语音提示及 LED4 灯点亮提示；

[0025] 5、输出电夹连接极性反向错误关断保护和提示，输出电夹极性接反时，直流接触器产关断保护，同时发出相应的语音信息提示及反接指示 LED7 灯点亮提示，同时数码管闪烁显示错误代码“Er1”信息；

[0026] 6、输出电夹连接电压错误关断保护和提示，即，内外连接的电池电压不匹配，一般指 12V 与 24V 电池对接错误或 24V 接外部电压高于 30.0V 的电池，应急启动电源自动发出错误连接语音信息提示和错接指示 LED6 灯点亮提示，同时数码管闪烁显示错误代码“Er2”信息；

[0027] 7、输出电夹过载关断保护和提示，当输出电夹出现电流过大时，自动关断而保护，应急启动电源发出相应的语音信息提示及数码管闪烁显示过载保护代码“P1”信息；

[0028] 8、输出电夹短路自动关断保护和提示，在吸合导通下，当输出电夹再次出现短接时，自动关断输出而保护，同时发出相应的语音信息提示及数码管闪烁显示短路保护代码“P2”信息；

[0029] 9、充电档位提示及充电状态指示，转换款应急启动电源充电仅现于 12V 档充电，即要把两电池并联后再一起充电，以确保两电池的充电电压平衡，即， 插入充电器后，如转换开关不在 12V 档位时，应急启动电源自动发出语音信息提示，同时充电指示灯也不会点亮，直到档位选择正确为止，正在充电指示灯 LED2 点亮、充电结束时 LED1 点亮；

[0030] 10、强制启动输出功能，当外部没有电池电压输入或输入电压信号过低，应急启动电源无法正常自动识别时，通过人为判断并正确可靠连接后，按下强制启动按扭，使应急启动电源强制吸合导通。当按下强制启动按开关后，应急启动电源自动发出安全预警信息语音和数码管同步显示“10—9—8—.....0”倒数时间计数提示信息给用户，提醒用户注意外接负载的极性和安全工作电压，需要持续按下 10s 后，应急启动电源才自动吸合，确保用户有足够的时间再对连接进行安全确认。

[0031] 本实施例中，语音存储控制电路中存储的语音内容如下（以英文版为例）：

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[0032] A.12V

[0033] B.24V

[0034] C.Low voltage,recharging recommended

[0035] D.Power is connected

[0036] E.Wrong Voltage

[0037] F.Wrong Polarity

[0038] G.Recharging ON,Turn the switch at back to 12V

[0039] H.charge immediately

[0040] I.Overload

[0041] J.Short Circuit

[0042] 其具体工作过程如下：

[0043] 1、当转换开关由 OFF 档转入 12V 或 24V 档位时，转换开关将电池组并联或串联后的电压送至直流接触器的输入端，同时“OUT+”端有高电平（OUT+ 取样点实际连接于直流接触器的输入端，“BAT/ 外部”连接于直流接触器的输出端），并通过二极管 D1、限流电阻 R1 和稳压二极管 DW1 限压后，由电阻 R2 驱动开关管 Q1，使继电器 JK1 吸合导通；电池 BAT+ 电压经过二极管 D4 加入三稳集成稳压器 7805 的输入端，使 3 脚输出一个稳定的 5VDC 电压给 CPU 及其他电路供电；

[0044] 当外部电夹正确连接且电压大于 1.5V 时，“BAT/ 外部”端电压经过二极管 D6 后，同样也加到开关管 Q1 的基极使继电器吸合导通，从而使 7805 进入正常工作状态；同理，当充电接口“CH+”接入电源时，7805 也进入正常工作状态。

[0045] 2、单片机上电工作后，首先检测转换开关是否打开，当“OUT+”端检测到电压 < 15.5VDC 时再与单电池正极“BAT1+”端取到的电压进行对比，当两个参考点的电压基本相同时，CPU 默认此时转换开关已置于 12V 档位；反之，当该点电压≥ 15.5V 且与“BAT1+”端的电压值相差较大时，CPU 默认转换开关已置于 24V 档；确定好档位后，单片机由 P52 端口或 P53 端口输出高电平，驱动对应的档位指示灯 LED3 或 LED4 点亮；同时由 P21 端口或 P23 端口输出一个脉冲信号驱动语音芯片，提取对应的语音信息经功放、扬声器等器件将对应的档位信息报告给用户；

[0046] 当单片机检测到“OUT+”的电压过低时，12V 档电压低于 10.0VDC（24V 档电压低于 20.0VDC）时，应急启动电源自动默认为电池已经溃电，不宜再使用，应及时补充电量；单片机 P16 脚将自动循环输出脉冲信号给语音存储芯片，提取低压报警提示语音，并通过扬声器及时地把低压信息报告给用户；同时将自动关断所有负载，即关闭点烟器和直流接触器的输出；

[0047] 当单片机检测到“UOT+”的电压为 0V，同时在“OUT+/ 外部”端检测到一定的正电压时，则表示应急启动电源的转换开关没有开，只是用户将输出电夹与外部电池已正确连接上；时此，应急启动电源默认用户想通过 JS 的数显电压表去测试外部电池电压，即单片机自动将从“OUT+/ 外部”端读到的实际电压值通过数码管显示出来；

[0048] 当单片机检测到“UOT+”的电压为 0V，同时在“CH+”端检测到充电器有接入电压时，表示此时转换开关没有开，只是充电器已接入，此时单片机自动将输出一个脉冲信号给语音存储芯片，提取充电档位置限制提示语音，告诉用户充电时请将转换开关置于 12V 档，

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如转换开关在其他档位时，单片机将自动循环输出触发信号，直到用户将转换开关转到正确的12V档位为止；当应急启动电源进入正常充电后，单片机通过检测取样电阻R31上的压降进行判断，当充电电流小于300mA时该电阻上的压降为0.03V，表示充电结束，反之则表示正在充电，当LED2点亮表示正在充电，当LED1点亮时表示充电结束。

[0049] 3、启动，其工作原理如下：

[0050] 3.1、12V档正确连接导通和提示：转换开产置于12V档，单片机检测到“OUT+”点和“BAT1+”点的电压均在12V档范围内时，应急启动电源自动报12V档位提示语音；同时外部12V电池两端电压分两路取样，一路接入直流接触器的输端，使单片机在“BAT+/外部”点检到12V档范围内的有效电压值；另一路通过电夹小齿取样、电夹线内部导线接至控制板的“J1”端口，使正接信号通过R5、D8和IC5进行转换后，将外部正接信号“RIGHT-Ctrl”送至单片机的P13端口，单片机判断应急启动电源已转到12V档，同时电夹已经正确可靠连接，此时单片机再向直流接触器控制电路输出高电平使其吸合导通，并向语音芯片发送一个脉冲信号提取正确连接及导通提示语音，将正确连接接信息及时地告诉用户；其他指示：12V档位指示灯点亮；对应的正确连接指示灯点亮提示；数码管自动显示内、外池电并联后的综合电压值。

[0051] 3.2、12V档极性反向连接保护和提示：转换开关转到12V档，相应的档位检测和提示内容同上；同时外部12V（或24V）电池两端电压通过电夹小齿取样、电夹线内部导线接至控制板的“J1”端口，使反接信号通过D9、IC6和R5进行转换后，将外部反接信号“Reverse-Ctrl”送至单片机的P12端口，单片机判断应急启动电源已转到12V档，同时检测到外部电池极性接反，此时直流接触器将保持断开状态，并向语音芯片连续发送脉冲信号提取反接提示语音信息，并将反接信息及时地告诉用户；其他指示：12V档位指示灯点亮；反接报警指示灯LED7点亮；数码管显示反接错误代码“Er1”闪烁。

[0052] 3.3、12V档外接电压过高错误保护和提示：转换开关转到12V档，相应的检测和提示内容同上；同时电夹从外部电池两端电压接入直流接触器的输端，使单片机在“BAT+/外部”点检到此时连接的电池电压已超出“12V”的安全范围内时，单片机直接默认外接电池电压与应急启动电源所选择的档位不匹配，直流接触器保持关闭保护；并向语音芯片连续发送脉冲信号提取电压错误连接提示语音信息，并将错接信息及时地告诉用户；其他指示：12V档位指示灯点亮；电压错误连接报警指示灯LED6点亮；数码管显示反接错误代码“Er2”闪烁。

[0053] 3.4、24V档正确连接导通和提示：转换开产置于24V档，单片机检测到“OUT+”点和“BAT1+”点的电压相关较大，应属于24V档位。应急启动电源自动报24V档位提示语音；同时外部24V电池两端电压分两路取样，一路接入直流接触器的输端，使单片机在“BAT+/外部”点检到24档范围内的有效电压值；中一路通过电夹小齿取样、电夹线内部导线后接至控制板的“J1”端口，使正接信号通过R5、D8和IC5进行转换后，将外部正接信号“RIGHT-Ctrl”送至单片机的P13端口，单片机判断应急启动电源已转到24V档，同时电夹已经正确可靠连接，此时单片机再向直流接触器控制电路输出高电平使其吸合导通，并向语音芯片发送一个脉冲信号提取正确连接及导通提示语音，将正确连接接信息及时地告诉用户；其他指示：24V档位指示灯点亮；对应的正确连接指示灯点亮提示；数码管自动显示内、外池电并联后的综合电压值。

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[0054] 3.5、24V 档极性反向连接保护和提示：转换开关转到 24V 档，相应的档位检测和提示内容同上；同时外部 24V（或 12V）电池两端电压通过电夹小齿取样、电夹线内部导线后接至控制板的“J1”端口，使反接信号通过 D9、IC6 和 R5 进行转换后，将外部反接信号“Reverse-Ctrl”送至单片机的 P12 端口，单片机判断应急启动电源已转到 24V 档，同时检测到外部电池极性接反，此时直流接触器将保持断开状态，并向语音芯片连续发送脉冲信号提取反接提示语音信息，并将反接信息及时地告诉用户；其他指示：24V 档位指示灯点亮；反接报警指示灯 LED7 点亮；数码管显示反接错误代码“Er1”闪烁。

[0055] 3.6、24V 档外接电压过低（或过高，超过 30.0V 时）错误保护和提示：转换开关转到 24V 档，相应的档位检测和提示内容同上；同时电夹从外部电池两端电压接入直流接触器的输端，使单片机在“BAT+/ 外部”点检到此时连接的电池电压已超出“24V”的安全范围内时，如外部电压低于 15.5V 或高于 30.0V 时，单片机直接默认外接电池电压与应急启动电源所选的档位不匹配，直流接触器保持关闭保护。并向语音芯片连续发送脉冲信号提取电压错误连接提示语音信息，并将错接信息及时地告诉用户；其他指示：24V 档位指示灯点亮；电压错误连接报警指示灯 LED6 点亮；数码管显示反接错误代码“Er2”闪烁。

[0056] 4、启动过载自动关断保护：当应急启动电源在启动的瞬间，整过启动系统中产生很大电流，应急启动电源通过从黑电夹小齿上取样，读取黑电夹的大齿到内部电池负极之间的压降，通过黑电夹小齿、内部信号线送到“J1”端口，再 经过 D0、IC7 等电路放大后，将过流信号“OVERLOAE-TEST”送到单片机的 P11 端口，当该电压值在一定时间内持续高于某一设定值（预先测试出黑电夹大齿到电池负极端子之间的电阻，参考应急启动电源电池最大放电能力计算出过流保护的参考电压值）时，应急启动电源就默认外部连接负载过重，已超出整个系统最大承受范围时，单片机切断直流接触器控制信号，使直流接触器强制关断输出；单片机同时向语音存片提取对应的过流保护提示语音信息，并将信息及时告知用户；其他指示：数码管显示过流保护代码“P1”闪烁。

[0057] 5、电夹输出短路自动关断保护：当应急启动电源在吸合导通后电夹出现短路时，整过启动系统中产生很大电流，应急启动电源同样通过从黑电夹小齿上取样，读取黑电夹的大齿到内部电池负极之间的压降，通过黑电夹小齿、内部信号线送到“J1”端口，再经过 D0、IC7 等电路放大后，将过流信号“OVERLOAE-TEST”送到单片机的 P11 端口；同时单片机判断直流接触器两端“OUT+”和“BAT/ 部外”两点之间压差，当这两个电压值在一定时间内持续高于某一设定值时，应急启动电源就默认外部电夹连接出现短路故障；单片机将立即切断直流接触器控制信号，使直流接触器强制关断输出；单片机同时向语音存片提取对应的短路保护提示语音信息，并将信息及时告知用户；其他指示：数码管显示过流保护代码“P2”闪烁。

[0058] 6、强制启动输出：当外部电池电压过低或没有电池时，用户可以先将转换开关打开到所需的电压档位（此时相应的档位检测和提示内容同上），再将正、负极电夹分别接到负载的输入电源正、负极上，注意电夹的大小齿同时可靠连接，并确认负载所需电源与应急启动电源转换开关选择的电压档位一致后；按持续按下强制启开关，强制启动开关将“J3”端口短接，使内部 5V 电源通过电阻 R15、R16 分压取样后，送至单片机的第 P25 端口，单片机将自动开始计时，并向语音芯片提取强制启动语音安全提示，持续按下 10S 后，单片机将自动发出接通指令，使直流接触器强制吸合导通；当应急启动电源在动自吸合之前（10S 内）

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出现连接异常(如、反接、高压错接)时,单片机将自动判断强制启动操作无效,需要排除故障后恢复;确保用户的操作安全;其他提示:按下此开关后,在 10s 内数码管显示“10s 倒数计时器”闪烁,吸合导通后,应急启动电源将发出正确导通语音提示,同时正确连接提示灯 LED5 点亮。

[0059] 7、语音控制电路工作原理:首先把所有的功能语音以 PCM 压缩模式存入语音存储芯片中,语音芯片选用 BLA 系列的 BLA4208 芯片,该芯片总共支持语音长度为 42s,最多可存储 30 段不同的语音内容;语音的读取是通过 S1-S8 共 8 个单独触发引脚控制,同时还支持不同引脚以不同的组合方式进行触发,使其能够支持 30 段语音触发的需要;再通过 CPU 控制任意提取每一段语音内容,通过第 8 脚输出语音信号,经过音频功放 IC4 放大后,直接驱动扬声器 SL1 发音;语音触发信号为高电平有效,单片机每发出一个脉冲触发信号,语音芯片将自动提取一次相应的语音内容进行播报;当触发为持续高电平时,芯片将自动循环播报相同语音内容。

[0060] 8、取样电路及控制电路工作原理:如图 5 所示,J1 为正、负极电夹小齿取样信号输入端,当外部正接时,电压通过电阻 R5、D8 及 IC5 进行转换后,将 AD 信号送入单机的第 P31 端口,作为判断外部电夹是否正接或断开的依据;当外接电池电压极性反向时,单片机无法直接读取“BAT/ 外部”端的负压,而通过 J1、D9、IC6、R5 进行转换后,将反接信号送入单片机的第 P12 端口,作为判断外部电夹连接极性反向依据;当输出电夹线出现负载电流过大时,大电流将会在负极电夹线上产生一定压降,这个电压将通过负极电夹的小齿取出送至 D0、R11 和 IC7 放大后送入单片机的第 P11 脚进行判断,当检测到该电压在 1s 内持续大于某一设定值时,单片机就默认为外接负载过重,立即关断直流接触器进行保护;同理,当检测到该电压值在瞬间内高于另一设定值,同时又分别从直流接触器两端检测到的压降也大于某一设定值时,应急启动电源就自动默认为输出电夹存在短路现象,立即关断直流接触器而保护;

[0061] J5 为充电电源接入端;J6 为内输出电压检测和外部电压检测输入端,同时也是直流接触器两端压降的取样点;J7 为直流接触器控制线圈接口;其中由主要元件 R25、R26、Q2、JK2、RT1 组成点烟器输出控制电路;由主要元件 R29、R30、Q3 组成蜂鸣器报警控制电路;由主要元件 R27、R28、Q3 组成直流接触器控制电路;由主要元 R17、R18、R31、C25、C21 组成充电电源取样及充电电流取样电路,用于判断充电器的接入以及充电状态的检测;由主要元件 R19、R20、R21、R22、R23、R24、C22、C23、C20 组成了内、外电池电压取样电路及转换开关档位判断取样电路;由主要元件 LED、Q5、Q6、Q7 等组成数码显 示控制电路。

[0062] 以上显示和描述了本实用新型的基本原理、主要特征和本实用新型的优点。本行业的技术人员应该了解,本实用新型不受上述实施例的限制,上述实施例和说明书中描述的只是说明本实用新型的原理,在不脱离本实用新型精神和范围的前提下本实用新型还会有各种变化和改进,这些变化和改进都落入要求保护的本实用新型范围内。本实用新型要求保护范围由所附的权利要求书及其等同物界定。

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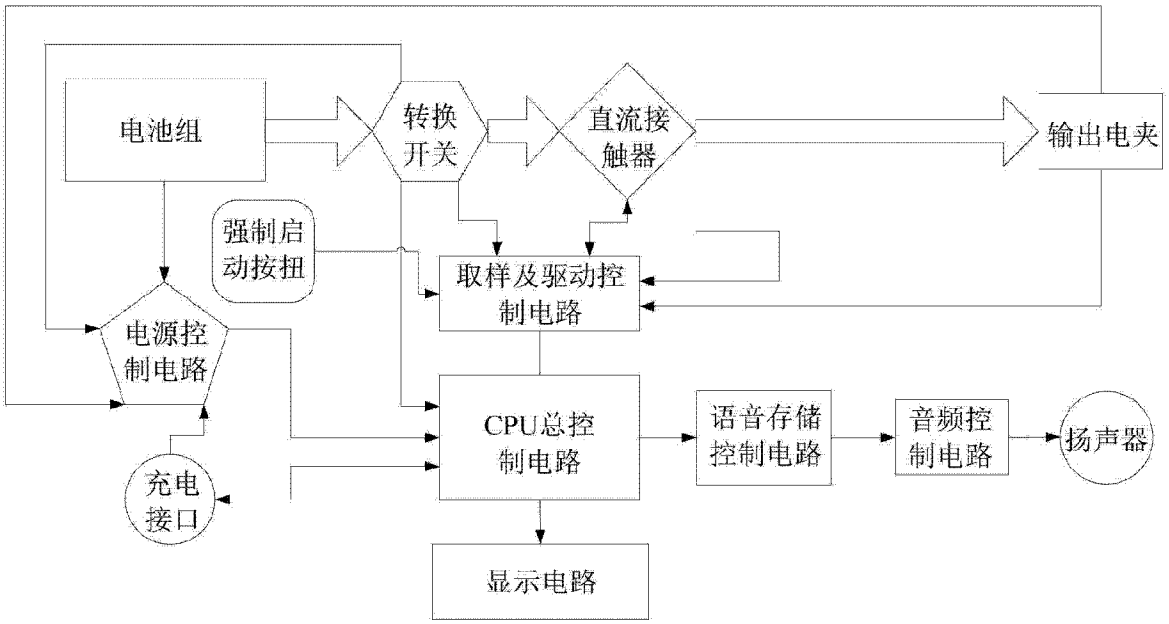


图 1

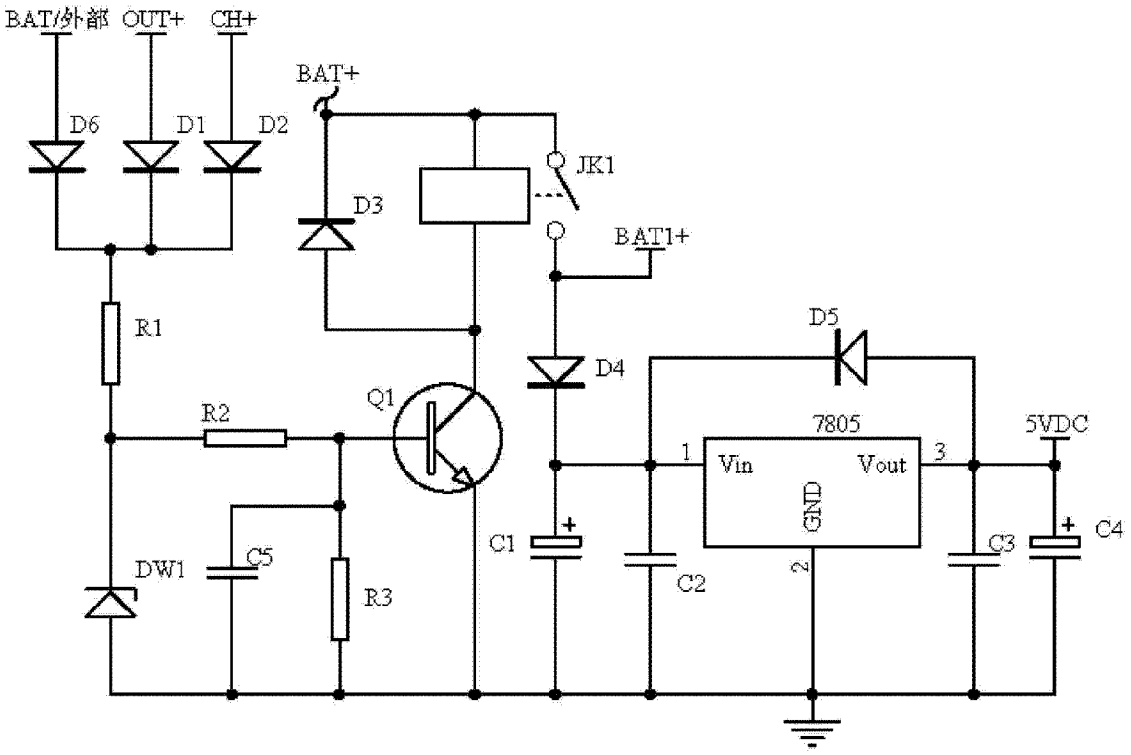


图 2

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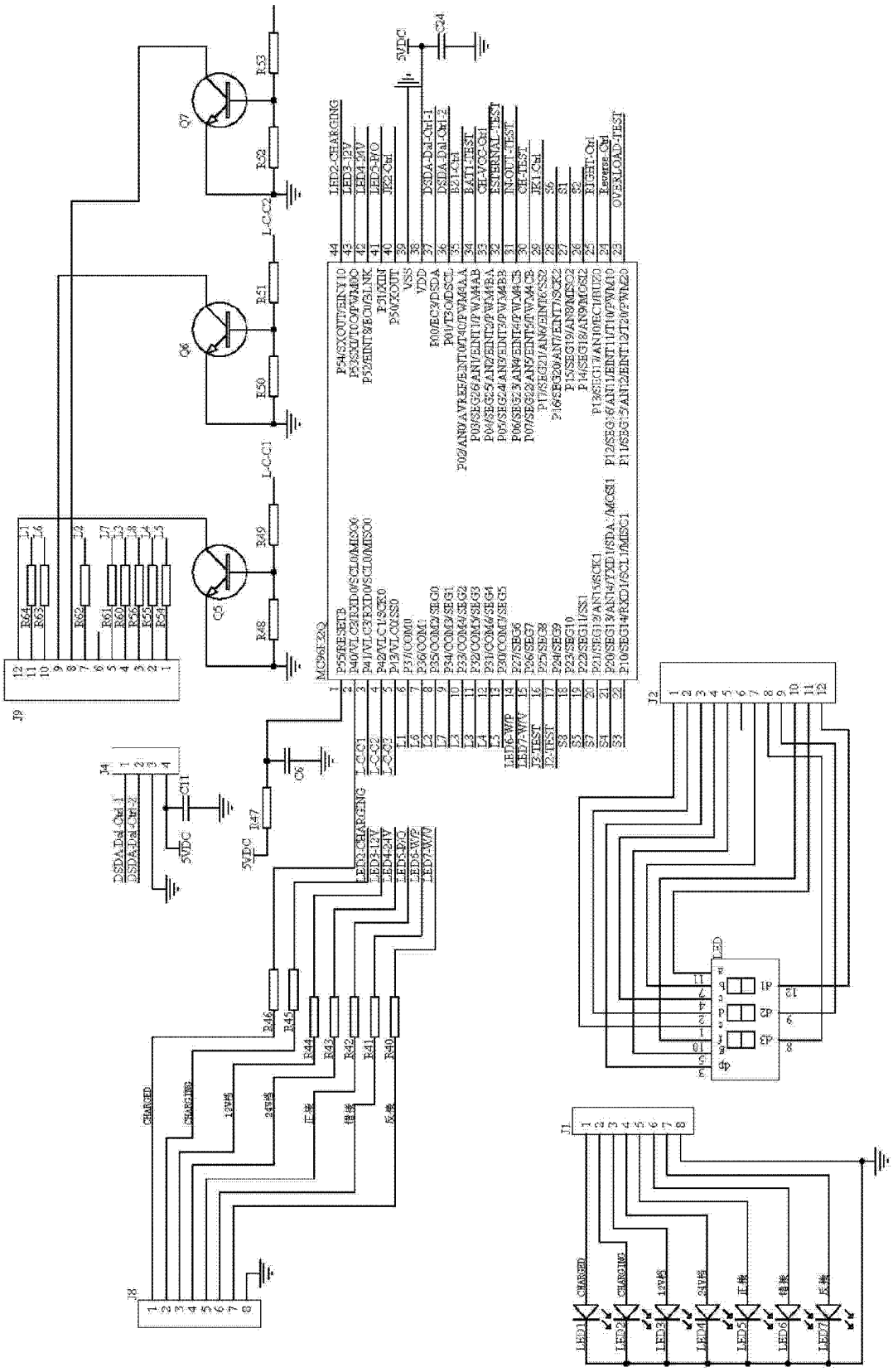


图 3

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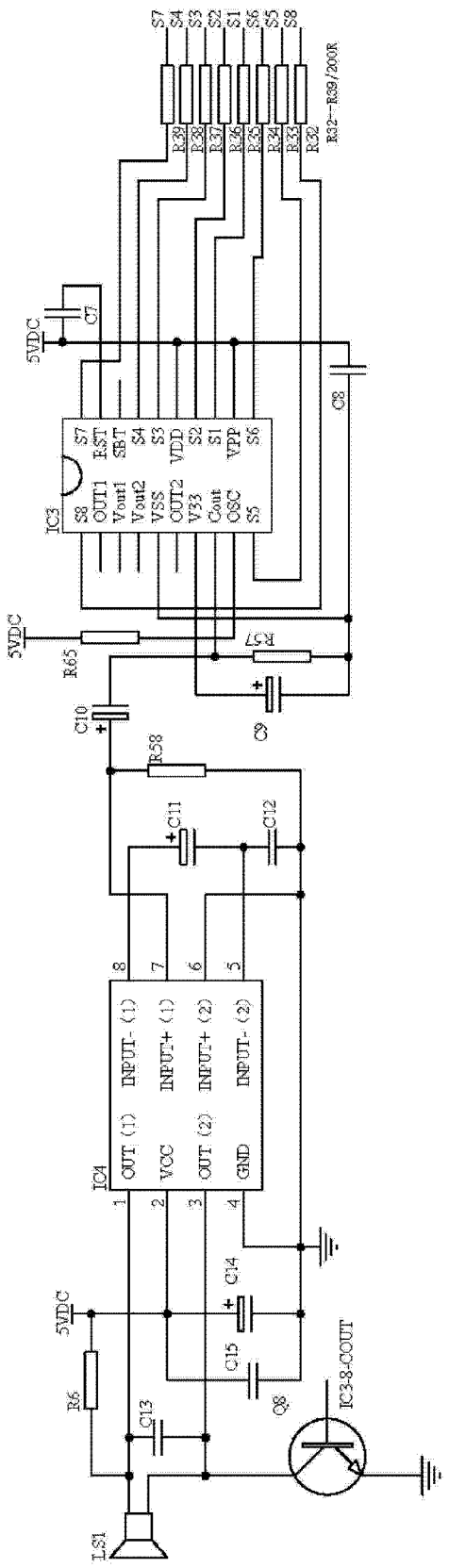


图 4

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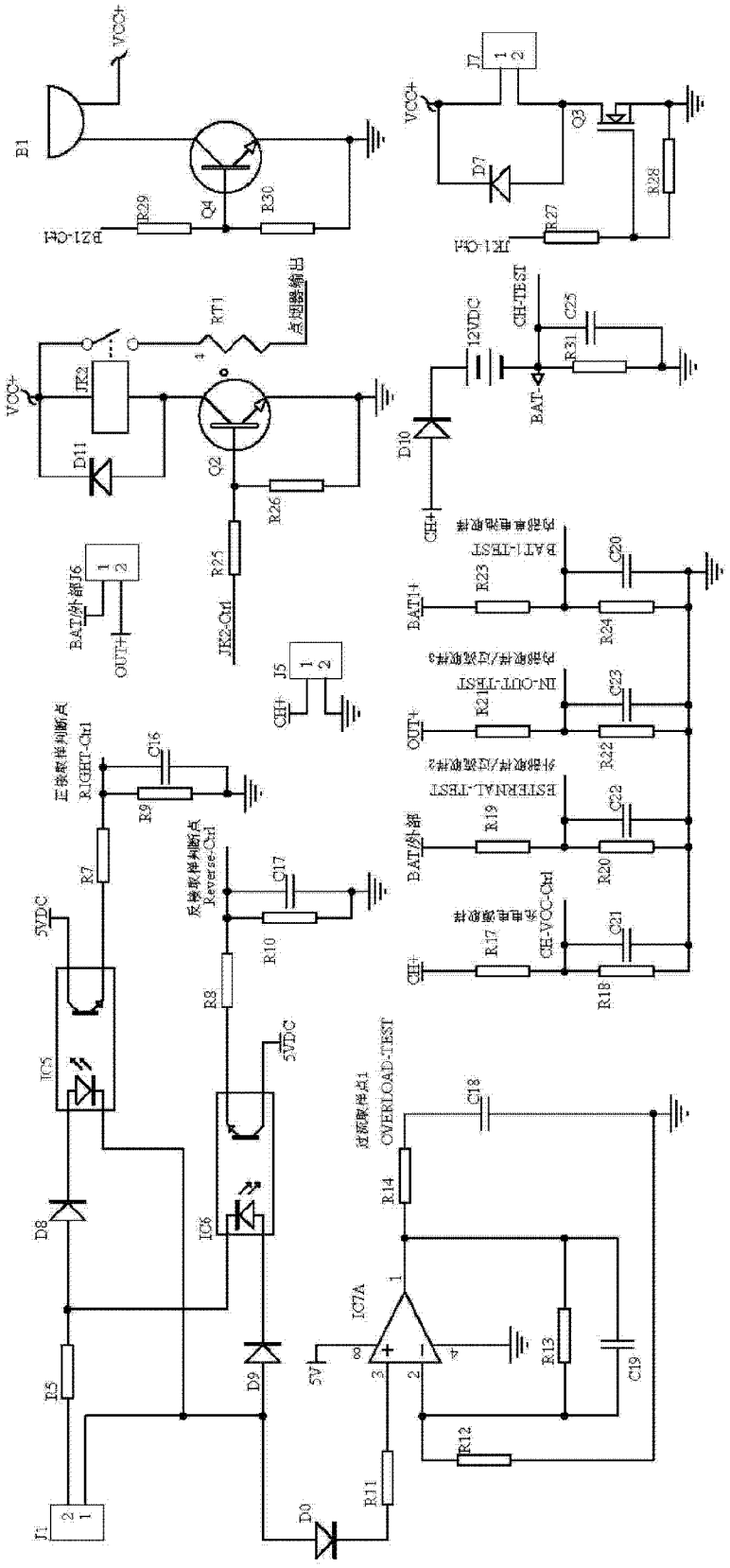


图 5

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ABSTRACT JP3185027U

[]

13 PROBLEM TO BE SOLVED: To provide a booster cable for a portable auxiliary power feeding device having a function as a jump starter, which is compact and lightweight and has excellent portability, which can withstand relatively intense bending motion and does not cause disconnection of a core wire. Provide booster cables. SOLUTION: A connector cover 240 is attached to a two-pole connector 230 having a male-female structure for connecting two connection cables 120A and 120B to a portable auxiliary power supply device, and two cables are derived from the two-pole connector 230. The lead-out portion of the connection cable is fixed by the connector cover 240. When the booster cable is grasped and the auxiliary power supply device is lifted and moved as it is, a strong pulling force is applied and the lead-out portion of the cable that is repeatedly bent is pinched and protected by the connector cover, so that there is no risk of disconnection in the core wire. [Selection diagram] Fig. 6

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25 【課題】ジャンプスタータとしての機能を有し、小型軽量で携帯性に優れた可搬型補助給電装置用のブースタケーブルであって、比較的激しい屈曲運動に耐え、心線の断線を引き起こす虞のないブースタケーブルを提供する。【解決手段】２本の接続ケーブル１２０Ａ，１２０Ｂを可搬型補助給電装置に接続するための雄雌同体構造の２極コネクタ２３０にコネクタカバー２４０を取り付け、２極コネクタ２３０から導出される２本の接続ケーブルの導出部分をコネクタカバー２４０により固定する。ブースタケーブルを掴んで補助給電装置を持ち上げそのまま移動した場合、強い引っ張り力が加わり、繰り返し屈曲されるケーブルの導出部分がコネクタカバーにより挟持保護されるので、心線に断線の虞がなくなる。【選択図】図６

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要約 開く ＋

請求の範囲 開く ＋

詳細な説明 開く ＋

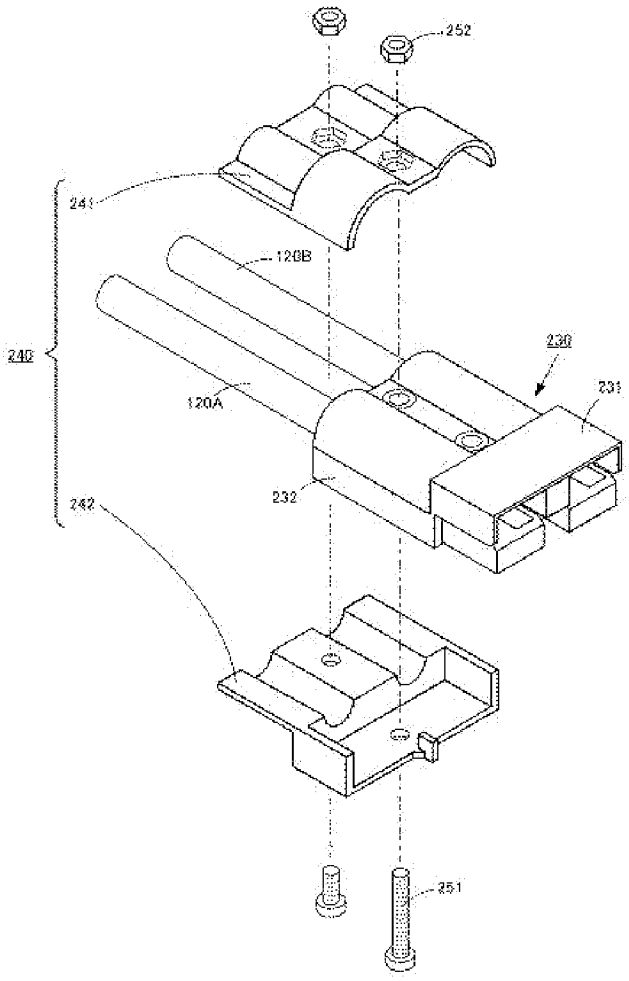
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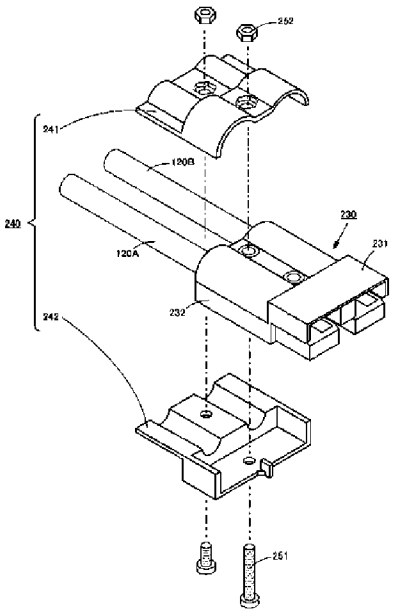
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(54)【考案の名称】可搬型補助給電装置用のブースタケーブル

(57)【要約】　(修正有)
【課題】ジャンプスタータとしての機能を有し、小型軽量で携帯性に優れた可搬型補助給電装置用のブースタケーブルであって、比較的激しい屈曲運動に耐え、心線の断線を引き起こす虞のないブースタケーブルを提供する。
【解決手段】２本の接続ケーブル１２０Ａ，１２０Ｂを可搬型補助給電装置に接続するための雄雌同体構造の２極コネクタ２３０にコネクタカバー２４０を取り付け、２極コネクタ２３０から導出される２本の接続ケーブルの導出部分をコネクタカバー２４０により固定する。ブースタケーブルを掴んで補助給電装置を持ち上げそのまま移動した場合、強い引っ張り力が加わり、繰り返し屈曲されるケーブルの導出部分がコネクタカバーにより挟持保護されるので、心線に断線の虞がなくなる。
【選択図】図６



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【実用新案登録請求の範囲】
【請求項１】
ジャンプスタータとしての機能を有する可搬型補助給電装置用のブースタケーブルであって、
２本の接続ケーブルと、
上記２本の接続ケーブルの一端部に接続された２つのジャンプスタータ用鰐口クリップと、
上記２本の接続ケーブルの他端端部に設けられ、上記２本の接続ケーブルを上記可搬型補助給電装置に接続するための雄雌同体構造の２極コネクタと、
上記２極コネクタに取り付けられ、上記２本の接続ケーブルの上記２極コネクタから導出される導出部分を固定するコネクタカバーと
を備える可搬型補助給電装置用のブースタケーブル。
【請求項２】
上記２極コネクタは、上記接続ケーブルに接続された接触子が挿入される接触子挿入部と、上記接触子に接続された上記接続ケーブルを覆うケーブル導出部とが設けられたコネクタハウジングを有し、
上記コネクタカバーは、上記接続ケーブルに沿った面で二分割された上ハーフと下ハーフからなり、上記上ハーフと下ハーフにより構成される上記コネクタハウジングの上記ケーブル導出部を覆う取り付け部と、上記２極コネクタのハウジングから導出された上記２本の接続ケーブルを挟持するケーブル支持部と有し、上記取り付け部において上記ケーブル導出部に一体的に組み付け固定されることを特徴とする請求項１記載の可搬型補助給電装置用のブースタケーブル。
【考案の詳細な説明】
【技術分野】
【０００１】
本考案は、車両のバッテリが上がった場合に、車載バッテリに接続されて、エンジンを始動させるスタータを含む車両の電気負荷に対して電力を供給して、上記エンジンを始動させるジャンプスタートさせるための可搬型補助給電装置用のブースタケーブルに関する。
【背景技術】
【０００２】
従来より、例えば路上等において、消費電気量の増加等により、車両に搭載されたバッテリが放電気味となりバッテリ容量が不足して電圧が低下し、電装品が作動しなくなった場合（いわゆるバッテリあがりの場合）に、他の自動車のバッテリや非常携帯電源（ジャンプスタータ）からブースタケーブルを介して電力を供給することによりエンジンを始動させるジャンプスタートが行われている。そして、ジャンプスタートのための電気的な接続を容易にする技術（例えば、特許文献１，２参照）や、ジャンプスタートを判定する技術（例えば、特許文献３参照）など各種提案がなされている。
【０００３】
従来、ジャンプスタータでは、コストと容量の関係から密閉式鉛蓄電池が用いられていた。
【０００４】
また、ＡＣアダプタを用いて充電可能なバッテリ駆動型のノートＰＣやその付帯機器などの情報機器が広く普及している。また、車両の車内に標準的に搭載されているＤＣ１２Ｖ／２４Ｖの車内用電源ソケット、いわゆるシガーソケットに接続して利用可能な車載対応の電気機器が数多く提供されている。また、近年の携帯電話やＵＳＢ（Universal Serial Bus）で給電可能な携帯音楽プレーヤ等の省電力で駆動可能な電子機器が広く使用されている。従来から、屋外で電気機器を使用するためにポータブル電源装置が用いられている。
【０００５】

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ところで、一般的な密閉式鉛蓄電池を用いた従来のジャンプスータでは、５～７ｋｇ程度の重量があり、携帯性に欠けるという問題点があった。また、満充電に平均１０～１５時間程度を要し、満充電状態での始動（ジャンプスタート）可能回数は平均で５回程度であった。さらに、鉛蓄電池は、過放電や過充電を行うと劣化が早くなり、自己放電も進みやすい性質があり、通常の鉛蓄電池の放電率は３０％程度であって、不使用状態でも自己放電して充電の必要性が出てくる。なれない人では適正な時期に充電操作が行えず、過充電や過放電を起こしてしまうことが多く、誰でも簡単に取り扱いができるものではなく、使い勝手が非常に悪いものであった。

【０００６】

また、従来のポータブル電源装置においても、鉛蓄電池が使われていたので重く、可搬性や使い勝手等の観点から従来のジャンプスータと同様な問題点があった。

【先行技術文献】

【特許文献】

【０００７】

【特許文献１】特開２００４－１３４２７８号公報

【特許文献２】特開２０１１－９７７１０号公報

【特許文献３】特開２００７－２７８２１６号公報

【考案の概要】

【考案が解決しようとする課題】

【０００８】

本件出願人は、上述の如き従来の実情に鑑み、ジャンプスータとしての機能を有し、しかも、バッテリ駆動型のノートＰＣやその付帯機器などの情報機器、シガーソケットに接続して利用可能な車載対応の電気機器、携帯電話やＵＳＢで給電可能な携帯音楽プレーヤ等の使用を可能にするポータブル電源としての機能を有し、さらに、ＯＢＤ（On-Board Diagnostic system）システムに対応した車両のメモリバックアップ用のポータブル電源として機能する小型軽量で携帯性に優れ、使い勝手のよい車両用補助給電装置を先に提案し、提供している。

【０００９】

ところで、上記車両用補助給電装置の場合、小型軽量で携帯性に優れることから、当該給電装置にブースタケーブルを接続した状態で、上記ブースタケーブルを掴んで当該給電装置を持ち上げそのまま移動するユーザが多いことが判明した。

【００１０】

上記ブースタケーブルを掴んで上記車両用補助給電装置を持ち上げそのまま移動した場合、上記ブースタケーブルは、上記車両用補助給電装置の重量により強い引っ張り力が加わった状態で、当該ブースタケーブルに設けられたコネクタの近傍において繰り返し屈曲されることになり、心線に断線の虞が生じる。

【００１１】

本考案は、上述の如き従来の実情に鑑みてなされたものであり、その目的は、ジャンプスータとしての機能を有し、小型軽量で携帯性に優れた可搬型補助給電装置用のブースタケーブルであって、比較的激しい屈曲運動に耐え、心線の断線を引き起こす虞のないブースタケーブルを提供することにある。

【００１２】

本考案のさらに他の目的、本考案によって得られる具体的な利点は、以下において図面を参照して説明される実施に形態から一層明らかにされる。

【課題を解決するための手段】

【００１３】

本考案は、ジャンプスータとしての機能を有する可搬型補助給電装置用のブースタケーブルであって、２本の接続ケーブルと、上記２本の接続ケーブルの一端部に接続された２つのジャンプスータ用鰐口クリップと、上記２本の接続ケーブルの他端端部に設けられ、上記２本の接続ケーブルを上記可搬型補助給電装置に接続するための雄雌同体構造の

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２極コネクタと、上記２極コネクタに取り付けられ、上記２本の接続ケーブルの上記２極コネクタから導出される導出部分を固定するコネクタカバーとを備えることを特徴とする。

【００１４】

本考案に係る可搬型補助給電装置用のブースタケーブルにおいて、上記２極コネクタは、上記接続ケーブルに接続された接触子が挿入される接触子挿入部と、上記接触子に接続された上記接続ケーブルを覆うケーブル導出部とが設けられたコネクタハウジングを有し、上記コネクタカバーは、上記接続ケーブルに沿った面で二分割された上ハーフと下ハーフからなり、上記上ハーフと下ハーフにより構成される上記コネクタハウジングの上記ケーブル導出部を覆う取り付け部と、上記２極コネクタのハウジングから導出された上記２本の接続ケーブルを挟持するケーブル支持部と有し、上記取り付け部において上記ケーブル導出部に一体的に組み付け固定されるものとすることができる。

【考案の効果】

【００１５】

本考案によれば、ジャンプスタータとしての機能を有し、小型軽量で携帯性に優れた可搬型補助給電装置用のブースタケーブルであって、比較的激しい屈曲運動に耐え、心線の断線を引き起こす虞のないブースタケーブルを提供することにある。

【図面の簡単な説明】

【００１６】

【図１】本考案を適用したブースタケーブルを接続した車両用補助給電装置を前方側斜め上方から見た外観斜視図である。

【図２】上記車両用補助給電装置の電気的な構成を示すブロック図である。

【図３】２極コネクタにコネクタカバーを取り付けた状態を示すブースタケーブルの平面図である。

【図４】上記ブースタケーブルに接続されている２極コネクタのコネクタハウジングと接触子を示す平面図である。

【図５】上記２極コネクタの接続状態を示す要部縦断面である。

【図６】上記２極コネクタに取り付けられるコネクタカバーの分解斜視図である。

【図７】上記２極コネクタに上記コネクタカバーを取り付けた状態を示す外観斜視図であり、（Ａ）は上面側から見た状態を示し、（Ｂ）は上記２極コネクタを裏返した状態を示している。

【考案を実施するための形態】

【００１７】

以下、本考案の実施の形態について、図面を参照しながら詳細に説明する。なお、本考案は、以下の実施の形態のみに限定されるものではなく、本考案の要旨を逸脱しない範囲内において種々の変更が可能であることは言うまでもない。

【００１８】

本考案は、例えば図１に示すように、車両用補助給電装置１００に接続されるブースタケーブル２００に適用される。

上記車両用補助給電装置１００は、ジャンプスタータとしての機能を有する可搬型補助給電装置であって、図１の外観斜視図に示すように薄型箱状の筐体１０を備え、また、図２のブロック図に示すように上記筐体１０の内部に設置された充電回路部１、リチウムイオン蓄電池２、出力回路部３及び制御回路部４を備えている。

【００１９】

そして、この車両用補助給電装置１００では、家庭用電源や自動車バッテリから例えば１２Ｖの電源供給を受けるための充電用の給電ケーブルがＤＣプラグを介して外部接続されるＤＣジャックからなるＤＣ入力端子２０が上記筐体１０の左側面壁に設置されている。このＤＣ入力端子２０には、上記充電回路部１が内部接続されている。上記充電回路部１には、上記リチウムイオン蓄電池２が内部接続されている。また、上記リチウムイオン蓄電池２には、上記出力回路部３が内部接続されている。さらに、上記充電回路部１及び

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出力回路部３には、上記制御回路部４が内部接続されている。

【００２０】

また、この車両用補助給電装置１００は、上記出力回路部３に内部接続されたジャンプスタート用の第１のＤＣ出力端子３１、ＰＣ電源用の第２のＤＣ出力端子３２、ＵＳＢ電源用の第３のＤＣ出力端子３３及びメモリバックアップ電源用の第４のＤＣ出力端子３４を備える。

【００２１】

上記第１のＤＣ出力端子３１は、ブースタケーブル２００が雄雌同体構造の所謂アンダーソンコネクタを用いたプラグを介して外部接続されるジャックからなる。

【００２２】

上記第２のＤＣ出力端子３２は、ＰＣ電源ケーブルがプラグを介して外部接続されるジャックからなる。

【００２３】

上記第３のＤＣ出力端子３３は、ＵＳＢケーブルがＵＳＢプラグを介して外部接続されるＵＳＢソケットからなる。

【００２４】

上記第４のＤＣ出力端子３４は、外部電源ケーブルがシガープラグを介して外部接続されるシガーソケットからなる。

【００２５】

上記ジャンプスタート用の第１のＤＣ出力端子３１と、ＰＣ電源用の第２のＤＣ出力端子３２は、上記筐体１０の右側面壁に設置されている。また、上記ＵＳＢ電源用の第３のＤＣ出力端子３３は、上記筐体１０の正面壁１３に設置されており、上記メモリバックアップ電源用の第４のＤＣ出力端子３４は、上記筐体１０の左側面壁１１に設置されている。

【００２６】

また、この車両用補助給電装置１００は、上記制御回路部４に内部接続された電源スイッチ４１、ジャンプスタートスイッチ４２、ライトセレクトスイッチ４３及びサイドライト・オン／オフ・スイッチ４４を備える。上記電源スイッチ４１、ジャンプスタートスイッチ４２、ライトセレクトスイッチ４３及びサイドライト・オン／オフ・スイッチ４４は、上記筐体１０の正面壁１３に設置されている。

【００２７】

さらに、この車両用補助給電装置１００は、上記制御回路部４に内部接続された充電量表示部５１、バッテリロー表示灯５２、一対の非常用警告灯５３Ａ，５３Ｂ及び一対の側面照明灯５４Ａ，５４Ｂを備える。

【００２８】

上記充電量表示部５１及び一対の非常用警告灯５３Ａ，５３Ｂは、上記筐体１０の正面壁１３に設置されている。

【００２９】

上記充電量表示部５１は、直線状に配置された発光色の異なる複数（この実施の形態では、赤・橙・黄・緑の４色）のＬＥＤにより構成されている。この充電量表示部５１は、上記制御回路部４により制御されて、充電量をバー表示する機能を果たすばかりでなく、緑点灯によりパワーランプとして機能し、また、黄点灯によりジャンプスタートランプとして機能する。また、上記一対の非常用警告灯５３Ａ，５３Ｂは、赤色ＬＥＤと白色ＬＥＤからなり、上記制御回路部により制御されて、交互に点滅することにより非常用警告灯として機能する。

【００３０】

また、上記バッテリロー表示灯５２は、上記筐体１０の右側面壁に設置されている。

【００３１】

上記バッテリロー表示灯５２は、赤色ＬＥＤからなり、上記制御回路部４により制御されて、上記リチウムイオン蓄電池２の電圧が所定値まで低下すると点滅状態あるいは点灯

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状態となることにより、バッテリロー表示灯として機能する。

【００３２】

また、上記一対の側面照明灯５４Ａ，５４Ｂは、それぞれ直線状に配置された複数の白色ＬＥＤにより構成されている。

【００３３】

このような構成の車両用補助給電装置１００において、上記筐体１０内に設置された制御回路部４は、上記充電回路部１の動作を制御する充電制御部、上記出力回路部１の動作を制御する出力制御部、充電量表示部５１等の動作を制御する表示制御部として機能するマイクロコンピュータからなり、内部接続された上記充電回路部１及び出力回路部３の動作を次のように制御する。

【００３４】

ここで、この車両用補助給電装置１００に接続される充電用の給電ケーブルとしては、家庭用電源から充電用の１２Ｖの電源供給するためのＡＣアダプタケーブルと、自動車バッテリから例えば１２Ｖの電源供給を供給するためのシガープラグケーブルが準備されている。

【００３５】

そして、上記車両用補助給電装置１００における上記制御回路部４は、上記ＤＣ入力端子２０にＡＣアダプタケーブル又はシガープラグケーブルが外部接続され、家庭用電源又は自動車バッテリから充電用の電源が供給されることにより、上記ＤＣ入力端子２０に所定電圧値以上の電圧が印加されたことを検出すると、充電モードの制御を行う。

【００３６】

この充電モードの制御において、上記制御回路部４は、充電制御部により上記充電回路部１の動作を制御して、上記充電回路部１を介して上記リチウムイオン蓄電池２を充電し、上記リチウムイオン蓄電池２が満充電まで充電されると過充電保護回路を機能させ、充電を終了する。

【００３７】

また、上記制御回路部４は、充電制御中には、出力制御部により上記出力回路部３の動作を制御して、上記出力回路部３から外部への電源供給を禁止する。

【００３８】

さらに、上記制御回路部４は、充電制御中には、表示制御部により上記充電量表示部５１の動作を制御して、上記充電量表示部５１を制御して充電量をバー表示する。

【００３９】

上記充電量表示部５１は、上記制御回路部４により動作が制御されて、未充電状態から、バッテリ残量２０％以下を示す赤色点状態、バッテリ残量２０％から３０％を示す赤色点灯、バッテリ残量３０％から４０％を示す橙色点滅状態、バッテリ残量４０％から７０％を示す黄色点灯状態、バッテリ残量７０％から１００％を示す緑色点灯状態へと、満充電状態まで充電が進むに従って、点灯状態が順次変化する。

【００４０】

上記車両用補助給電装置１００は、上記リチウムイオン蓄電池２を充電した状態で、可搬型ジャンプスータとして機能し、また、屋外で電気機器を使用するためにポータブル電源装置として使用することができる。

【００４１】

ここで、この車両用補助給電装置１００には、上記ジャンプスタート用の第１のＤＣ出力端子３１を構成している雄雌同体構造の所謂アンダーソンコネクタからなるジャック１３０にプラグ２３０を介して外部接続されるジャンプスタート用のブースタケーブル２００が準備されている。

【００４２】

上記ブースタケーブル２００は、図３に示すように、２本の接続ケーブルケーブル２１０Ａ、２１０Ｂの一端部に接続された２つのジャンプスタータ用鰐口クリップ２２０Ａ、２２０Ｂと、上記２本の接続ケーブルケーブル２１０Ａ、２１０Ｂの他端端部に設けられ

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、上記２本の接続ケーブルケーブル２１０Ａ、２１０Ｂを上記車両用補助給電装置１００に接続するための雄雌同体構造の２極コネクタ２３０と、上記２極コネクタ２３０に取り付けられ、上記２本の接続ケーブル２１０Ａ、２１０Ｂの上記２極コネクタ２３０から導出される導出部分を固定するコネクタカバー２４０とを備える。

【００４３】

上記２極コネクタ２３０は、図４に示すように、上記接続ケーブル２１０Ａ、２１０Ｂに接続された接触子２３５Ａ，２３５Ｂが挿入される接触子挿入部２３１と、上記接触子に接続された上記接続ケーブル２１０Ａ、２１０Ｂを覆うケーブル導出部２３２とが設けられ、図５に接続状態の要部縦断面図を示すように、雄雌の区別がないにも拘わらず誤接続を物理的に不可能とした構造のコネクタハウジング２３３を有する雄雌同体構造の所謂アンダーソンコネクタからなる。

【００４４】

また、上記コネクタカバー２４０は、図６に示すように、上記接続ケーブル２１０Ａ、２１０Ｂに沿った面で二分割された上ハーフ２４１と下ハーフ２４２からなり、上記上ハーフ２４１と下ハーフ２４２により構成される上記コネクタハウジング２３３の上記ケーブル導出部２３２を覆う取り付け部２４４と、上記コネクタハウジング２３３から導出された上記２本の接続ケーブル２１０Ａ、２１０Ｂを挟持するケーブル支持部２４５と有する。そして、上記コネクタカバーは、図７の（Ａ），（Ｂ）に示すように、上記取り付け部において上ハーフ２４１と下ハーフ２４２が上記ケーブル導出部２３２にネジ２５１とナット２５２により一体的に組み付け固定される。

【００４５】

このような構造のコネクタカバー２４０を上記２極コネクタ２３０のケーブル導出部２３２に取り付けた上記ブースタケーブル２００では、上記２極コネクタ２３０のケーブル導出部２３２から導出された上記２本の接続ケーブルケーブル２１０Ａ、２１０Ｂの導出部分が上記コネクタカバー２４０のケーブル支持部２４５により挟持されるので、比較的激しい屈曲運動に耐え、心線の断線を引き起こす虞がなくなる。

【００４６】

そして、この車両用補助給電装置１００は、上記ブースタケーブル２００を介してジャンプスタートさせる車両の車載バッテリに接続され、次のようにしてジャンプスタータとして使用される。

【００４７】

すなわち、この車両用補助給電装置１００をジャンプスタータとして使用する場合、当該車両用補助給電装置１００の電源スイッチ４１がＯＦＦの状態で、上記ジャンプスタート用のブースタケーブル２００がユーザにより上記第１のＤＣ出力端子３１に接続される。

【００４８】

上記車両用補助給電装置１００のユーザは、上記充電量表示部５１を構成している複数のＬＥＤが全て消灯していることで、電源スイッチ４１がＯＦＦの状態であることを確認することができる。

【００４９】

次に、ユーザが電源スイッチ４１を押して電源ＯＮにすると、この車両用補助給電装置１００の制御回路部４は、電源ＯＮを検知して上記表示制御部により充電量表示部５１の動作を制御し、上記充電量表示部５１を緑色点灯状態とする。上記充電量表示部５１は、緑色点灯により電源ＯＮを表示するパワーランプとして機能する。

【００５０】

そして、この電源ＯＮ状態でユーザがジャンプスタートスイッチ４２を押してジャンプスタートすると、この車両用補助給電装置１００の制御回路部４は、上記ジャンプスタートスイッチ４２の短時間操作によるジャンプスタートを検知して、ジャンプスタートモードの制御を行う。

【００５１】

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このジャンプスタートモードの制御において、上記制御回路部４は、上記ジャンプスタート用の第１のＤＣ出力端子３１にブースタケーブル２００を介してジャンプスタートさせる自動車の車載バッテリの電圧を正常に検知できた場合に、上記出力制御部により出力回路部３の動作を制御し、上記リチウムイオン蓄電池２をジャンプスタート用の電源として上記出力回路部３を介して上記ジャンプスタート用の第１のＤＣ出力端子３１に接続するとともに、上記表示制御部により充電量表示部５１の動作を制御し、上記充電量表示部５１を黄色点灯状態とする。上記充電量表示部５１は、黄色点灯によりジャンプスタートを表示するジャンプスタートランプとして機能する。このジャンプスタートモードでは、上記充電量表示部５１は、緑色点灯により電源ＯＮを表示するとともに黄色点灯によりジャンプスタートを表示している。

【００５２】

このジャンプスタートモードの状態で、ユーザは、この車両用補助給電装置１００が接続されている上記車載バッテリを搭載した自動車のエンジンを始動させるジャンプスタートを行うことができる。

【００５３】

ここで、従来の一般的な鉛蓄電池を用いた１２Ｖ／４．５Ａｈ程度の容量のジャンプスタータは、本体重量が５ｋｇ～７ｋｇ程度あり、満充電電状態での始動可能回数は平均５回程度であったのに対し、本考案を適用した上記車両用補助給電装置１００は、例えば３０ｍｍ×１５０ｍｍ×１００ｍｍ（縦×幅×奥行き）の大きさの筐体１０内に例えば３．６Ｖの充電式リチウムイオンを３個直列接続して実装することにより、重さ８３０ｇ程度で３０００ｃｃまでのガソリン乗用車に対応する１２Ｖ／４．５Ａｈの容量の可搬型ジャンプスータとして機能し、小型軽量で、しかも、満充電電状態での始動可能回数も１０～２０回程度に向上している。

【００５４】

また、上記車両用補助給電装置１００は、例えば４５ｍｍ×１９０ｍｍ×１８０ｍｍ（縦×幅×奥行き）の大きさの筐体１０を用いて、２倍の６個の充電式リチウムイオンを実装することにより、重さ１３００ｇ程度でガソリン乗用車全般及び３０００ｃｃ４気筒までのディーゼル車に対応する１２Ｖ／９Ａｈの容量の可搬型ジャンプスータとして機能する。

【００５５】

なお、この車両用補助給電装置１００における上記制御回路部４は、上記電源ＯＮ状態でユーザがジャンプスタートスイッチ４２を長時間操作すなわち例えば５秒以上長押しすると、チャージブーストモードの制御状態となり、上記リチウムイオン蓄電池２に充電されている電気を１度に放出するように、上記出力制御部により上記出力回路部３の動作を制御する。このチャージブーストモードの制御状態では、上記表示制御部により充電量表示部５１の動作を制御し、上記充電量表示部５１を黄色点灯状態とする。すなわち、上記充電量表示部５１は、黄色点灯によりチャージブーストモードを表示するチャージブーストモードとして機能する。このチャージブーストモードは、車載バッテリが深放電状態になっている場合に使用される。

【００５６】

また、この車両用補助給電装置１００は、上述の如く１２Ｖ／４．５Ａｈの容量のもので重さ８３０ｇ程度、１２Ｖ／９Ａｈの容量のものでも１３００ｇ程度の重量で小型軽量であるので、可搬性に優れ、しかも、上記ジャンプスタート用の第１のＤＣ出力端子３１の他に、屋外で電気機器を使用するための外部接続用の第２乃至第４のＤＣ出力端子３２～３４を備えているので、次のようにポータブル電源として使用することができる。

【００５７】

すなわち、この車両用補助給電装置１００において、上記第２のＤＣ出力端子３２には、ＰＣ電源ケーブルを介してＰＣを外部接続することができる。

【００５８】

また、この車両用補助給電装置１００において、上記第３のＤＣ出力端子３３には、Ｕ

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ＳＢ（Universal Serial Bus）で給電可能な携帯音楽プレーヤ等の電子機器を市販のＵＳＢケーブルを介して接続することができる。

【００５９】

また、この車両用補助給電装置１００は、上記第４のＤＣ出力端子３４に外部接続されるシガーゲーブルを介して車載対応の電気機器を駆動するポータブル電源として機能する。

さらに、この車両用補助給電装置１００は、上記第４のＤＣ出力端子３４に外部接続されるシガーゲーブルを介してＯＢＤ（On-Board Diagnostic system）システムに対応した車両のメモリバックアップ用のポータブル電源として機能する。

【００６０】

すなわち、この車両用補助給電装置１００は、ジャンプスタータとしての機能を有し、しかも、バッテリ駆動型のノートＰＣやその付帯機器などの情報機器、シガーソケットに接続して利用可能な車載対応の電気機器、携帯電話やＵＳＢで給電可能な携帯音楽プレーヤ等の使用を可能にするポータブル電源としての機能を有し、さらに、ＯＢＤ（On-Board Diagnostic system）システムに対応した車両のメモリバックアップ用のポータブル電源として機能する小型軽量で携帯性に優れ、使い勝手のよい車両用補助給電装置となっている。さらに、この車両用補助給電装置１００は、上述の如きジャンプスタータやポータブル電源として機能するばかりでなく、非常時に使用する警告表示灯や照明灯として機能する。

【００６１】

以上説明した本考案の実施の形態のように、可搬性に優れた小型軽量でジャンプスタータとしての機能を有する車両用補助給電装置１００に接続される可搬型補助給電装置用のブースタケーブル２００では、上記２極コネクタ２３０のケーブル導出部２３２から導出された上記２本の接続ケーブルケーブル２１０Ａ、２１０Ｂの導出部分が上記コネクタカバー２４０のケーブル支持部２４５により挟持されるので、比較的激しい屈曲運動に耐え、心線の断線を引き起こす虞がなく、所期の目的を達成することができる。

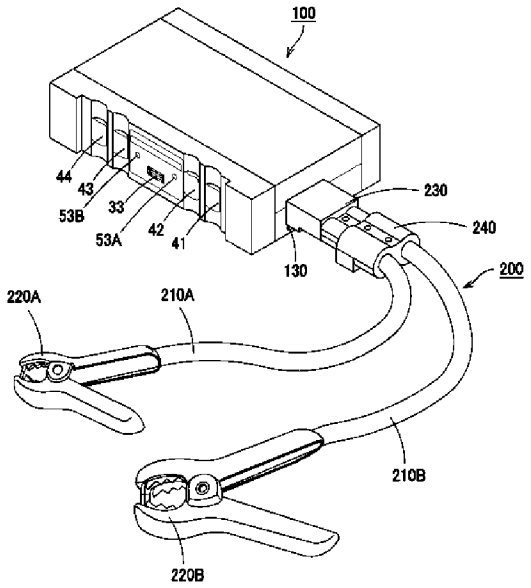
【符号の説明】

【００６２】

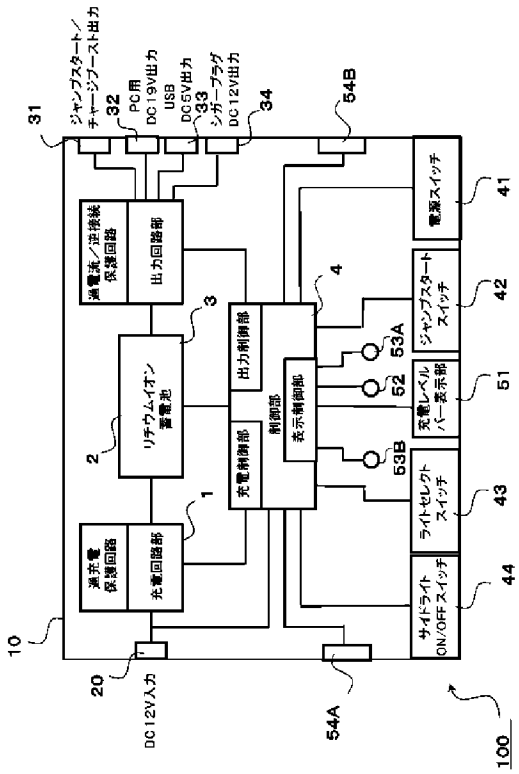
１　充電回路部、２　リチウムイオン蓄電池、３　出力回路部、４　制御回路部、１０　筐体、１１　左側面壁、１２　右側面壁、１３　正面壁、２０　ＤＣ入力端子、３１　第１のＤＣ出力端子、３２　第２のＤＣ出力端子、３３　第３のＤＣ出力端子、３４　第４のＤＣ出力端子、４１　電源スイッチ、４２　ジャンプスタートスイッチ、４３　ライトセレクトスイッチ、４４　サイドライト・オン／オフ・スイッチ、５１　充電量表示部、５２　バッテリロー表示灯、５３Ａ，５３Ｂ　非常用警告灯、５４Ａ，５４Ｂ　側面照明灯、１００　車両用補助給電装置、２００　ブースタケーブル、２１０Ａ，２１０Ｂ　ケーブル、２２０Ａ，２２０Ｂ　ジャンプスタータ用鰐口クリップ、２３０　２極コネクタ、２３１　接触子挿入部、２３２　ケーブル導出部、２３３　コネクタハウジング、２３５Ａ，２３５Ｂ　接触子、２４０　コネクタカバー、２４１　上ハーフ、２４２　下ハーフ、２４４　取り付け部、２４５　ケーブル支持部

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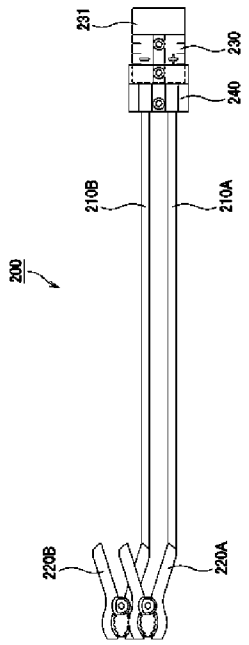
【図１】



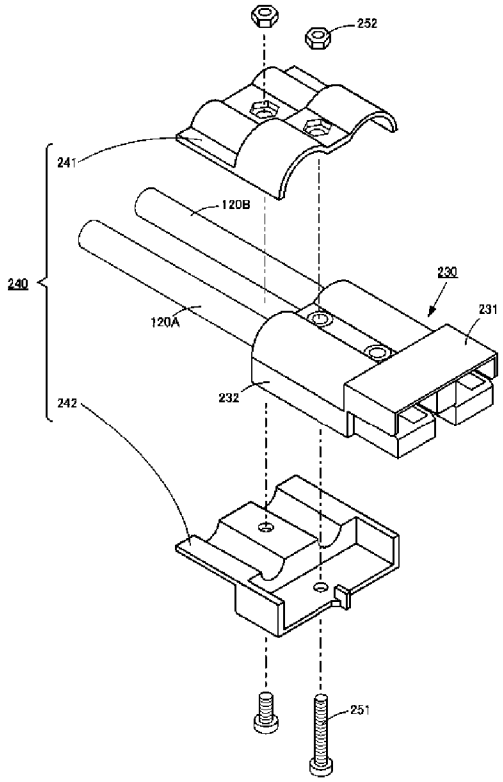
【図２】



【図３】

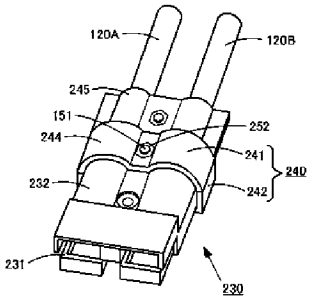


【図６】

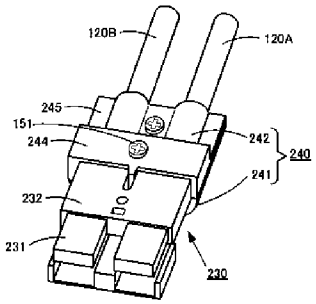


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【図７】

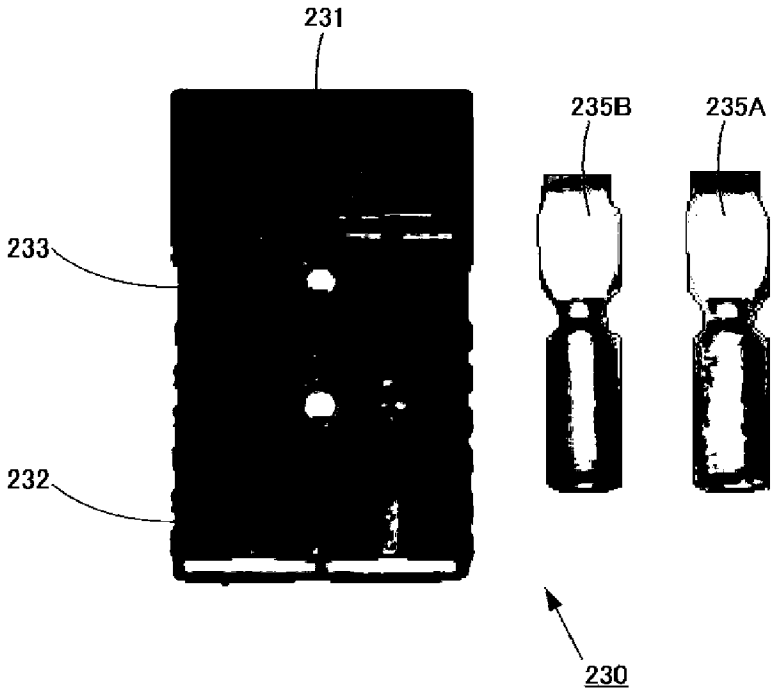


(A)



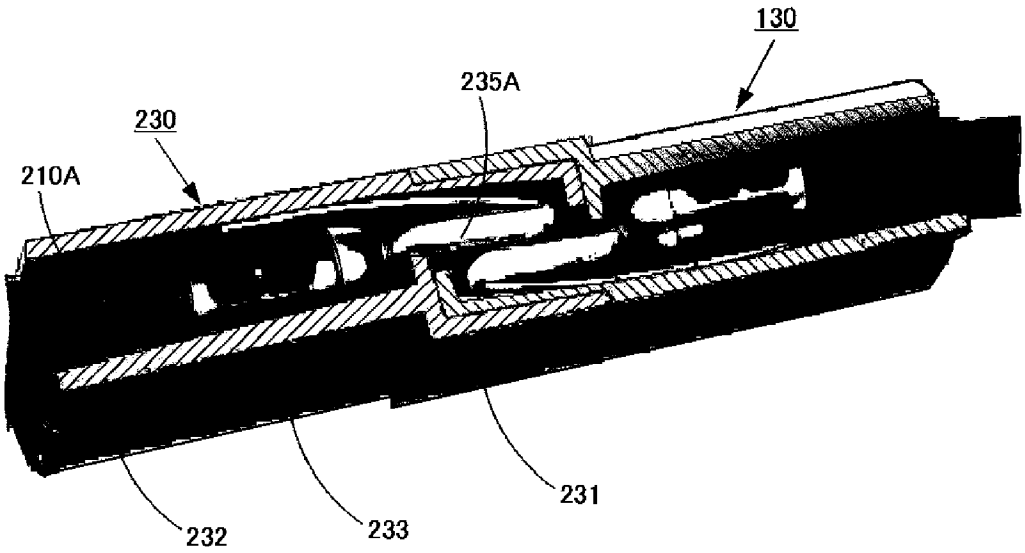
(B)

【図４】



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【図５】



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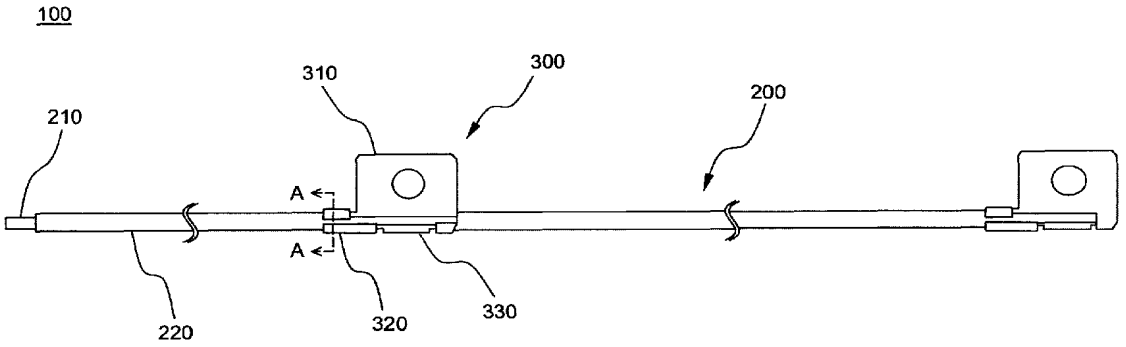
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(54) Title: ELECTRODE CONNECTOR CONTAINING PLATE AND BATTERY MODULE EMPLOYED WITH THE SAME



(57) Abstract: An electrode connector includes a conductive wire and plates mounted on the wire such that the plates can be electrically connected to electrodes of cells. The plates are electrically connected to the wire. A battery module is manufactured with the electrode connector. The electrode connector is electrically connected to the electrodes of the cells by means of the plates. Consequently, the coupling of the electrode connector to the electrodes of the cells is easily accomplished by welding while damage to the cells is minimized. Furthermore, the electrical connection between the plates is accomplished by means of the flexible wire. Consequently, the assembly operation for the electrode connection is very easily carried out, and the electrode connector can be manufactured inexpensively.

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ELECTRODE CONNECTOR CONTAINING PLATE AND BATTERY MODULE EMPLOYED WITH THE SAME

FIELD OF THE INVENTION

The present invention relates to an electrode connector for connecting electrodes of cells with each other, and, more particularly, to an electrode connector having plates, which are weldable to electrodes, mounted on a wire, thereby accomplishing easy and convenient electrical connection between the electrodes while minimizing damage to the cells and enabling inexpensive manufacture of the electrode connector. Also, the present invention relates to a battery module manufactured with such an electrode connector.

BACKGROUND OF THE INVENTION

As mobile devices have been increasingly developed, and the demand of such mobile devices has increased, the demand of secondary batteries has also sharply increased as a power source for the mobile devices. One of the secondary batteries is a lithium secondary battery having high energy density and discharge voltage, into which much research has been carried out and which is now commercially and widely used.

Based on kinds of external devices in which the secondary battery is used, the secondary battery may be used in the form of a single unit cell or in the form of a battery pack including a plurality of unit cells electrically connected with each other.

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For example, small-sized devices, such as a mobile phone, can be operated for a predetermined period of time from the output and the capacity of a single unit cell. On the other hand, large-sized devices, such as lap-top computers or electric vehicles, require use of a medium- or large-sized battery pack because a high output and a large capacity are necessary.

The battery pack is a battery structure including a plurality of unit cells electrically connected in series and/or parallel with each other. A wire, a plate, and a flexible printed circuit board (FPCB) are used in the battery pack so as to accomplish the electrical connection between electrodes of the unit cells.

The wire is a linear conductive member. Generally, an insulating resin is covered on the outer surface of the wire, and therefore, the wire has advantages in that the linear conductive member is easily deformed, and the costs of the liner conductive member are inexpensive. However, the wire has problems in that it is difficult to accomplish the electrical connection between the electrodes of the cells by a welding process, such as spot welding, ultrasonic welding, or laser welding, and a large amount of heat is transferred to the cells during the welding process, which causes damage to the cells.

The plate, which is a plate-shaped conductive member, has an advantage in that the electrical connection between the electrodes of the cells can be easily accomplished by the above-mentioned welding process. However, the plate has a problem in that it is difficult to accomplish the electrical connection between the electrodes of the cells even with only a slight-degree error.

The FPCB, which is widely used in recent years, has advantages in that the electrical connection between the electrodes of the cells can be easily accomplished like

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the plate, and it is suitable for the electrical connection in a complicated structure. However, the FPCB has problems in that the FPCB is very expensive, the formability is lowered, and the assembly operation is difficult.

Processes for constituting a battery module through the electrical connection between electrodes of a plurality of cells using an FPCB are partially shown in FIGS. 1 and 2. FIG. 1 illustrates a normal assembly process of the battery module in which the connection between the electrodes is normally accomplished, and FIG. 2 illustrates an abnormal assembly process of the battery module in which the connection between the electrodes is abnormally accomplished.

Referring to FIGS. 1 and 2, an FPCB 10 includes a flexible board 12, on which a circuit 14 is formed. To the circuit 14 are connected electrodes 22 of cells 20. When the connection circuit 14 of the FPCB 10 is properly arranged on the electrodes 22 of the cells 20, which are disposed regularly, as shown in FIG. 1, normal electrical connection between the electrodes is accomplished. When an error occurs at the first connection process as shown in FIG. 2, on the other hand, it is difficult to accomplish subsequent electrical connections between the electrodes. Consequently, the assembly operation is inaccurately carried out.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to substantially obviate the above-mentioned problems of the conventional arts as well as the technical problems requested from the past.

The inventors have performed various experiments and research, and finally have developed an electrode connector having advantages of both the wire and the

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plate. Specifically, the electrode connector includes a flexible wire and plates, which can be easily welded to electrodes of cells, mounted on the wire. Consequently, the electrode connector can be manufactured inexpensively, the assembly operation is easily carried out due to the characteristics of the deformable wire, and the electrical connection between the electrodes of the cells is accomplished by the plates, which can be easily welded to the electrodes.

In accordance with one aspect of the present invention, the above and other objects can be accomplished by the provision of an electrode connector comprising: a conductive wire; and plates mounted on the wire such that the plates can be electrically connected to electrodes of cells, wherein the plates are electrically connected to the wire.

The conductive wire is a linear conductive member. Preferably, the conductive wire is covered with an insulating resin such that a short circuit to a peripheral device is prevented. The material for the wire is not particularly restricted so long as the material is conductive. For example, conductive materials generally used in electrical engineering applications, such as copper, iron, and lead, may be used for the wire. Preferably, the wire is made of copper, which has excellent flexibility and electrical conductivity.

The plates are plate-shaped conductive members, which are parts of the electrode connector and which are electrically connected to the electrodes of the cells. The material for the plates is not particularly restricted so long as the electrical connection between the plates and the electrodes of the cells is accomplished. For example, nickel, aluminum, copper, iron, and alloy thereof may be used for the plates. Preferably, the plates are made of nickel or nickel alloy, which is excellent in terms of

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cost and electrical conductivity.

The electrical connection between the plates and the electrodes of the cells may be accomplished in various manners. For example, the plates and the electrodes of the cells may be electrically connected with each other by welding, mechanical coupling, or adhesion. Preferably, the electrical connection between the plates and the electrodes of the cells is accomplished by spot welding, ultrasonic welding, laser welding, or soldering.

The present invention is characterized in that the electrical connection between the electrode connector and the electrodes of the cells is accomplished by the plates, and the interconnection of the plates is accomplished by the wire. Consequently, the coupling between the electrodes and the plate is easy, and the electrical connection of the plates is accomplished using the flexible wire irrespective of the distance between the electrodes.

The electrode connector according to the present invention may be constructed by separately manufacturing the wire and the plates and then coupling the wire and the plates with each other. Alternatively, the wire and the plates are integrally formed in a single body to construct the electrode connector. In a preferred embodiment, the electrode connector is constructed by clamping a plurality of plates to a single wire. According to circumstances, a plurality of unit members, each of which is manufactured by coupling a single plate to a single wire, are connected with each other to construct the electrode connector according to the present invention.

In accordance with another aspect of the present invention, there is provided a battery module manufactured with the electrode connector as described above.

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The battery module includes two or more cells, which are electrically and mechanically connected with each other to provide high-output, large-capacity current, which cannot be obtained by a single cell. In the battery module is used a connector for connecting the unit cells in series and/or parallel with each other. The electrode connector serves to electrically connect a plurality of cells (unit cells), and therefore, the electrode connector is useful to connect the electrodes of the unit cells with each other and to connect the electrodes of the unit cells to a predetermined external device when manufacturing a medium- or large-sized battery module.

The structure of the battery module manufactured with two or more unit cells to provide high output and large capacity may be various. The structure of the battery module is well known to those skilled in the art to which the present invention pertains, and therefore, a detailed description thereof will not be given. It should be noted, however, that the structure of the battery module using the electrode connector according to the present invention falls into the scope of the present invention.

Preferably, the battery module according to the present invention is used in a battery pack, which is a power source for small-sized devices, such as lap-top computers, and large-sized devices, such as electric vehicles or hybrid electric vehicles.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIGS. 1 and 2 are typical views respectively illustrating normal and abnormal

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assembly processes when electrodes of cells are connected with each other using a flexible printed circuit board (FPCB) according to a conventional art;

FIG. 3 is a partial typical view illustrating an electrode connector according to a preferred embodiment of the present invention;

FIG. 4 is a typical view illustrating an exemplary plate used in the electrode connector according to the present invention; and

FIG. 5 is a sectional view taken along line A-A of FIG. 3.

<Description of Main Reference Numerals of the Drawings>

100: electrode connector

200: wire

300: plate

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Now, a preferred embodiment of the present invention will be described in detail with reference to the accompanying drawings. It should be noted, however, that the scope of the present invention is not limited by the illustrated embodiment.

FIG. 3 is a partial typical view illustrating an electrode connector 100 according to a preferred embodiment of the present invention.

Referring to FIG. 3, the electrode connector 100 includes a wire 200 and a plurality of plates 300 mounted on the wire 200. The wire 200 includes a conductive core member 210 and an insulating sheath 220 for covering the conductive core member 210.

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The structure of the plate 300 is shown in more detail in FIG. 4. As shown in FIG. 4, the plate 300 has a side clamping part 320 formed at one side end of a plate-shaped body 310 and a lower clamping part 330 formed at the lower end of the plate-shaped body 310. The plate 300 is securely mounted on the wire core member 210 (chain double-dashed line) by the clamping parts 320 and 330, and therefore, the electrical connection between the plate and the wire is accomplished. The side clamping part 320 may be formed at the other side end of the plate-shaped body 310. Each electrode of cells (not shown) is electrically connected to the plate-shaped body 310, preferably, by welding.

Referring back to FIG. 3, the conductive core member 210 is exposed at the area of the wire 200 where the plate 300 is mounted. Consequently, the plate 300 is connected to the wire 200 by the clamping parts 320 and 330 of the plate 300, and therefore, the electrical connection between the plate and the wire is accomplished.

FIG. 5 is a sectional view taken along line A-A of FIG. 3. The insulating sheath 220 (chain double-dashed line) is not present at the area of the wire where the plate is connected to the wire. Consequently, the conductive core member 210 is brought into direct contact with the side clamping part 320 of the plate 300, and therefore, the electrical connection between the plate and the wire is accomplished.

Although the preferred embodiment of the present invention has been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

For example, the structure of the plate and the electrical connection between the plate and the wire may be modified in various ways based on the illustrative

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example of FIG. 3.

INDUSTRIAL APPLICABILITY

As apparent from the above description, the electrode connector according to the present invention is electrically connected to the electrodes of the cells by means of the plates. Consequently, the coupling of the electrode connector to the electrodes of the cells is easily accomplished by welding while damage to the cells is minimized. Furthermore, the electrical connection between the plates is accomplished by means of the flexible wire. Consequently, the assembly operation for the electrode connection is very easily carried out, and the electrode connector can be manufactured inexpensively.

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WHAT IS CLAIMED IS:

1. An electrode connector comprising:

a conductive wire; and

plates mounted on the wire such that the plates can be electrically connected to electrodes of cells, wherein

the plates are electrically connected to the wire.

2. The electrode connector as set forth in claim 1, wherein the wire is covered with an insulating resin.

3. The electrode connector as set forth in claim 1, wherein the wire is made of copper, and the plates are made of nickel.

4. The electrode connector as set forth in claim 1, wherein the electrical connection between the plates and the electrode of the cells is accomplished by spot welding, ultrasonic welding, laser welding, or soldering.

5. The electrode connector as set forth in claim 1, wherein the electrode connector is constructed by clamping a plurality of plates to a single wire.

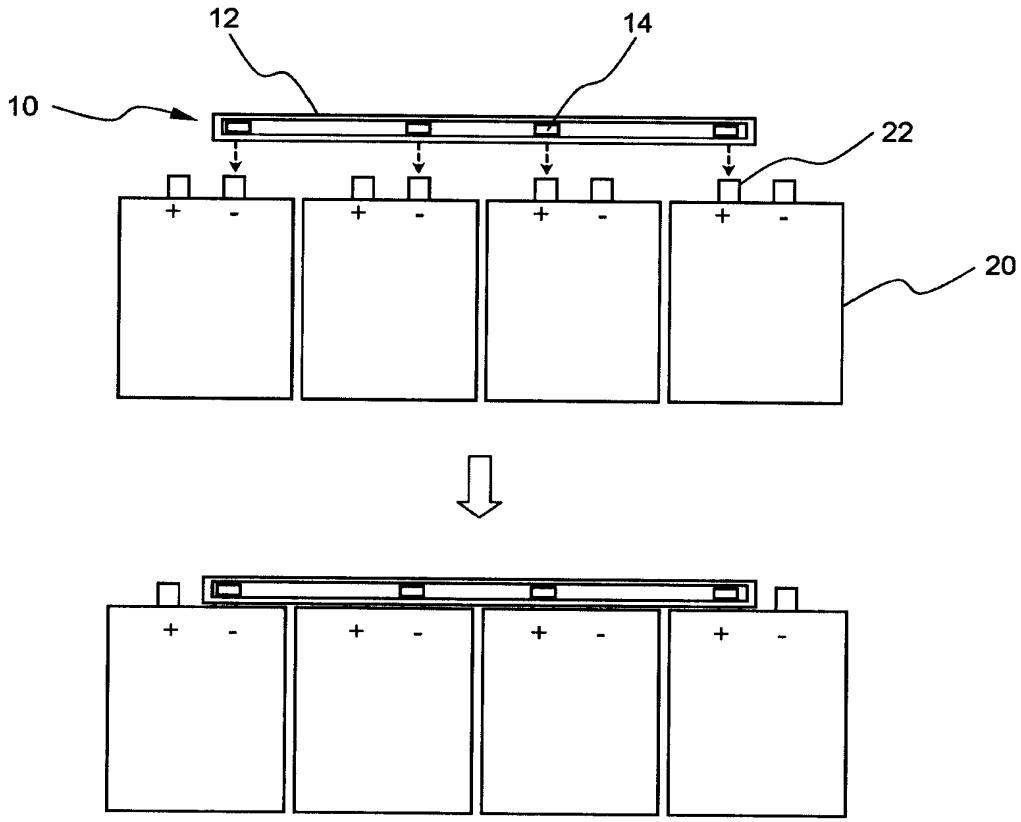
6. A battery module manufactured with an electrode connector as set forth in any one of claims 1 to 5.

7. The battery module as set forth in claim 6, wherein the electrode connector is used to connect electrodes of a plurality of cells (unit cells) with each other or to connect the electrode of one of the unit cells with a predetermined external device.

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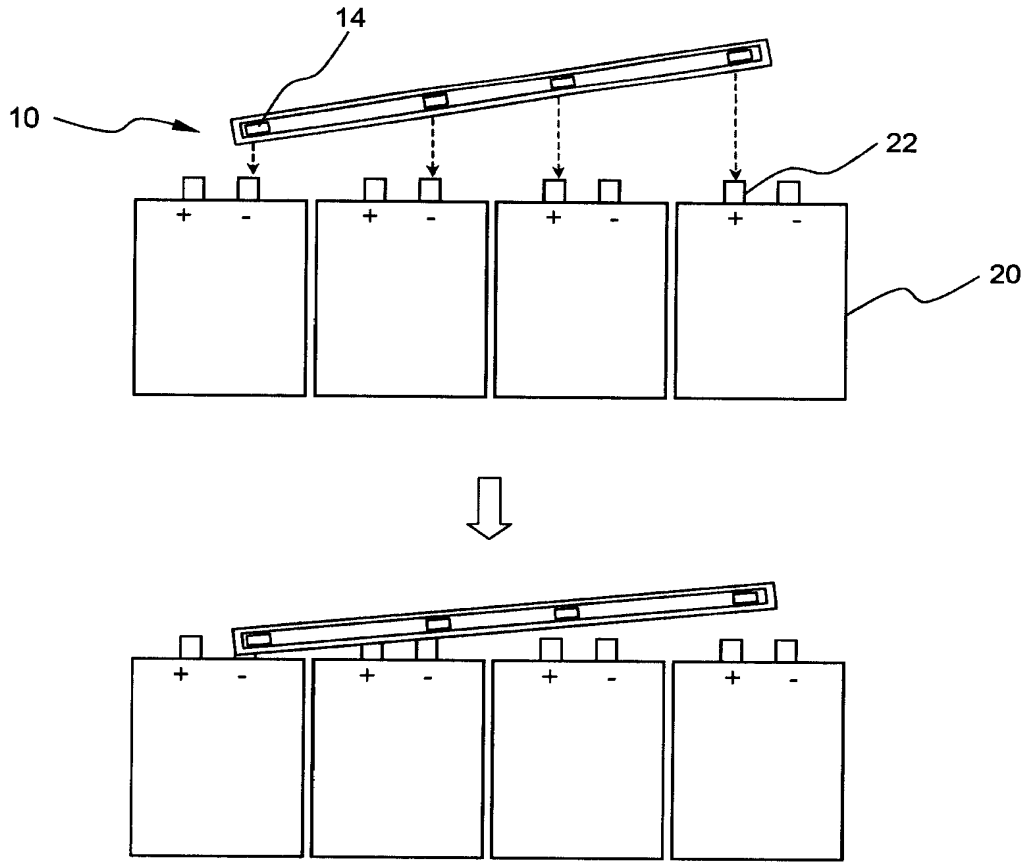
DRAWINGS

FIG. 1



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FIG. 2



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FIG. 3

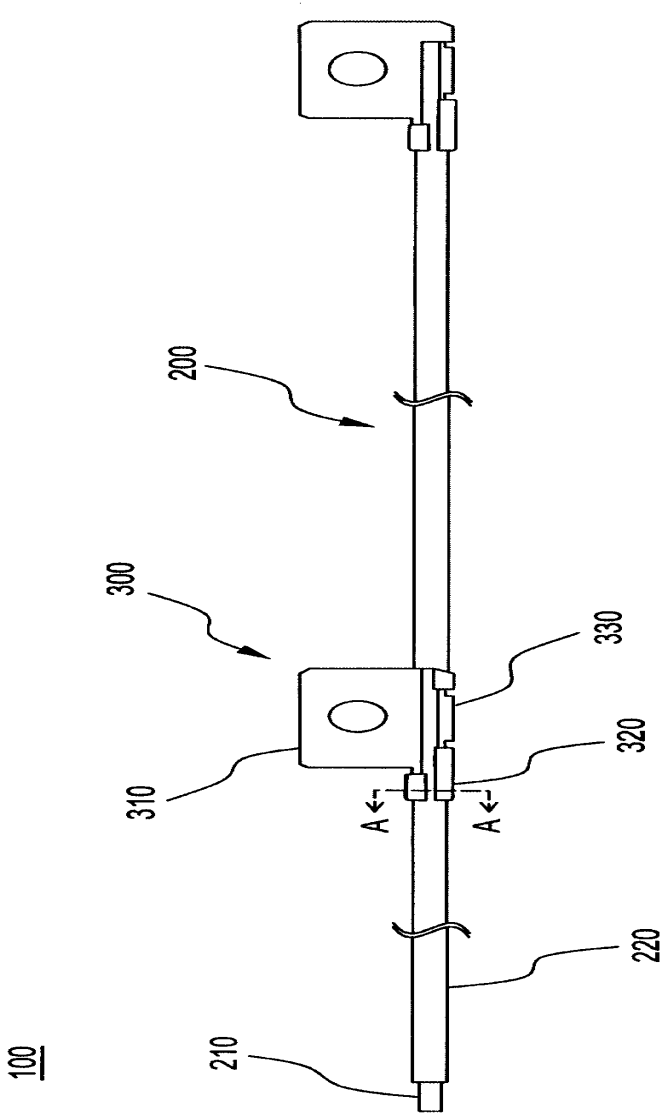


FIG. 4

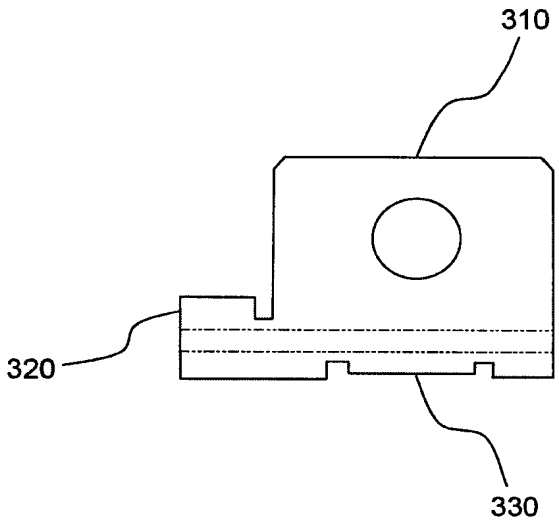
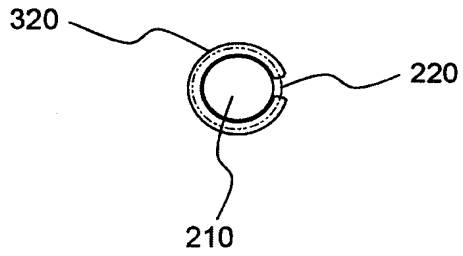


FIG. 5



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INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2005/003899

A. CLASSIFICATION OF SUBJECT MATTER

H01M 2/20(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01M 2/10(2006.01)i, H01M 2/20(2006.01)i, H01M 2/22(2006.01)i, H01M 2/26(2006.01)i

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Patents and applications for inventions since 1976.
Korean Utility models and applications for Utility models since 1976.

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2001-6644 A2 (MATSUSHITA ELECTRIC IND. CO. LTD.) 12 JANUARY 2001 * the whole document *	1 - 7
A	US 5158842 A (ACME ELECTRIC CORPORATION) 27 OCTOBER 1992 * the whole document *	1 - 7

☐ 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
"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 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
"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
"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	Date of mailing of the international search report
02 MARCH 2006 (02.03.2006)	**03 MARCH 2006 (03.03.2006)**

Name and mailing address of the ISA/KR
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Telephone No. 82-42-481-5735

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(54) Connecting contact leads to lithium-based electrodes

(57) There is disclosed a method of connecting a lithium electrode to a contact lead in a rechargeable battery. The electrode comprises a sheet or foil of lithium or lithium alloy with a tab protruding from an edge of the sheet or foil. The contact lead comprises an electrically conductive lead with an end portion made of a second metal that does not alloy with lithium and has a plurality of through holes. The end portion of the contact lead and the tab of the electrode are positioned so that there is substantial overlap between the end portion and the tab. The metal of the tab is then caused, for example by pressing and welding, to penetrate through the through holes of the end portion so as to join the electrode to the contact lead. A combination electrode/contact lead assembly made by this method is also disclosed.

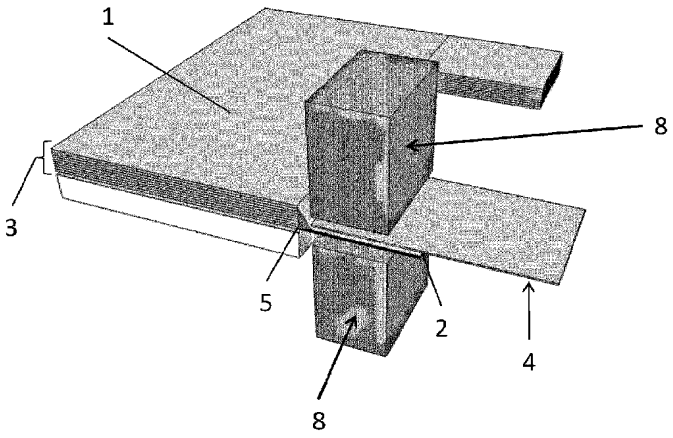


Figure 3

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Description

[0001] The present invention relates to the connection of a lithium or lithium alloy foil electrode or electrodes to a contact lead, so as to promote good electrical and mechanical contact therebetween.

BACKGROUND

[0002] Primary and rechargeable batteries using metallic lithium as the active material for the negative electrode are known to have the highest energy per unit weight and per unit volume.

[0003] For the purposes of the present application, the following definitions are to be considered:

[0004] A negative electrode, or anode, is a lithium or lithium alloy foil component having a negative potential. A negative electrode typically features a current collector and a contact tab.

[0005] A current collector is an electrically conductive metallic foil used to provide a path for electrons from the external electrical circuit to the electrochemically active portion of the battery. A current collector will typically feature a contact tab.

[0006] A contact tab is a metal foil portion of the current collector, which does not take part in the electrochemical process. It may extend from an edge of the main body of the current collector and is used to form the mechanical base for a weld to a contact lead.

[0007] A contact lead is a piece of electrically conductive metallic material used to form an electrical contact from the contact tab through a hermetically sealed battery container to the external electrical circuit. It is typically welded (in cells where metallic lithium is not used) or mechanically connected to the contact tab.

[0008] The contact lead must be connected or joined to the lithium in such a manner that a low resistance electrical connection is formed. Further, the connection or join must be mechanically strong enough to last for the expected life of the battery.

[0009] The current collectors in lithium primary batteries are typically composed of a metallic conductor other than lithium. The contact lead may be exposed to the electrolyte in an electrochemically active zone of the battery. This is not generally a problem in primary batteries; however it may cause problems in rechargeable (or secondary) batteries. In secondary batteries, lithium must be electrochemically deposited when the battery is recharged. In order to provide good reproducibility of performance, when the battery is repeatedly recharged, an excess of lithium is used so that lithium is only ever deposited onto lithium. If the contact lead or current collector is left exposed, then lithium will be plated onto a non-lithium substrate. This greatly increases the probability of unpredictable lithium deposition and hence poor cycling performance. This typically takes the form of active dendrite formation resulting in the quick degradation of the rechargeable lithium system. Examples of such failure mechanisms are described in US5368958, the full disclosure of which is incorporated into the present application by reference.

[0010] In a secondary battery with a lithium-based anode, the lithium is typically connected to the external circuit by one of two methods. Either a contact lead similar in design to that described for primary lithium batteries is used; as in US7335440, the full disclosure of which is incorporated into the present application by reference. US7335440 discloses the provision of a current collector in the form of a flat, solid piece of titanium, nickel, copper or an alloy of nickel or copper. The current collector is provided with a contact tab. A relatively long strip of alkali metal foil, having a width similar to the height of the current collector, is placed under the current collector and the two are pressed together. It is to be noted that, following assembly of the battery, the current collector (which is not made of an alkali metal) is immersed in electrolyte. Moreover, US7335440 states that this arrangement has problems in coiled, anode-limited cells of the type disclosed therein since there is a potential for a short circuit to be formed between the cathode material and the anode current collector when the thin layer of lithium has substantially depleted into the cathode in the outermost winding.

[0011] A variation of this method uses the metallic cell casing for the dual purpose of collecting current from the lithium, as in US7108942, the full disclosure of which is incorporated into the present application by reference. Additionally, the reverse face of the lithium electrode may be pressed or rolled against a thin metal current collector, as in US5368958, the full disclosure of which is incorporated into the present application by reference. The current collector can then be welded to a metal contact lead. However, if the current collector becomes exposed to the electrolyte, there is a risk that lithium will be plated onto the non-lithium current collector with the possible formation of dendrites that may short-circuit the battery. The metal current collector also adds unnecessary mass to the battery and reduces its specific energy.

[0012] In all of the examples described above, the contact of metallic lithium with the current collector is purely mechanical, which may be acceptable for primary batteries. However, for lithium metal rechargeable batteries such mechanical contact is not reliable. Indeed due to the reactive character of metallic lithium, corrosion layers may readily form on the interface of the mechanical connection between the lithium and the current collector. This may result in lower battery reliability as well as faster degradation in the capacity and cycle life of rechargeable lithium metal batteries.

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BRIEF SUMMARY OF THE DISCLOSURE

[0013] Viewed from a first aspect, there is provided a method of connecting at least one electrode to a contact lead, wherein the electrode comprises a sheet or foil of a first metal with a tab protruding from an edge of the sheet or foil, and wherein the contact lead comprises an electrically conductive lead with an end portion made of a second metal that does not alloy with the first metal and having a plurality of through holes, the method comprising the steps of:

i) positioning the end portion of the contact lead and the tab of the at least one electrode so that there is substantial overlap between the end portion and the tab;

ii) causing the metal of the tab to penetrate through the through holes of the end portion so as to join the at least one electrode to the contact lead.

[0014] In step ii), the metal of the tab may be caused to penetrate through the through holes by pressing and welding, for example by way of ultrasonic welding, thermal contact welding, laser welding or induction welding. Advantageously, the welding is effected in such a way so as not to cause significant thermal deformation or changes in the main laminar sheet or foil of the at least one electrode, but to concentrate the applied energy in the locality of the tab.

[0015] The end portion of the contact lead may be substantially flat or planar, or may take other shapes or configurations depending, for example, on the shape or configuration of any welding equipment that is used.

[0016] In some embodiments, there may be provided a plurality of electrodes, each comprising a sheet or foil of the first metal with a tab protruding from each sheet in substantially the same location, so that the tabs of the stack of electrodes are substantially aligned when the electrodes are aligned with each other and arranged as an electrode stack.

[0017] In these embodiments, the perforated end portion of the contact lead may be placed on top of the tabs of the electrode stack, underneath the tabs of the electrode stack, or at an intermediate position between the top and the bottom (i.e. with at least one tab above and at least one tab below). The tabs and the perforated end portion are then pressed together and the first metal (of the tabs) is caused to penetrate through the holes in the perforated planar end portion (made of the second metal) of the contact lead. Alternatively, the tabs of the electrode stack may be pressed together before the perforated end portion is placed on top of or underneath the compressed tabs and the penetration of step ii) is performed.

[0018] In embodiments where there is provided a stack of electrodes, the pressing and welding step causes the tabs to join together physically as well as to penetrate into the through holes of the contact lead.

[0019] Particularly preferred metals for the first metal are lithium and lithium alloys, since these tend to be useful as anode materials in secondary batteries, and are also soft and malleable, which allows a good connection to be made with the perforated end portion of the contact lead when the pressing and welding step is performed.

[0020] The end portion of the contact lead may be perforated, punched or have a mesh-like or reticulated form. What is important is that when the first metal of the tabs is sufficiently malleable that it can pass through the through holes so as to cause the second metal of the end portion to become embedded in what is preferably a single phase of the first metal. This forms an intimate contact between the first and second metals, and thus between the contact lead and the electrodes.

[0021] The greater the openness or surface area of the end portion of the contact lead, the better the electrical (and physical) connection between the contact lead and the electrodes. The openness of the end portion may be defined as the ratio of open area to the full surface area of the end portion. The openness of the end portion of the contact lead may be in the range of 5% to 95%.

[0022] The electrically conductive lead of the contact lead may itself be generally planar, for example in the form of a ribbon, although other profiles may be useful. The electrically conductive lead may be made of the same metal as the second metal forming the end portion, or of a different metal.

[0023] In this way, it is possible for form a reliable connection with a contact lead made of a metal other than the metal of the electrode. It will be understood that the contact lead, which will generally be exposed outside the casing of the battery, must be made of a metal that has good electrical conductivity but is not highly reactive when exposed to air or moisture. Suitable metals include nickel, copper, stainless steel or various alloys.

[0024] Moreover, the metal of the contact lead, since it is connected only to the protruding tabs of the electrodes, is not directly exposed to electrolyte when the battery is assembled.

[0025] A further advantage is that a good connection can be made to the at least one electrode without the electrode as a whole needing to be formed or disposed on a current collector made of a metal other than the first metal. In other words, the main part of the electrode that is exposed to the electrolyte consists solely of the first metal (e.g. lithium or a lithium alloy), with no need for a copper or nickel or other current collector that would add unnecessary weight and act as a substrate for the formation of dendrites during cycling.

[0026] Moreover, it is important that the second metal (of the contact lead) is selected so that it does not form an alloy

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with the first metal (of the electrode). This is in order to avoid reduction of the amount of the first metal that is available to the electrochemical system of the battery. For example, lithium will form an alloy with aluminium, but not with nickel or copper.

[0027] In certain embodiments, the electrode is configured as an anode, or negative electrode, for a battery. However, it will be appreciated that the method is applicable also to cathodes, or positive electrodes, where these are made of a metal that is suitable for pressing and welding to a perforated second metal as described.

[0028] Viewed from a second aspect, there is provided, in combination, at least one electrode for a battery and a contact lead, wherein the electrode comprises a sheet or foil of a first metal with a tab protruding from an edge of the sheet or foil, and wherein the contact lead comprises an electrically conductive lead with an end portion made of a second metal that does not alloy with the first metal and having a plurality of through holes, wherein the first metal of the tab has been pressed and welded so as to penetrate through the through holes of the second metal end portion.

[0029] Embodiments of the present invention seek to provide a negative electrode (anode) eliminating the need for the current collector, and a method of forming a reliable physical contact between different pieces of metallic lithium and the contact lead, thereby to promote good electrical contact between metallic lithium and the material of the contact lead.

[0030] In preferred embodiments, an excess of metallic lithium is used such that at the end of the battery life there is a substantial amount of lithium metal which serves as the current collector for the negative electrode. The use of lithium as the current collector eliminates mechanical contact between metal lithium and another current collector material.

[0031] In some embodiments, there may be provided a plurality of electrodes, each comprising a sheet or foil of the first metal with a tab protruding from each sheet in substantially the same location, so that the tabs of the stack of electrodes are substantially aligned when the electrodes are aligned with each other and arranged as an electrode stack.

[0032] The lithium metal of the negative electrode in the region of the tabs may form a single phase connection from lithium electrode to lithium electrode in the electrode stack. Such connection is achieved by using pressing and welding as hereinbefore described.

[0033] The contact lead, or at least the end portion thereof, may be thin (for example, with a thickness of 5 to 50μm), or may be thick (for example, with a thickness of 50 to 10,000μm).

[0034] The contact lead may be substantially linear, or may have a 'T'-shaped or 'L'-shaped configuration.

[0035] The end portion of the contact lead may be an integral part of the contact lead (in other words, formed from the same material as the rest of the contact lead and integral therewith), or may be a separate metal component, not necessarily of the same material as the rest of the contact lead, and welded thereto (for example by ultrasonic welding, thermal contact welding, laser welding, induction welding or other types of welding).

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] Embodiments of the invention are further described hereinafter with reference to the accompanying drawings, in which:

FIGURES 1a to 1c shows a battery stack with anodes, cathodes and tabs, and three alternative positionings for a contact lead;

FIGURES 2a to 2e shows possible designs for the contact lead; and

FIGURE 3 shows the contact lead being ultrasonically welded to the tabs.

DETAILED DESCRIPTION

[0037] A battery can be formed by an alternating stack of numerous cathodes and anodes. Each of these layers is divided by a separator. An ionic pathway is maintained by the presence, between each electrode, of an electrolyte. Each electrode 1 features a tab 2 protruding from its electrochemically active area and beyond the edge of the separator. These tabs 2 provide the first surface through which the stack 3 of lithium anodes will be welded to each other and joined to a contact lead 4. The tabs 2 are first folded and/or formed by pressing. A contact lead 4 is then positioned at the top **(Figure 1a)** or bottom **(Figure 1b)** of the stack 5 of tabs 2, or it may be positioned between any two lithium tabs 2 **(Figure 1c)**.

[0038] The contact leads 4 may take a number of forms **(Figures 2a to 2e)**. The body 6 is composed of a conductive metal ribbon, typically nickel, copper, stainless steel or some composite conductor. The end portion 7 (the area to be welded) is typically perforated, meshed or punched. The end portion 7 may be an integral part of the metal ribbon 6, or it may be a separate piece welded to the ribbon 6. Where the end portion 7 is a separate piece welded to the ribbon 6, it may be made of a different metal to that of the ribbon 6. The contact may be linear, "T" or "L" shaped. The perforations may be rhombic, circular, square, rounded, polygonal or any other suitable shape.

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[0039] The tabs 2 and the contact lead 4 are then positioned between the two weld fixtures 8 of an ultrasonic welder (**Figure 3**). The ultrasonic welder then simultaneously applies pressure and an ultrasonic wave to the weld area. This causes the numerous lithium layers 2 to fuse together to form a lithium-lithium weld. Further, the softened lithium percolates through the perforated or meshed area 7 of the contact lead 4. The contact lead 4 is hence joined to the lithium 2 as the mesh 7 is intimately surrounded by lithium. The high surface area contact between the mesh 7 of the contact lead 4 and the lithium electrode 1 produces a low resistance and a mechanically strong electrical contact. When the ultrasonic wave ceases and the pressure is released, the contact lead 4 will be joined to the lithium anodes 1.

EXAMPLE 1

[0040] A linear nickel contact lead, composed of 50μm thick nickel ribbon, was used. The endmost 5mm of the contact lead was expanded to form a mesh. A battery with 60 lithium anodes, each of 78μm thickness, was assembled. A stack of lithium contact tabs protruded from the battery. The lithium contact tabs were formed and trimmed to produce a flat welding area and to ensure that each of the tabs, regardless of its position, in the stack used the minimum quantity of lithium. The formed stack of lithium tabs was then positioned between the welding fixtures of an ultrasonic welder. The contact lead was then positioned on top of the stack of lithium tabs, such that the meshed region overlapped with the flat lithium welding zone. The welding conditions listed in **Table 1** were then entered into an AmTech 900B 40kHz ultrasonic welder. A single weld was then performed. Each of the 60 lithium layers were welded firmly to each other. A strong join was produced between the lithium and the contact lead. This join had been created by the softened lithium penetrating through the mesh of the contact lead.

Table 1 - The welder setting used in Example 1.

Energy / J	Amplitude / μm	Trigger Pressure / Psi	Pressure / Psi
180	5	20	20

EXAMPLE 2

[0041] A "T" shaped contact lead was made by welding a piece of nickel ribbon (50μm thick) to a piece of copper mesh. The mesh opening was approximately 200x700μm, with a bar width of 100μm. The mesh was thrice as long as the nickel ribbon was wide. The mesh was 5mm wide; the same as the welding zone. The mesh was positioned centrally to form the cross of the "T" and welded into position by an ultrasonic welder using the conditions given in **Table 2, weld A.** The contact lead was positioned between the welding fixtures of an ultrasonic welder such that the meshed region fell into the welding zone.

[0042] A battery with 20 lithium anodes, each of 78μm thickness, was assembled. A stack of lithium contact tabs protruded from the battery. The stack of lithium contact tabs was formed and trimmed to produce a flat welding area and to ensure that each of the contact tabs, regardless of its position, in the stack used the minimum quantity of lithium.

[0043] The stack of lithium contact tabs was then positioned on top of the contact lead, between the welding fixtures of an ultrasonic welder. The copper mesh "arms" of the "T" shaped contact lead were then folded around the stack of lithium contact tabs. The welding conditions listed in **Table 2, weld B** were then entered into an AmTech 900B 40kHz ultrasonic welder. A single weld was then performed. Each of the 20 lithium layers were welded firmly to each other. A strong join was produced between the lithium and the contact lead. This join had been created by the softened lithium penetrating through the mesh of the contact lead.

Table 2 - The welder settings used in Example 2

Weld	Energy / J	Amplitude / μm	Trigger Pressure / Psi	Pressure / Psi
A	70	80	80	5
B	10	5	20	20

EXAMPLE 3

[0044] An "L" shaped contact lead was manufactured by photochemical etching from a sheet of 100μm thick stainless steel. The upright section of the "L" is continuous steel foil. The base of the "L" was etched with a mesh pattern. The mesh opening was 500x500μm and the bar width was 100μm. The base of the "L" was twice the width of the upright section. The width of the base section was 5mm, the same as the weld zone.

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[0045] A battery with 20 lithium anodes, each of 78μm thickness, was assembled. A stack of lithium contact tabs protruded from the battery. The contact lead was positioned between the top face to the lowermost lithium contact tab and the bottom face of the remainder of the stack. The remainder of the stack of lithium contact tabs was pushed down onto the meshed region of the contact lead. The protruding meshed section of the contact lead was folded over the stack of contact tabs. The contact assembly was positioned between the welding fixtures of an ultrasonic welder such that the meshed regions fell into the welding zone.

[0046] The welding conditions listed in **Table 3** were then entered into an AmTech 900B 40kHz ultrasonic welder. A single weld was then performed. Each of the 20 lithium layers were welded firmly to each other. A strong join was produced between the lithium and the contact lead. This join had been created by the softened lithium penetrating through the mesh of the contact lead.

Table 3 - The welder settings used in Example 3

Energy / J	Amplitude / μm	Trigger Pressure / Psi	Pressure / Psi
40	5	20	20

[0047] Throughout the description and claims of this specification, the words "comprise" and "contain" and variations of them mean "including but not limited to", and they are not intended to (and do not) exclude other moieties, additives, components, integers or steps. Throughout the description and claims of this specification, the singular encompasses the plural unless the context otherwise requires. In particular, where the indefinite article is used, the specification is to be understood as contemplating plurality as well as singularity, unless the context requires otherwise.

[0048] Features, integers, characteristics, compounds, chemical moieties or groups described in conjunction with a particular aspect, embodiment or example of the invention are to be understood to be applicable to any other aspect, embodiment or example described herein unless incompatible therewith. All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive. The invention is not restricted to the details of any foregoing embodiments. The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

[0049] The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

Claims

1. A method of connecting at least one electrode to a contact lead, wherein the electrode comprises a sheet or foil of a first metal with a tab protruding from an edge of the sheet or foil, and wherein the contact lead comprises an electrically conductive lead with an end portion made of a second metal that does not alloy with the first metal and having a plurality of through holes, the method comprising the steps of:

   i) positioning the end portion of the contact lead and the tab of the at least one electrode so that there is substantial overlap between the end portion and the tab;
   ii) causing the metal of the tab to penetrate through the through holes of the end portion so as to join the at least one electrode to the contact lead.

2. A method according to claim 1, wherein, in step ii), the metal of the tab is caused to penetrate through the through holes by pressing and welding.

3. A method according to claim 2, wherein the welding is ultrasonic welding.

4. A method according to claim 2, wherein the welding is thermal contact welding, laser welding or induction welding.

5. A method according to any one of claims 2 to 4, wherein the welding does not cause significant thermal deformation or changes in the laminar sheet or foil of the at least one electrode, but concentrates the applied energy in the locality of the tab.

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6. A method according to any one of the preceding claims, wherein there is provided a plurality of electrodes, each comprising a sheet or foil of the first metal with a tab protruding from each sheet in substantially the same location, so that the tabs of the stack of electrodes are substantially aligned when the electrodes are aligned with each other and arranged as an electrode stack.

7. A method according to claim 6, wherein the perforated end portion of the contact lead is placed on top of the tabs of the electrode stack in step i).

8. A method according to claim 6, wherein the perforated end portion of the contact lead is placed underneath the tabs of the electrode stack in step i).

9. A method according to claim 6, wherein the perforated end portion of the contact lead is placed at an intermediate position between the top and the bottom of the electrode stack in step i).

10. A method according to any one of claims 7 to 9, wherein the tabs and the perforated end portion are then pressed together and the first metal is caused to penetrate through the holes in the perforated end portion of the contact lead.

11. A method according to claim 7 or 8, wherein the tabs of the electrode stack are pressed together before the perforated end portion is placed on top of or underneath the compressed tabs and the penetration of step ii) is performed.

12. A method according to any preceding claim, wherein the end portion of the contact lead is an integral part of the contact lead.

13. A method according to any one of claims 1 to 11, wherein the end portion of the contact lead is a separate metal component that is welded to the contact lead.

14. A method according to any preceding claim, wherein the first metal is lithium or a lithium alloy.

15. A method according to any preceding claim, wherein the second metal is selected from a group comprising: nickel, copper, a nickel or copper alloy that does not alloy with lithium, and stainless steel.

16. In combination, at least one electrode for a battery and a contact lead, wherein the electrode comprises a sheet or foil of a first metal with a tab protruding from an edge of the sheet or foil, and wherein the contact lead comprises an electrically conductive lead with an end portion made of a second metal that does not alloy with the first metal and having a plurality of through holes, wherein the first metal of the tab has been pressed and/or welded so as to penetrate through the through holes of the second metal end portion.

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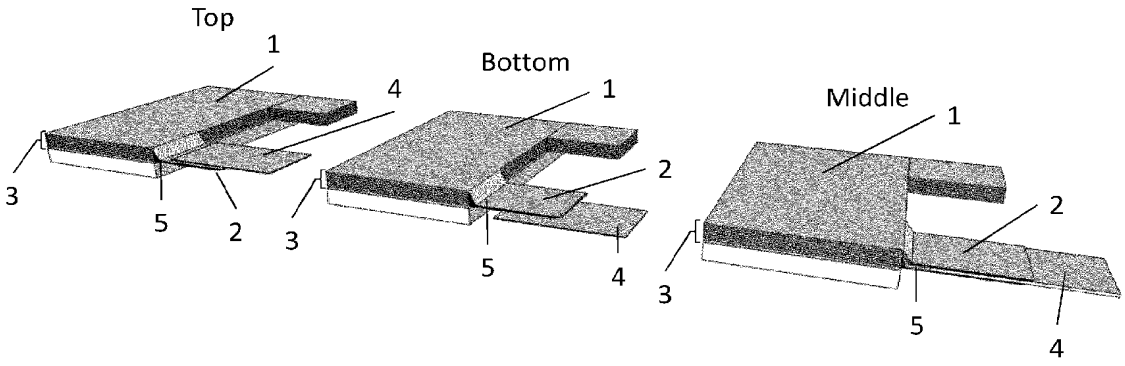


Fig 1a Fig 1b Fig 1c

Figure 1

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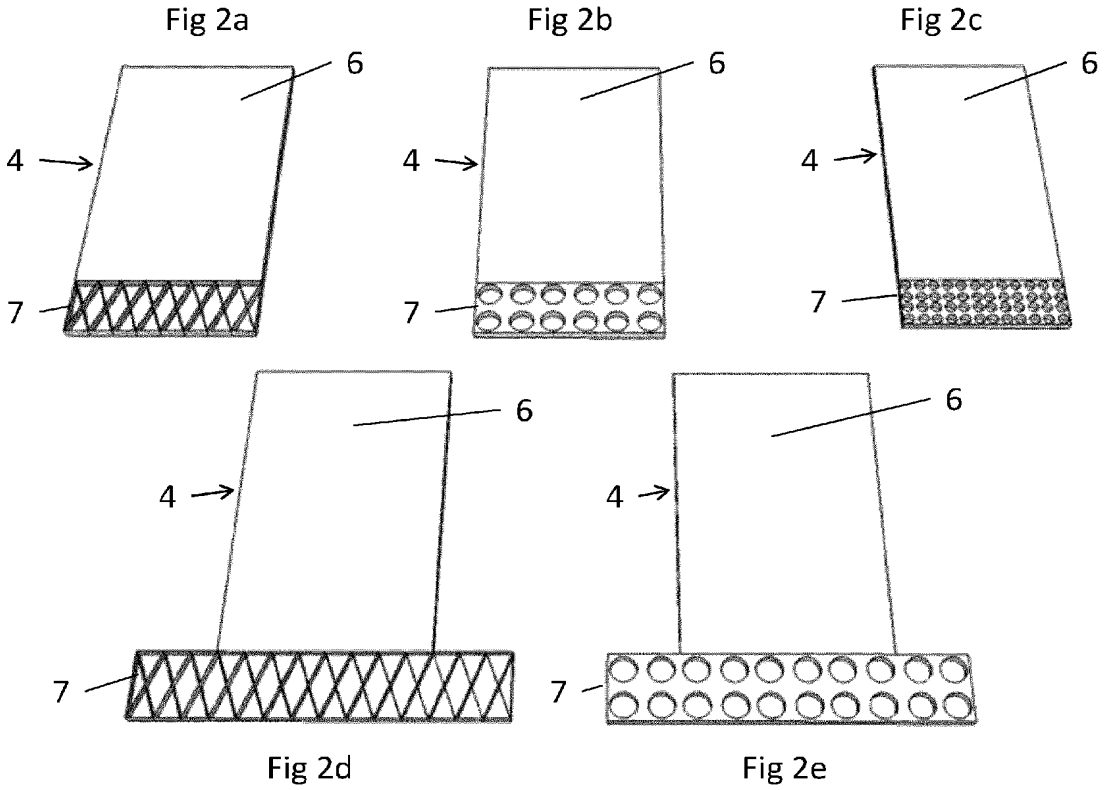


Figure 2

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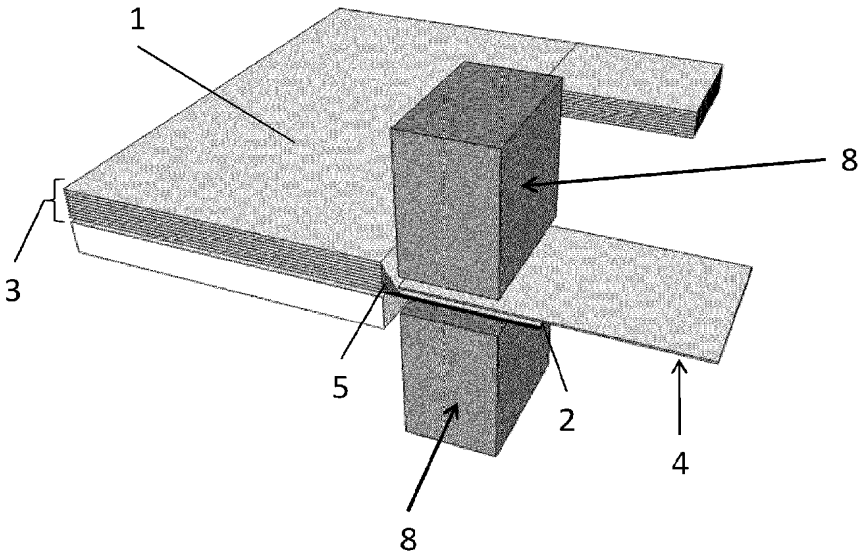


Figure 3

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EUROPEAN SEARCH REPORT

Application Number
EP 11 19 3678

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 7 335 440 B2 (AAMODT PAUL B [US] ET AL) 26 February 2008 (2008-02-26) * column 4, line 52 - column 5, line 2; figure 1C * * column 5, line 53 - line 57 *	1-12, 14-16	INV. H01M2/26 H01M2/30
Y	GB 2 200 068 A (SYLVA IND LIMITED) 27 July 1988 (1988-07-27) * page 2, line 17 - line 15 * * page 3, paragraph 2 * * page 3, line 24 - line 28 * * page 6, line 14 - line 16 * * page 7, line 16 *	1-12, 14-16	
A	EP 0 924 783 A1 (JAPAN STORAGE BATTERY CO LTD [JP]; GS MELCOTEC CO LTD [JP]) 23 June 1999 (1999-06-23) * paragraph [0025]; figures 1A,1B * * paragraph [0034] * * paragraph [0042] *	1-4,6-12	
A	EP 2 026 402 A1 (NISSAN MOTOR [JP]) 18 February 2009 (2009-02-18) * paragraph [0010] - paragraph [0011] * * paragraph [0014] * * paragraph [0018] * * paragraph [0035] * * paragraph [0047]; figure 4 * * paragraph [0076] - paragraph [0077]; figure 10 *	1-12, 14-16	TECHNICAL FIELDS SEARCHED (IPC) H01M
A	JP 2011 108469 A (TOYOTA MOTOR CORP) 2 June 2011 (2011-06-02) * paragraph [0016] * * paragraph [0025] *	1-12	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	3 May 2012	Engert, Andrea

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 19 3678

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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03-05-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7335440 B2	26-02-2008	NONE	
GB 2200068 A	27-07-1988	NONE	
EP 0924783 A1	23-06-1999	CN 1224250 A	28-07-1999
		DE 69813164 D1	15-05-2003
		DE 69813164 T2	23-10-2003
		EP 0924783 A1	23-06-1999
		US 6241790 B1	05-06-2001
EP 2026402 A1	18-02-2009	EP 2026402 A1	18-02-2009
		US 2009017376 A1	15-01-2009
JP 2011108469 A	02-06-2011	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 5368958 A **[0009] [0011]**
- US 7335440 B **[0010]**
- US 7108942 B **[0011]**

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Espacenet

JP2014232666A NONAQUEOUS ELECTROLYTE SECONDARY BATTERY

Applicants: KANEKA CORP

Inventors: IMAMURA YUICHI,NIWA YUKIMASA,SAWADA YUKI

Classifications:

IPC ***H01M10/052; H01M10/0585; H01M10/0587; H01M10/52; H01M2/02; H01M2/06; H01M2/08; H01M2/30; H01M2/34; H01M4/13; H01M4/131; H01M4/48; H01M4/485; H01M4/505;***

CPC Y02E60/10 (EP);

Priorities: JP2013113362A 2013-05-29

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Published as: JP2014232666A

NONAQUEOUS ELECTROLYTE SECONDARY BATTERY

Abstract

PROBLEM TO BE SOLVED: To provide a nonaqueous electrolyte secondary battery arranged so that gas generated when charge and discharge is repeated can be absorbed, and an outer sheath can be prevented from being swelled.SOLUTION: A nonaqueous electrolyte secondary battery comprises: an internal power-generation body 8 including a positive electrode including a positive electrode active material, a negative electrode including a negative electrode active material, and a separator interposed between the positive and negative electrodes; at least two metal tab leads 14 connected to the positive and negative electrodes respectively; and a film-like outer sheath 10 which houses the internal power-generation body 8 together with an electrolytic solution 20 of nonaqueous electrolyte in a hermetic condition. The nonaqueous electrolyte secondary battery further comprises a resin part 26 used to prevent the short circuit inside the battery and provided between the outer sheath 10 and the internal power-generation body 8. The resin part 26 has a gas-absorbing material such as a hydrogen-absorbable alloy mixed therein.

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H01M 2/34	***(2006.01)***	H01M	2/34	B	5H029
H01M 2/08	***(2006.01)***	H01M	2/08	K	5H031
H01M 2/06	***(2006.01)***	H01M	2/06	K	5H043
H01M 2/30	***(2006.01)***	H01M	2/30	D	5H050

審査請求 未請求　請求項の数 10　ＯＬ　（全 21 頁）　最終頁に続く

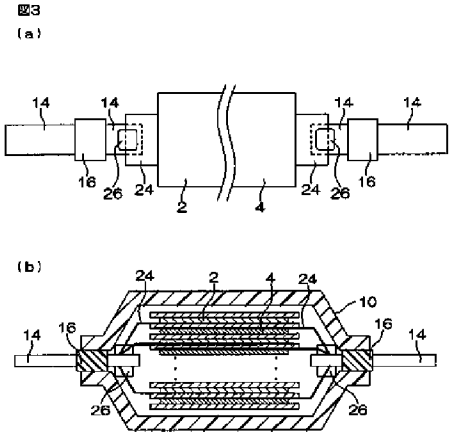
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最終頁に続く

(54)【発明の名称】非水電解質二次電池

(57)【要約】
【課題】充放電を繰り返すときに発生するガスを吸収し、外装体の膨れを防止できる非水電解質二次電池を提供する。
【解決手段】正極活物質を含む正電極と、負極活物質を含む負電極と、前記正電極と負電極との間に介在するセパレータとで構成される内部発電体８と、正電極と負電極とにそれぞれ接合された少なくとも２本の金属タブリード１４と、内部発電体８を非水電解質の電解液２０と共に密封状態に収容するフィルム状の外装体１０とを備え、前記外装体１０と前記内部発電体８との間に、電池内部の短絡防止のために使用されている樹脂部品２６を有し、前記樹脂部品２６に水素吸蔵合金などのガス吸着材を混入させている。
【選択図】図３



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【特許請求の範囲】
【請求項１】
正極活物質を集電箔に塗工した正電極と、負極活物質を集電箔に塗工した負電極と、前記正電極と前記負電極との間に介在するセパレータとで構成される内部発電体と、前記正電極と前記負電極とにそれぞれ接合された少なくとも２本の金属タブリードと、前記内部発電体を非水電解質の電解液と共に密封状態に収容するための少なくとも一層の金属膜を積層したフィルム状の外装体と、前記外装体と前記内部発電体との間に、電池内部の短絡防止のために使用されている樹脂部品とを有し、前記樹脂部品にガス吸着材が混入していることを特徴とする、非水電解質二次電池。
【請求項２】
前記短絡防止のために使用されている樹脂部品が、
（ａ）前記内部発電体の絶縁固定のために使用される樹脂テープ、
（ｂ）前記金属タブリードと前記集電箔とが接合される部分に形成される樹脂材、又は
（ｃ）前記正極活物質の前記金属タブリード側の端部若しくは前記負極活物質の前記金属タブリード側の端部に形成される樹脂材、
のいずれかである、請求項１に記載の非水電解質二次電池。
【請求項３】
前記負極活物質が、前記リチウムイオンの脱離及び挿入が０．３Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以上２．０Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以下で進行する負極活物質である、請求項１又は請求項２に記載の非水電解質二次電池。
【請求項４】
前記負極活物質が、チタン酸リチウムあるいはチタン酸化物である、請求項３に記載の非水電解質二次電池。
【請求項５】
前記正極活物質が、前記リチウムイオンの脱離及び挿入の電位が４．５Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以上４．９Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）未満の正極活物質である、請求項１～請求項４のいずれか１項に記載の非水電解質二次電池。
【請求項６】
前記正極活物質が、リチウムマンガン化合物である、請求項５に記載の非水電解質二次電池。
【請求項７】
前記外装体の金属膜の材質はアルミニウムである、請求項１～請求項６のいずれか１項に記載の非水電解質二次電池。
【請求項８】
前記内部発電体は、前記正電極と前記負電極と前記セパレータとの積層体で構成される、請求項１～請求項７のいずれか１項に記載の非水電解質二次電池。
【請求項９】
前記内部発電体は、前記正電極と前記負電極と前記セパレータとの積層体を倦回したものである、請求項１～請求項７のいずれか１項に記載の非水電解質二次電池。
【請求項１０】
請求項１～請求項９のいずれか１項に記載の非水電解質二次電池を複数個接続してなる組電池。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明はリチウムイオン二次電池等の非水電解質二次電池に関するものである。
【背景技術】
【０００２】
近年、携帯機器などの電子機器、ハイブリット自動車、電気自動車、家庭用蓄電用途に、リチウムイオン二次電池等の非水電解質二次電池の研究開発が盛んにおこなわれている

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。これらの分野に用いられる非水電解質二次電池は、長期間、充放電サイクルが繰り返されて使用される。

非水電解質二次電池の構造は、正極活物質を集電箔に塗工したシート状正電極と、負極活物質を集電箔に塗工したシート状負電極とをセパレータを介して交互に積層又は倦回した内部発電体と、当該内部発電体を電解液と共に密封状態に収容したフィルム状の外装体とを有している。フィルムは、ガスバリア性を向上させるため、アルミニウムなどの金属膜を内部に配置している。

【０００３】

内部発電体から電流を引き出すための金属タブリードは、密封された外装体の、融着されたフィルム同士の隙間から外に露出している。

非水電解質二次電池は、電解液として有機溶媒を含んでいて、これが電極活物質と作用しあって、充放電時に水素ガスなどのガスが発生することがある。外装体の内部は完全に密封された状態になっているので、このことが原因で、非水電解質二次電池が膨れてしまい、この電池が組み込まれている電子機器内部のプリント基板や端子部等に異常な圧力を加えて、変形を生じさせるおそれがあり、機器の信頼性を損なう原因となる。

【０００４】

特に、従来のカーボン系負極活物質を用いた非水電解質二次電池では、通常の使用条件ではガスの発生は少ないものの、過充電時や高温保存時に急激に大量のガスが発生することがあり、非水二次電池の膨れによる影響を十分に抑制するため、相当な量のガス吸着材を、電池の内部に配置することが必要となる。

特許文献１は、電池上部の空き空間、電池底部、正電極と負電極とセパレータを巻回して作成した発電要素の中心部、または電池ケースの内側などに水素吸蔵合金を配置して、発生した水素を吸収する構造を示している（実施例２）。特許文献２では、ラミネート型非水電解質二次電池において、ラミネートフィルムの内面のうち、封止した部分以外の内面に水素吸蔵合金からなるガス吸着層を貼り付ける技術が開示されており、特許文献３では、ラミネートフィルムに、電極群を収容する収納部を形成し、この収納部におけるコーナー部の少なくとも一箇所以上の内面に水素吸蔵合金からなるガス吸着材を配置する技術が開示されている。特許文献４は、外装体と内部発電体との間にガス吸着材を配置する技術を示している。

【先行技術文献】

【特許文献】

【０００５】

【特許文献１】特開平１１－３１２５４０号公報
【特許文献２】特開２０１１－２４９２６９号公報
【特許文献３】特開２０１２－５９４８９号公報
【特許文献４】特開２００１－１５５７９０号公報
【特許文献５】特開２００８－１４６９６３号公報
【特許文献６】特開平１１－１９１４００号公報

【発明の概要】

【発明が解決しようとする課題】

【０００６】

しかし何れの技術も、電極、セパレータなどの二次電池の本来の構成部品とは別に、ガス吸収剤を用意し、外装体の内部に設置する技術である。二次電池の構成部品とは別のガス吸着材を配置するための余分なスペースが必要になり、またそれを設置する工程若しくは貼り付ける工程が必要になる。このため電池の体積が増え、エネルギー密度が低下するといった問題がある。

【０００７】

ガス吸着材を二次電池の本来の構成部品に、ガス吸着材を混合する技術もある。特許文献５は、ガス吸収剤をセパレータ基材に混ぜ込む例を示し、特許文献６は、フィルム状の外装体の一層に、ガス吸収剤を練り込む技術を開示している。

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しかし、ガス吸着材は直径の大きなザラザラした粒子であり、内部発電体の構成部品にガス吸着材を混合すると、構成部品の物性を変えてしまい、充放電性能を劣化させるおそれがある。フィルム状の外装体自体にガス吸着材の粒子を混ぜる場合も、外装体のガスバリア性能を低下させるおそれがある。

【０００８】

一方、カーボン系負極活物質に変わる材料として、高安全性、高耐久性であることから、リチウムの脱離及び挿入の平均電位が金属リチウム基準で０．３Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以上２．０Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）未満である負極活物質（チタン酸リチウムあるいはチタン酸化物）を用いた非水電解質二次電池が開発されている。

このような非水電解質二次電池は、従来のカーボン系負極活物質では見られない、２５℃～４５℃といった通常の使用温度域で少量のガスが徐々に発生するという傾向がある。このため、通常の使用温度域での充放電時における長期に渡る微量のガス発生に対応するには、特許文献１～４のように特別の場所に大量のガス吸着材を配置しなくてもよいと考えられる。

【０００９】

そこで、本発明者は、外装体の内部の特別の場所に大量のガス吸着材を配置しないで済み、かつ二次電池の本来の構成部品であって、電池の性能に影響を与えない部品にガス吸着材を含ませることを想定した。

本発明は、小スペースであるが非水二次電池に使用されている短絡防止樹脂にガス吸着材を含ませることで、エネルギー密度を低下させることなく非水二次電池の外装体の膨れを防止することを目的とする。

【課題を解決するための手段】

【００１０】

本発明の非水電解質二次電池は、正極活物質を集電箔に塗工した正電極と、負極活物質を集電箔に塗工した負電極と、正電極と負電極との間に介在するセパレータとで構成される内部発電体と、正電極と負電極とにそれぞれ接合された少なくとも２本の金属タブリードと、内部発電体を非水電解質の電解液と共に密封状態に収容するための少なくとも一層の金属膜を積層したフィルム状の外装体と、フィルム状の外装体と内部発電体との間に、電池内部の短絡防止のために使用されている樹脂部品とを有し、樹脂部品にガス吸着材を混入させていることを特徴とする。

【００１１】

この構成であれば、二次電池に従来から用いられる小さな構成部品であって、電池の性能に影響を与えない部品にガス吸着材を含ませて、内部発電体から発生するガスを吸収するので、電池の性能に悪い影響を与えることはない。また外装体の内部の特別の場所を占める物ではないので、電池が大型化することもない。

短絡防止のために使用されている樹脂部品の具体例は、（ａ）内部発電体の固定のために使用される樹脂テープ、（ｂ）金属タブリードと集電箔とが接合される部分に形成される樹脂材、又は（ｃ）正極活物質の金属タブリード側の端部又は負極活物質の金属タブリード側の端部に形成される樹脂材、のいずれかであってもよい。

【００１２】

負極活物質が、リチウムイオンの脱離及び挿入が０．３Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以上２．０Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以下で進行する負極活物質（例えばチタン酸リチウムあるいはチタン酸化物）である場合は、通常の使用温度域で長期にわたって発生する少量のガスを吸着すればよいので、本発明のようにフィルム状の外装体と内部発電体との間に、電池内部の短絡防止のために使用されている樹脂部品にガス吸着材を混入させておけば、非水二次電池の外装体の膨れを防止するのに十分である。

【００１３】

正極活物質が、リチウムイオンの脱離及び挿入の電位が４．５Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以上４．９Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）未満の正極活物質（例えばリチウムマンガン化合物）である場合は、通常の使用温度域でも電解液の酸化分解によりガスが発生するといった問題

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があったが、本発明の構造を採用することにより、ガスを吸収することができる。

【発明の効果】

【００１４】

本発明によれば、フィルム状の外装体と内部発電体との間に、電池内部の短絡防止のために使用されている樹脂部品にガス吸着材を混入させることにより、電池性能の低下を回避し、電池容積の無駄な増大を回避しながら、非水二次電池の外装体の膨れを防止することができる。特に、チタン酸リチウムを負電極に用いた非水二次電池特有の問題である、通常の使用温度域での充放電時における長期に渡る微量のガスの発生に対応することができる。

【図面の簡単な説明】

【００１５】

【図１】非水電解質二次電池の内部発電体の構造を示す断面図である。

【図２】本発明の実施の形態に係る非水電解質二次電池の全体構造を示す平面図（ａ）及び側断面図（ｂ）である。

【図３】本発明の他の実施の形態に係る非水電解質二次電池の全体構造を示す平面図（ａ）及び側断面図（ｂ）である。

【図４】本発明のさらに他の実施の形態に係る非水電解質二次電池の内部発電体を示す平面図である。

【図５】図５の変形例に係る内部発電体を示す平面図である。

【発明を実施するための形態】

【００１６】

以下、本発明の実施の形態を添付図面を参照して説明する。本発明の範囲は特許請求の範囲によって示され、特許請求の範囲と均等の意味及び範囲内でのすべての変更が含まれることが意図されている。

＜非水電解質二次電池＞

図１は、非水電解質二次電池の内部発電体８の構造を示す断面図である。内部発電体８は、正電極２と、負電極４と、正電極２と負電極４との間に介在するセパレータ６とで構成される。正電極２は、正極活物質をシート状の集電箔２４に塗工したものであり、負電極４は、負極活物質をシート状の集電箔２４に塗工したものである。

【００１７】

非水電解質二次電池の集電箔２４は、セパレータ６を挟んで両側に配置されており、そのうち片側の集電箔２４は正極活物質を塗工したものであり、他側の集電箔２４は負極活物質を塗工したものである。正極活物質の集電箔２４が形成されていない方の面と負極活物質の集電箔２４が形成されていない方の面とは、他のセパレータ６を挟んで向かい合っている。このようにして、正電極２と負電極４とセパレータ６とで１つの発電単位を構成する。発電単位が１層又は複数層積層されて内部発電体８を構成している。積層数は、所望の電池容量を発現する数までとすることができる。

【００１８】

内部発電体８は、リチウムイオンの伝導を担う非水電解質の電解液に浸されている。集電箔２４の材質と電解液の成分については後述する。

なお、本発明の非水電解質二次電池の内部発電体の構造は図１の構造に限定されることはない。例えば、集電箔の片面に正電極、他面に負電極を形成させた形態、すなわち、バイポーラ電極を用いて内部発電体を構成してもよい。この場合は、隣り合うバイポーラ電極の正電極側と負電極側との間にセパレータを配置する。１枚の集電箔を挟んで正電極側と負電極側とが対向している層には、液絡を防止するため周辺部に絶縁材料を配置する必要がある。

【００１９】

図２は、本発明の実施の形態に係る非水電解質二次電池の全体構造を示す平面図（ａ）と側断面図（ｂ）である。非水電解質二次電池は、内部発電体８と、内部発電体８の正電極側の集電箔２４と負電極側の集電箔２４とにそれぞれ接合された金属タブリード１４を

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有している。さらにこの内部発電体８を、２枚のフィルム状の外装体１０の間に収容し、非水電解質の電解液２０と共に密封状態に収容している。

【００２０】

フィルム状の外装体１０の内壁と内部発電体８との空間に満たされている非水電解質の電解液２０は、あらかじめ正電極２、負電極４及びセパレータ６に含ませておいてもよいし、正電極側と負電極側との間にセパレータ６を配置したものを巻回あるいは積層し、フィルム状の外装体１０の中に収容した後に添加してもよい。電解液２０の量は、特に限定されないが、正極合剤、負極合剤及びセパレータの総空隙体積以上であることが好ましく、前記総空隙体積の１２０％以上が更に好ましい。正極合剤、負極合剤及びセパレータの総空隙体積未満であると充放電に寄与する部分への電解液の未充填部位が発生し、充放電に寄与できなくなってしまう。

【００２１】

フィルム状の外装体１０は、一般的に少なくとも３層を有しており、最外層は物理的保護を目的にポリエチレンなどの合成樹脂フィルムが用いられ、中間層にはガスバリア性を向上させるため、アルミニウム金属箔などが用いられ、最内層には、ラミネート接着性、ガスバリア性及び耐電解液性を目的に変性ポリプロピレンなどの合成樹脂フィルムが用いられる。合成樹脂層は複数の機能を持たせるため多層構造となる場合もある。

【００２２】

２本の金属タブリード１４は薄い板状であり、そのうち１本の金属タブリード１４は、内部発電体８の正電極２の集電箔２４に接合され、他の１本の金属タブリード１４は、内部発電体８の負電極４の集電箔２４に接合されている。図示するように、内部発電体８が積層したものであれば、積層された複数の正電極２の各集電箔２４が１本の金属タブリード１４に接合され、積層された複数の負電極４の各集電箔２４が他の１本の金属タブリード１４に接合される。

【００２３】

金属タブリード１４の材質は、導電性に優れた金属であればよく、例えばアルミニウム、銅、ニッケルなどがあげられる。集電箔２４の金属タブリード１４への接合法には、超音波溶接、半田付け、抵抗溶接などがあげられる。

金属タブリード１４の一部には、ポリプロピレンなどの熱融着樹脂１６が金属タブリード１４の上面から下面にわたって塗布されている。この熱融着樹脂１６は、金属タブリード１４を上下の外装体１０どうしの間に挟んで熱処理するときに融解して、外装体１０と金属タブリード１４とを接着するのに役立つように、予め形成されたものである。

【００２４】

本発明の非水電解質二次電池では、正電極２と負電極４とセパレータ６とが離れないように、積層された内部発電体８を固定する電極固定テープ２２を用いる。

この電極固定テープ２２は、フィルム状の外装体１０の中にラミネートされている金属層を通した電気的な短絡を防止するために絶縁性を有している。この絶縁性は内部発電体８を構成する正電極２と負電極４との間の電気的な短絡を防止するのにも役立つ。この電極固定テープ２２が、「電池内部の短絡防止のために使用されている樹脂部品」に該当する。

【００２５】

電極固定テープ２２は、テープの強度を保つための基材層と接着層とで構成されるが、本発明では、基材層、接着層のいずれか又は両方にガス吸着材が混入されている。

ガス吸着材としては、特に限定しないがシリカゲル、ゼオライト、活性炭、ステアリン酸金属塩、ハイドロタルサイト、水素吸蔵合金、活性アルミナ、遷移金属酸化物、ソーダ石灰、酸化カルシウム、酸化マグネシウム、アスカライトなどから、発生ガス種に応じて選ばれる少なくとも一種以上であることが好ましい。

【００２６】

ガス吸着材は粒子状のものを用いることが好ましい。その粒子径は、特に限定しないが、作業性、表面積、混入後の凹凸から1～50μm程度が好ましい。

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ガス吸着材の混入量は、テープとして接着性が維持される限り、特に限定されない。ただしガス吸着材の混入量が多すぎると、粒子同士が接触して導電性が発現することがあるが、テープによってセパレータ上を固定するので、極板や端子等には触れない限り、差し支えない。

【００２７】

ガス吸着材のテープ基材層への混入の場合は、基材フィルムの製膜時に混入させる。また接着樹脂層に混入する場合は、テープ基材へ塗工する際の塗工液に混入する。

テープ基材層の材質は、特に限定しないが、耐熱性（熱収縮）、強度、耐久性、耐電解液性からポリイミド等が好ましい。

電極固定テープ２２にガス吸着材が混入されていることにより、内部発電体８から発生し外装体１０の中に閉じ込められた水素ガスなどのガスを吸収することができる。

【００２８】

図３は、本発明の他の実施の形態に係る非水電解質二次電池の全体構造を示す平面図（ａ）と側断面図（ｂ）である。平面図（ａ）では右側に負極活物質の層を示し、左側に正極活物質の層を示している。積層された内部発電体８を固定する電極固定テープは図示していない。

図２から追加された点を説明すると、外装体１０の中であって、薄い板状の金属タブリード１４の、正電極２の集電箔２４に接合されている部分が短絡防止樹脂２６で覆われ、他の１本の金属タブリード１４の、負電極４の集電箔２４に接合されている部分が短絡防止樹脂２６で覆われていることである。

【００２９】

短絡防止樹脂２６の材質として、一般的には、ポリイミドが用いられるが、ポリイミドに限定されず、強度、耐熱性（熱収縮）、耐久性、耐電解液性があれば他の種類の樹脂でも良い。

正電極２又は負電極４の集電箔２４を、超音波溶接法などで金属タブリード１４に接合するときに、集電箔２４や金属タブリード１４上に鋭利な金属切片が生じる可能性があり、この短絡防止樹脂２６は、その金属切片がラミネートフィルム内の金属膜に接触するのを防止するために形成されるものである。

【００３０】

短絡防止樹脂２６の形成方法は限定されないが、例えば、正電極２の集電箔２４を金属タブリード１４に超音波溶接した後、小さくカットした短絡防止樹脂２６片を、金属タブリード１４の両面の溶接された部分に置き、負電極側の短絡防止樹脂２６も他方の金属タブリード１４の両面の溶接された部分に置き、前述した熱融着樹脂１６とともに、上下の外装体１０どうしの間に挟んで熱融解させると、短絡防止樹脂２６が金属タブリード１４上に、かつ集電箔２４を覆った状態で形成される。またこれ以外に、ポリイミドテープを金属タブリード１４に貼り付ける方法もある。この短絡防止樹脂２６が、「電池内部の短絡防止のために使用されている樹脂部品」に該当する。

【００３１】

本発明では、短絡防止樹脂２６の中にガス吸着材が混入されている。

ガス吸着材としては、特に限定しないがシリカゲル、ゼオライト、活性炭、ステアリン酸金属塩、ハイドロタルサイト、水素吸蔵合金、活性アルミナ、遷移金属酸化物、ソーダ石灰、酸化カルシウム、酸化マグネシウム、アスカライトなどから、発生ガス種に応じて選ばれる少なくとも一種以上であることが好ましい。

【００３２】

ガス吸着材は粒子状のものを用いることが好ましい。その粒子径は、特に限定しないが、作業性、表面積、混入後の凹凸から1～50μｍ程度が好ましい。

ガス吸着材の混入量が多すぎると粒子同士が接触して導電性が発現することがあるので、ガス吸着材の混入量の上限は、短絡防止樹脂２６の絶縁性が維持されるかどうかに応じて決められる。このような導電性が発現するような混入量の上限は、実際に短絡防止樹脂２６にガス吸着材を混入させてみて抵抗率を測定して、定めるとよい。

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【００３３】
短絡防止樹脂２６にガス吸着材が混入されていることにより、内部発電体８から発生し外装体１０の中に閉じ込められる水素ガスなどのガスを吸収することができる。
図４は、本発明のさらに他の実施の形態に係る非水電解質二次電池の内部発電体８を示す平面図（ａ）及び断面図（ｂ）である。
この図（ａ）は、図１に示した構造の内部発電体８を負電極側から見た平面図になる。負電極４の一端部において、負極活物質が塗工されていない部分があり、集電箔２４が露出している。ここに負電極側の金属タブリード１４を溶接している。なお図示しないが、正電極側（図の紙面裏側）においても、正電極２の一端部において、正極活物質が塗工されていないで集電箔２４が露出していて、ここに正電極側の金属タブリード１４が溶接されている。
【００３４】
この内部発電体８を巻回して、フィルム状の外装体１０の中に入れて、電解液２０で満たしながら、金属タブリード１４を残してフィルム状の外装体１０を密閉することにより、非水電解質二次電池を製造することができる。
巻回する前、集電箔２４が露出している部分において、超音波溶接法などで金属タブリード１４を接合するときに、集電箔２４や金属タブリード１４上に鋭利な金属切片が生じる可能性がある。その金属切片が、巻回された内部発電体８の正電極２と電気的に接触するのを防止するために、短絡防止樹脂２８を、図４に示すように、集電箔２４上に金属タブリード１４を覆う状態で形成している。また短絡防止樹脂３０を、集電箔２４と活物質４の端部との境界上にも形成している。
【００３５】
短絡防止樹脂２８，３０の形成方法は限定されないが、例えば金属タブリード１４を集電箔２４の片面に超音波溶接した後、小さくカットした短絡防止樹脂片を、金属タブリード１４の溶接された部分上に置き、上下から熱と圧力を加えながら熱融解させるとよい。また短絡防止樹脂片を集電箔２４と活物質の端部との境界上に置き、同時に熱融解させる。この短絡防止樹脂２８，３０が、「電池内部の短絡防止のために使用されている樹脂部品」に該当する。
【００３６】
この実施形態においても、短絡防止樹脂２８，３０の中にガス吸着材が混入されている。ガス吸着材の混入量、混入方法などは図３に関連して前述した実施形態と同様である。短絡防止樹脂２８，３０にガス吸着材が混入されていることにより、巻回された内部発電体８から発生するガスをガス吸着材に吸収することができる。
以上に説明した本発明の非水電解質二次電池は、内部発電体が外装体に包まれ、金属タブリードが外装体から露出した形状のものであり、このまま二次電池として、電子機器内部に組み込んで使用する。
【００３７】
本発明の非水電解質二次電池は、複数接続することによって組電池とすることができる。本発明の組電池は、所望の大きさ、容量、電圧によって適宜直列、並列に接続することによって作製することができる。また、各電池の充電状態の確認、安全性向上のため、前記組電池に制御回路が付属されていることが好ましい。
以下、本発明の非水電解質二次電池の各構成部分である、負電極、正電極、セパレータ、非水電解質の材質、製造方法などを説明する。
【００３８】
＜負電極＞
本発明の非水電解質二次電池に用いる負電極は、特に、リチウムイオンの挿入・脱離反応が０．３Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以上２．０Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以下で進行する負極活物質を含む。
リチウムイオンの挿入反応が０．３Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以上２．０Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以下で進行するとは、負極活物質へのリチウムイオン挿入が２．０Ｖ（ｖｓ

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．Ｌｉ$^{+}$／Ｌｉ）以下で開始し、０．３Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以上で終了することである。一方、リチウムイオンの脱離反応が０．３Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以上２．０Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以下で進行するとは、負極活物質からのリチウムイオン脱離が０．３Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以上で開始し、２．０Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以下で終了することである。

【００３９】

リチウムイオン挿入・脱離反応の電圧値（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）は、例えば、負極活物質を用いた動作極、リチウム金属を対極とした半電池の充放電特性を測定し、プラトー開始時、及び終了時の電圧値を読み取ることによって求めることができる。プラトーが２箇所以上あった場合は、もっとも低い電圧値のプラトーが０．３Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以上であればよく、もっとも高い電圧値のプラトーが２．０Ｖ（ｖｓ．Ｌｉ+／Ｌｉ）以下であればよい。前記半電池に用いる動作極、電解液、セパレータは後述のものと同様のものを用いることができる。

【００４０】

リチウムイオンの挿入・脱離反応が０．３Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以上２．０Ｖ（ｖｓ．Ｌｉ$^{+}$／Ｌｉ）以下で進行する負極活物質は、チタン酸リチウム、二酸化チタン、五酸化ニオブ及び二酸化モリブデンなどが好ましく、負極活物質の安定性が高い点から、チタン酸リチウム、二酸化チタンがより好ましく、チタン酸リチウムがさらに好ましい。これら負極活物質は１種類でもよいし、２種類以上用いてもよい。

【００４１】

チタン酸リチウムは、スピネル構造であることが好ましく、分子式として$Li_4Ti_5O_{12}$で表されるものが好ましい。スピネル構造の場合、リチウムイオンの挿入・脱離の反応における活物質の膨張収縮が小さい。チタン酸リチウムには、たとえばＮｂなどのリチウム、チタン以外の元素が微量含まれていてもよい。

チタン酸リチウムは、ＣｕＫαによる粉末Ｘ線回折の（４００）面の半値幅が０．５°以下であることが好ましい。０．５°より大きいと、チタン酸リチウムの結晶性が低いため、電極の安定性が低下する場合がある。

【００４２】

チタン酸リチウムは、Ｘ線回折によるリートベルト解析法による８ａサイトに占めるリチウム含有率が９０％以上であることが好ましい。９０％未満であると、チタン酸リチウムの結晶中の欠陥が多いため、電極の安定性が低下する場合がある。

チタン酸リチウムは、リチウム化合物、チタン化合物を５００℃以上１５００℃以下で加熱処理することによって得ることができる。５００℃未満、又は１５００℃より高いと、所望の構造をしたチタン酸リチウムを得ることができにくい傾向がある。チタン酸リチウムの結晶性を向上させるため、加熱処理後、再び５００℃以上１５００℃以下で再加熱処理してもよい。再加熱処理の温度は、最初におこなった温度と同じでもよいし、違っていてもよい。加熱処理は、空気存在下でもよいし、窒素あるいはアルゴンなどの不活性ガスの存在下でおこなってもよい。加熱処理には、特に限定されないが、例えば、箱型炉、管状炉、トンネル炉、ロータリーキルン等を用いることができる。

【００４３】

前記リチウム化合物としては、例えば、水酸化リチウム、炭酸リチウム、硝酸リチウム、酢酸リチウム、シュウ酸リチウム、ハロゲン化リチウムなどを用いることができる。これらリチウム化合物は、１種類でもよいし、２種類以上用いてもよい。

前記チタン化合物としては、特に限定されないが、例えば、二酸化チタン、一酸化チタンなどのチタン酸化物を用いることができる。

【００４４】

リチウム化合物、及びチタン化合物の配合比は、原料の性状や加熱条件によってリチウム、及びチタンの原子比、Ｔｉ／Ｌｉ＝１．２５前後で多少の幅をもたせてもよい。

チタン酸リチウムの表面には、導電性向上、あるいは安定性向上のため、炭素材料、金属酸化物、あるいは高分子等で覆われてもよい。

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チタン酸リチウムの粒子径は、０．５μｍ以上５０μｍ以下であることが好ましく、１μｍ以上３０μｍ以下であることは取り扱いの観点からさらに好ましい。前記粒子径はＳＥＭ、ＴＥＭ像から各粒子の大きさを測定し、平均粒子径を算出した値である。

【００４５】

チタン酸リチウムの比表面積は、０．１m^2／ｇ以上５０m^2／ｇ以下であることは所望の出力密度を得やすいことから好ましい。前記比表面積は、水銀ポロシメータ、ＢＥＴ法での測定により算出するのがよい。

チタン酸リチウムの嵩密度は、０．２ｇ／ｃm^3以上１．５ｇ／ｃm^3以下であることが好ましい。０．２ｇ／ｃm^3未満の場合では後述のスラリー作製時に多量の溶媒が必要となるため経済的に不利となる傾向があり、１．５ｇ／ｃm^3より大きいと後述の導電助材、バインダーとの混合が困難となる傾向がある。

【００４６】

本発明の負電極は炭素材料を含む導電助材を含有している。導電助材を構成する炭素材料としては、例えば、天然黒鉛、人造黒鉛、気相成長炭素繊維、カーボンナノチューブ、アセチレンブラック、ケッチェンブラック、又はファーネスブラックなどが挙げられる。これら炭素材料は１種類でもよいし、２種類以上用いてもよい。

本発明において、負電極に含まれる導電助材の量は、負極活物質１００重量部に対して、好ましくは０重量部以上１０重量部以下、より好ましくは０重量部以上８重量部以下である。前記範囲であれば、バインダーとの接着性が維持され、集電箔との接着性が十分に得ることができる。

【００４７】

本発明の負電極にはバインダーを使用してよい。バインダーとしては、特に限定されないが、例えば、ポリフッ化ビニリデン（ＰＶｄＦ）、ポリテトラフルオロエチレン（ＰＴＦＥ）、スチレン－ブタジエンゴム、ポリイミド及びそれらの誘導体からなる群からえらばれる少なくとも１種を用いることができる。バインダーは負電極の作製しやすさから、非水溶媒又は水に、溶解又は分散されていることが好ましい。非水溶媒は、特に限定されないが、Ｎ－メチル－２－ピロリドン（ＮＭＰ）、ジメチルホルムアミド、ジメチルアセトアミド、メチルエチルケトン、酢酸メチル、酢酸エチル、及びテトラヒドロフランなどを挙げることができる。これらに分散剤、増粘剤を加えてもよい。

【００４８】

本発明において、負電極に含まれるバインダーの量は、負極活物質１００重量部に対して、好ましくは１重量部以上２０重量部以下、より好ましくは２重量部以上１５重量部以下である。前記範囲であれば、負極活物質と導電助材との接着性が維持され、集電箔との接着性が十分に得ることができる。

本発明において好ましい負電極の一形態としては、負極活物質、導電助材、及びバインダーの混合物を集電箔上に形成することによって作製されるが、作製方法の容易さから、前記混合物及び溶媒でスラリーを作製し、得られたスラリーを集電箔上に塗工した後に、溶媒を除去することによって負電極を作製する方法が好ましい。

【００４９】

本発明の負電極に用いることのできる集電箔は、０．３Ｖ（ｖｓ．Li^+／Ｌｉ）以上２．０Ｖ（ｖｓ．Li^+／Ｌｉ）以下で安定な金属、例えば、銅、ＳＵＳ、ニッケル、チタン、アルミニウム又はそれらの合金が好ましく、安定性が高いことからアルミニウムであることが特に好ましい。アルミニウムは、正電極及び負電極の電極反応雰囲気下で安定であることから、その組成は特に限定されないが、ＪＩＳ規格１０３０、１０５０、１０８５、１Ｎ９０、１Ｎ９９等に代表される高純度アルミニウムであることが好ましい。

【００５０】

集電箔の表面粗度Ｒａは、０．０５μｍ以上０．５μｍ以下であることが好ましい。０．０５μｍ未満であると、負電極との接着性が低下する場合があり、０．５μｍより大きいと、負電極を均一に形成することが困難となる場合がある。なお、表面粗度Ｒａは、光波干渉式表面粗さ測定器などを用いて測定できる。

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集電箔の電気抵抗は、５μΩ・ｃｍ以下であることが好ましい。５μΩ・ｃｍより高い場合は、電池の性能が低下する恐れがある。電気抵抗は、四端子法で測定することができる。

【００５１】

集電箔の厚みは、特に限定されないが、１０μｍ以上１００μｍ以下であることが好ましい。１０μｍ未満では作製の観点から取り扱いが困難となり、１００μｍより厚い場合は経済的観点から不利になる。

なお、集電箔は、アルミニウム以外の金属材料（銅、ＳＵＳ、ニッケル、チタン、及びそれらの合金）の表面にアルミニウムを被覆したものも用いることもできる。

【００５２】

前記スラリーの作製方法は、特に限定されないが、負極活物質、導電助材、バインダー、及び溶媒を均一に混合できることから、ボールミル、プラネタリミキサ、ジェットミル、薄膜旋回型ミキサーを用いることが好ましい。スラリーの作製は、特に限定されないが、負極活物質、導電助材、及びバインダーを混合した後に溶媒を加えて作製してもよいし、負極活物質、導電助材、バインダー、及び溶媒を一緒に混合して作製してもよい。

【００５３】

スラリーの固形分濃度は、３０ｗｔ％以上８０ｗｔ％以下であることが好ましい。３０ｗｔ％未満の場合、スラリーの粘度が低すぎる傾向があり、一方、８０ｗｔ％より高い場合は、スラリーの粘度が高すぎる傾向があるため、後述の電極の形成が困難となる場合がある。

スラリーに用いる溶媒は、非水溶媒、あるいは水であることが好ましい。非水溶媒は、特に限定されないが、例えば、Ｎ－メチル－２－ピロリドン（ＮＭＰ）、ジメチルホルムアミド、ジメチルアセトアミド、メチルエチルケトン、酢酸メチル、酢酸エチル、及びテトラヒドロフランなどを挙げることができる。また、これらに分散剤、増粘剤を加えてもよい。

【００５４】

集電箔上への負電極の形成方法は、特に限定されないが、例えば前記スラリーをドクターブレード、ダイコータ、コンマコータ等により塗布した後に、溶剤を除去する方法、あるいはスプレーにより塗布した後に溶剤を除去する方法が好ましい。溶媒を除去する方法は、オーブンや真空オーブンを用いた乾燥が簡単であり好ましい。雰囲気としては室温、あるいは高温とした空気、不活性ガス、真空状態などが挙げられる。また、溶媒を除去する温度は特に限定されないが、６０℃以上２００℃以下であることが好ましい。６０℃未満では溶媒の除去に時間を要する場合があり、２００℃より高いとバインダーが劣化する場合がある。負電極の形成は、前述の正電極を形成する前でも、後でもよい。また、負電極作製後、ロールプレス機などを用いて負電極を圧縮させてもよい。前記電極の圧縮は、前述の正電極を形成する前でも、後でもよい。

【００５５】

本発明において、負電極の厚みは、１０μｍ以上２００μｍ以下であることが好ましい。１０μｍ以下では、所望の容量を得ることが難しい場合があり、２００μｍより厚い場合は、所望の出力密度を得ることが難しい場合がある。

本発明において、負電極の重量密度は、１．０ｇ／ｃｍ^{3}以上３．０ｇ／ｃｍ^{3}以下であることが好ましい。１．０ｇ／ｃｍ^{3}未満であれば、負極活物質、導電助材との接触が不十分となり電子伝導性が低下する場合がある。３．０ｇ／ｃｍ^{3}より大きい場合は、後述の電解液が負電極内に浸透しにくくなり、リチウム伝導性が低下する場合がある。負電極は、所望の厚み、密度まで圧縮させてもよい。圧縮は、特に限定されないが、例えば、ロールプレス、油圧プレス等を用いておこなうことができる。電極の圧縮は、前述の正電極を形成する前でも、後でもよい。

【００５６】

本発明において、負電極の面積１ｃｍ^{2}あたりの電気容量は、０．５ｍＡｈ以上３．６ｍＡｈ以下であることが好ましい。０．５ｍＡｈ未満である場合は所望する容量の電池の

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大きさが大きくなる場合があり、一方、３．６ｍＡｈより多い場合は所望の出力密度を得ることが難しい場合がある。負電極の１ｃｍ^{2}あたりの電気容量の算出は、負電極作製後、リチウム金属を対極とした半電池を作製した後に、充放電特性を測定することによって算出できる。負電極の面積１ｃｍ^{2}あたりの電気容量は、特に限定されないが、集電箔単位面積あたりに形成させる負電極の重量で制御する方法、例えば、前述の負電極塗工時の塗工厚みで制御することができる。

【００５７】

＜正電極＞

本発明の非水電解質二次電池に用いる正電極は、特に、リチウムイオンの挿入・脱離反応が４．５Ｖ（ｖｓ．Ｌｉ$^+$／Ｌｉ）以上４．９Ｖ（ｖｓ．Ｌｉ$^+$／Ｌｉ）以下で進行する正極活物質を含む。このように４．５Ｖ（ｖｓ．Ｌｉ$^+$／Ｌｉ）以上４．９Ｖ（ｖｓ．Ｌｉ$^+$／Ｌｉ）以下である場合、前述した負極活物質と組み合わせて高い電池電圧を発現できる。

【００５８】

リチウムイオン挿入・脱離反応の電圧値（ｖｓ．Ｌｉ$^+$／Ｌｉ）は、例えば、正極活物質を用いた動作極、リチウム金属を対極とした半電池の充放電特性を測定し、プラトー開始時、及び終了時の電圧値を読み取ることによって求めることができる。プラトーが２箇所以上あった場合は、もっとも低い電圧値のプラトーが４．５Ｖ（ｖｓ．Ｌｉ$^+$／Ｌｉ）以上であればよく、もっとも高い電圧値のプラトーが４．９Ｖ（ｖｓ．Ｌｉ$^+$Ｌｉ）以下であればよい。前記半電池に用いる動作極、電解液、セパレータは後述のものと同様のものを用いることができる。

【００５９】

リチウムイオンの挿入・脱離反応が４．５Ｖ（ｖｓ．Ｌｉ$^+$／Ｌｉ）以上４．９Ｖ（ｖｓ．Ｌｉ$^+$／Ｌｉ）以下で進行する正極活物質は、特に限定されないが、充放電サイクルの安定性効果が高いことから、リチウムマンガン化合物であることが好ましい。

リチウムマンガン化合物としては、例えば、Li_2MnO_3、$Li_aM_bMn_{1-b}N_cO_4$（$0<a\leqq 2$、$0\leqq b\leqq 0.5$、$1\leqq c\leqq 2$、Ｍは２～１３族でかつ第３、４周期に属する元素、Ｎは１４～１６族でかつ第３周期に属する元素）、$Li_{1+x}M_yMn_{2-x-y}O_4$（$0\leqq x\leqq 0.2$、$0<y\leqq 0.6$、Ｍは２～１３族でかつ第３～４周期に属する元素からなる群から選ばれる少なくとも１種）で表されるリチウムマンガン化合物が挙げられる。ここでの”Ｍ”は、２～１３族でかつ第３～４周期に属する元素から選ばれる少なくとも１種であるが、安定性向上の効果が大きい点から、Ａｌ、Ｍｇ、Ｚｎ、Ｎｉ、Ｃｏ、Ｆｅ、Ｔｉ、Ｃｕ及びＣｒが好ましく、Ａｌ、Ｍｇ、Ｚｎ、Ｎｉ、Ｔｉ、Ｃｕ及びＣｒがより好ましく、Ａｌ、Ｍｇ、Ｚｎ、Ｔｉ、Ｃｕ及びＮｉがさらに好ましい。また、ここでの”Ｎ”は安定性向上の効果が大きい点から、Ｓｉ、Ｐ及びＳが好ましい。

【００６０】

中でも、正極活物質の安定性が高いことから、$Li_{1+x}M_yMn_{2-x-y}O_4$（$0\leqq x\leqq 0.2$、$0<y\leqq 0.6$、Ｍは２～１３族でかつ第３～４周期に属する元素からなる群から選ばれる少なくとも１種）で表されるリチウムマンガン化合物であることが特に好ましい。ｘ＜０の場合は、正極活物質の容量が減少する傾向がある。また、ｘ＞０．２の場合は炭酸リチウムなどの不純物が多く含まれるようになる傾向がある。ｙ＝０の場合は、正極活物質の安定性が低くなる傾向がある。また、ｙ＞０．６の場合はＭの酸化物などの不純物が多く含まれるようになる傾向がある。例えば、Ｍ＝Ｎｉ，ｘ＝０，ｙ＝０．４の場合、化合物は$LiNi_{0.4}Mn_{1.6}O_4$であり、ｘ＝０，ｙ＝０．５の場合、化合物は$LiNi_{0.5}Mn_{1.5}O_4$である。

【００６１】

前記$Li_{1+x}M_yMn_{2-x-y}O_4$は、スピネル構造であることが好ましい。スピネル構造の場合、リチウムイオンの挿入・脱離の反応における活物質の膨張収縮が小さいので好ましい。

前記$Li_{1+x}M_yMn_{2-x-y}O_4$は、ＣｕＫαによる粉末Ｘ線回折の（４００）面

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の半値幅が０．５°以下であることが好ましい。０．５°より大きいと、正極活物質の結晶性が低いため、電極の安定性が低下する場合がある。

【００６２】

前記$Li_{1+x}M_yMn_{2-x-y}O_4$は、Ｘ線回折によるリートベルト解析法による８ａサイトに占めるリチウム含有率は、９０％以上であることが好ましい。９０％未満であると、正極活物質の結晶中の欠陥が多いため、電極の安定性が低下する場合がある。

前記$Li_{1+x}M_yMn_{2-x-y}O_4$の粒子径は、０．５μｍ以上５０μｍ以下であることが好ましく、１μｍ以上３０μｍ以下であることは取り扱いの観点からさらに好ましい。ここでの粒子径はＳＥＭ、ＴＥＭ像から各粒子の大きさを測定し、平均粒子径を算出した値である。

【００６３】

前記$Li_{1+x}M_yMn_{2-x-y}O_4$の比表面積は、０．１m^2／ｇ以上５０m^2／ｇ以下であることは所望の出力密度を得やすいことから好ましい。比表面積はＢＥＴ法での測定により算出できる。

前記$Li_{1+x}M_yMn_{2-x-y}O_4$の嵩密度は、０．２ｇ／cm^3以上２．５ｇ／cm^3以下であることが好ましい。０．２ｇ／cm^3未満の場合では後述のスラリー作製時に多量の溶媒が必要となるため経済的に不利となり、２．５ｇ／cm^3より大きい場合では後述の導電助剤、バインダーとの混合が困難となる傾向がある。

【００６４】

前記$Li_{1+x}M_yMn_{2-x-y}O_4$は、リチウム化合物、マンガン化合物、Ｍの化合物を５００℃以上、１５００℃以下で加熱処理することによって製造することができる。５００℃未満、又は１５００℃より高いと、所望の構造をした正極活物質を得ることができない場合がある。加熱処理は、リチウム化合物、マンガン化合物、及びＭの化合物を混合して加熱処理もよいし、マンガン化合物とＭの化合物とを加熱処理した後に、リチウム化合物と加熱処理してもよい。正極活物質の結晶性を向上させるため、加熱処理後、再び５００℃以上、１５００℃以下で再加熱処理してもよい。再加熱処理の温度は、最初におこなった温度と同じでもよいし、違っていてもよい。加熱処理は、空気存在下でもよいし、窒素あるいはアルゴンなどの不活性ガスの存在下でおこなってもよい。加熱処理には、特に限定されないが、例えば、箱型炉、管状炉、トンネル炉、ロータリーキルン等を用いることができる。

【００６５】

前記リチウム化合物としては、例えば、水酸化リチウム、炭酸リチウム、硝酸リチウム、酢酸リチウム、シュウ酸リチウム、ハロゲン化リチウムなどを用いることができる。これらリチウム化合物は、１種類でもよいし、２種類以上用いてもよい。

前記マンガン化合物としては、例えば、二酸化マンガン等のマンガン酸化物、炭酸マンガン、硝酸マンガン、マンガン水酸化物などを用いることができる。これらマンガン化合物は、１種類でもよいし、２種類以上用いてもよい。

【００６６】

前記Ｍの化合物としては、例えば、炭酸化物、酸化物、硝酸化物、水酸化物、硫酸化物などを用いることができる。$Li_{1+x}M_yMn_{2-x-y}O_4$に含まれるＭの量は、加熱処理時におけるＭの化合物の量で制御することができる。Ｍの化合物は、１種類でもよいし、２種類以上用いてもよい。

リチウム化合物、マンガン化合物及びＭの化合物の配合比は、リチウム、マンガン及びＭの原子比をそれぞれ１＋ｘ（リチウム）、２－ｘ－ｙ（マンガン）、及びｙ（Ｍ）、但し、$0 \leqq x \leqq 0.2$、$0 < y \leqq 0.6$を満たす範囲で選択される。例えば、Ｍｎ／Ｌｉの原子比１．５の正極活物質を作製する場合、原料の性状や加熱条件によって前記配合比１．５前後で多少の幅をもたせてもよい。

【００６７】

本発明の正極活物質の表面は、導電性向上、あるいは安定性向上のため、炭素材料、金属酸化物、あるいは高分子等で覆われてもよい。

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本発明の正電極は、好ましくは導電助材を含有している。導電助材としては、特に限定されないが、炭素材料が好ましい。例えば、天然黒鉛、人造黒鉛、気相成長炭素繊維、カーボンナノチューブ、アセチレンブラック、ケッチェンブラック、及びファーネスブラックなどが挙げられる。これら炭素材料は１種類でもよいし、２種類以上用いてもよい。

【００６８】

本発明の正電極に含まれる導電助材の量は、正極活物質１００重量部に対して、好ましくは１重量部以上２０重量部以下、より好ましくは２重量部以上１５重量部以下である。前記範囲であれば、正電極の導電性が確保される。また、後述のバインダーとの接着性が維持され、集電箔との接着性が十分に得ることができる。

本発明の正電極にはバインダーを含有させてよい。バインダーは、特に限定されないが、例えば、ポリフッ化ビニリデン（ＰＶｄＦ）、ポリテトラフルオロエチレン（ＰＴＦＥ）、スチレンーブタジエンゴム、ポリイミド、及びそれらの誘導体からなる群からえらばれる少なくとも１種を用いることができる。バインダーは正電極の作製しやすさから、非水溶媒又は水に溶解又は分散されていることが好ましい。非水溶媒は、特に限定されないが、例えば、Ｎ－メチル－２－ピロリドン（ＮＭＰ）、ジメチルホルムアミド、ジメチルアセトアミド、メチルエチルケトン、酢酸メチル、酢酸エチル、及びテトラヒドロフランなどを挙げることができる。これらに分散剤、増粘剤を加えてもよい。

【００６９】

本発明の正電極に含まれるバインダーの量は、正極活物質１００重量部に対して、好ましくは１重量部以上２０重量部以下、より好ましくは２重量部以上１５重量部以下である。前記範囲であれば、正極活物質と導電助材との接着性が維持され、集電箔との接着性が十分に得ることができる。

本発明の正電極の作製方法としては、正極活物質、導電助材、及びバインダーの混合物を集電箔上に塗工することによって作製する方法が挙げられるが、作製方法の容易さから、前記混合物及び溶媒でスラリーを作製し、得られたスラリーを集電箔上に塗工した後に、溶媒を除去することによって正電極を作製する方法が好ましい。

【００７０】

本発明の正電極に用いる集電箔は、アルミニウム及びその合金であることが好ましい。前記アルミニウムは、正電極反応雰囲気下で安定であることから、特に限定されないが、ＪＩＳ規格１０３０、１０５０、１０８５、１Ｎ９０、１Ｎ９９等に代表される高純度アルミニウムであることが好ましい。

集電箔の表面粗度Ｒａは、０．０５μｍ以上０．５μｍ以下であることが好ましい。０．０５μｍ未満であると、正電極との接着性が低下する場合があり、０．５μｍより大きいと、正電極を均一に形成することが困難となる場合がある。なお、表面粗度Ｒａは、光波干渉式表面粗さ測定器などを用いて測定できる。

【００７１】

集電箔の電気抵抗は、５μΩ・ｃｍ以下であることが好ましい。５μΩ・ｃｍより高い場合は、電池の性能が低下する恐れがある。電気抵抗は、四端子法で測定することができる。

集電箔の厚みは、特に限定されないが、１０μｍ以上１００μｍ以下であることが好ましい。１０μｍ未満では作製の観点から取り扱いが困難となり、１００μｍより厚い場合は経済的観点から不利になる。

【００７２】

なお、集電箔は、アルミニウム以外の金属（銅、ＳＵＳ、ニッケル、チタン、及びそれらの合金）の表面にアルミニウムを被覆したものも用いることもできる。

スラリーの作製方法は、特に限定されないが、正極活物質、導電助材、バインダー、及び溶媒を均一に混合できることから、ボールミル、プラネタリミキサ、ジェットミル、薄膜旋回型ミキサーを用いることが好ましい。スラリーの作製は、特に限定されないが、正極活物質、導電助材、及びバインダーを混合した後に溶媒を加えて作製してもよいし、正極活物質、導電助材、バインダー、及び溶媒を一緒に混合して作製してもよい。

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【００７３】
スラリーの固形分濃度は、３０ｗｔ％以上８０ｗｔ％以下であることが好ましい。３０ｗｔ％未満の場合スラリーの粘度が低すぎる傾向があるため、一方、８０ｗｔ％より高い場合はスラリーの粘度が高すぎる傾向があるため、後述の電極の形成が困難となる場合がある。
スラリーに用いる溶媒は、非水溶媒、あるいは水であることが好ましい。非水溶媒は、特に限定されないが、例えば、Ｎ－メチル－２－ピロリドン（ＮＭＰ）、ジメチルホルムアミド、ジメチルアセトアミド、メチルエチルケトン、酢酸メチル、酢酸エチル、及びテトラヒドロフランなどを挙げることができる。また、これらに分散剤、増粘剤を加えてもよい。
【００７４】
集電箔上への正電極の形成方法は、特に限定されないが、例えば前記スラリーをドクターブレード、ダイコータ、コンマコータ等により塗布した後に、溶剤を除去する方法、あるいはスプレーにより塗布した後に溶剤を除去する方法が好ましい。溶媒を除去する方法は、オーブンや真空オーブンを用いた乾燥が簡単であり好ましい。溶媒を除去する雰囲気としては、空気、不活性ガス、真空状態などが挙げられる。また、溶媒を除去する温度は、特に限定されないが、６０℃以上２００℃以下であることが好ましい。６０℃未満では溶媒の除去に時間を要する場合があり、２００℃より高いと、バインダーが劣化する場合がある。なお、正電極の形成は、後述の負電極を形成する前でも、後でもよい。
【００７５】
本発明の正電極の厚みは、１０μｍ以上２００μｍ以下であることが好ましい。１０μｍ未満では所望の容量を得ることが難しい場合があり、一方、２００μｍより厚い場合は所望の出力密度を得ることが難しい場合がある。
本発明の正電極の重量密度は、１．０ｇ／ｃｍ^{3}以上４．０ｇ／ｃｍ^{3}以下であることが好ましい。１．０ｇ／ｃｍ^{3}未満であると、正極活物質、導電助材との接触が不十分となり電子伝導性が低下する場合がある。一方、４．０ｇ／ｃｍ^{3}より大きいと、電解液が正電極内に浸透しにくくなり、リチウム伝導性が低下する場合がある。
【００７６】
本発明の正電極は、所望の厚み、密度まで圧縮させてもよい。圧縮は、特に限定されないが、例えば、ロールプレス、油圧プレス等を用いておこなうことができる。電極の圧縮は、前述の負電極を形成する前でも、後でもよい。
本発明の正電極は、面積１ｃｍ^{2}あたりの電気容量が０．５ｍＡｈ以上３．６ｍＡｈ以下であることが好ましい。０．５ｍＡｈ未満である場合は所望する容量の電池の大きさが大きくなる傾向があり、３．６ｍＡｈより多い場合は所望の出力密度を得ることが難しくなる傾向がある。面積１ｃｍ^{2}あたりの電気容量の算出は、正電極作製後、リチウム金属を対極とした半電池を作製した後に、充放電特性を測定することによって算出してもよい。
【００７７】
前記正電極の面積１ｃｍ^{2}あたりの電気容量は、特に限定されないが、集電箔単位面積あたりに形成させる正電極の重量で制御する方法、例えば、前述のスラリー塗工時の塗工厚みで制御することができる。
＜セパレータ＞
本発明の非水電解質二次電池に用いるセパレータは、前述の正電極と負電極との間に設置され、電子伝導性がなくかつリチウムイオン伝導性を有する物質であればよく、例えば、ナイロン、セルロース、ポリスルホン、ポリエチレン、ポリポロピレン、ポリブテン、ポリアクリロニトリル、ポリイミド、ポリアミド、及びそれらを２種類以上複合したものの織布、不織布、微多孔膜などが挙げられる。セパレータには、各種可塑剤、酸化防止剤、難燃剤が含まれてもよいし、金属酸化物等が被覆されていてもよい。
【００７８】
セパレータの厚みは、１０μｍ以上１００μｍ以下であることが好ましい。１０μｍ未

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満の場合、正電極と負電極との接触する場合があり、１００μｍより厚い場合は電池の抵抗が高くなる場合がある。経済性、取り扱いの観点から、１５μｍ以上５０μｍ以下であることがさらに好ましい。

＜非水電解質＞

本発明の非水電解質二次電池に用いる非水電解質は、特に限定されないが、非水溶媒に溶質を溶解させた電解液、非水溶媒に溶質を溶解させた電解液を高分子に含浸させたゲル電解質などを用いることができる。

【００７９】

非水溶媒としては、環状の非プロトン性溶媒及び／又は鎖状の非プロトン性溶媒を含むことが好ましい。環状の非プロトン性溶媒としては、環状カーボネート、環状エステル、環状スルホン及び環状エーテルなどが例示される。鎖状の非プロトン性溶媒としては、鎖状カーボネート、鎖状カルボン酸エステル及び鎖状エーテルなどが例示される。また、前記に加えアセトニトリルなどの一般的に非水電解質の溶媒として用いられる溶媒を用いても良い。より具体的には、ジメチルカーボネート、メチルエチルカーボネート、ジメチルカーボネート、ジプロピルカーボネート、メチルプロピルカーボネート、エチレンカーボネート、プロピレンカーボネート、ブチレンカーボネート、γ－ブチルラクトン、１，２－ジメトキシエタン、スルホラン、ジオキソラン、プロピオン酸メチルなどを用いることができる。これら溶媒は１種類で用いてもよいし、２種類以上混合しても用いてもよいが、後述の溶質を溶解させやすさ、リチウムイオンの伝導性の高さから、２種類以上混合した溶媒を用いることが好ましい。また、高分子に電解液をしみこませたゲル状電解質も用いることができる。

【００８０】

前記溶質は、特に限定されないが、例えば、ＬｉＣｌＯ４、ＬｉＢＦ４、ＬｉＰＦ６、ＬｉＡｓＦ６、ＬｉＣＦ３ＳＯ３、ＬｉＢＯＢ（Ｌｉｔｈｉｕｍ　Ｂｉｓ　（Ｏｘａｌａｔｏ）　Ｂｏｒａｔｅ）、ＬｉＮ（ＳＯ２ＣＦ３）２などは溶媒に溶解しやすいことから好ましい。電解液に含まれる溶質の濃度は、０．５ｍｏｌ／Ｌ以上２．０ｍｏｌ／Ｌ以下であることが好ましい。０．５ｍｏｌ／Ｌ未満では所望のリチウムイオン伝導性が発現しない場合があり、一方、２．０ｍｏｌ／Ｌより高いと、溶質がそれ以上溶解しない場合がある。

【００８１】

＜負電極と正電極の好ましい容量比及び面積比＞

本発明の電極活物質混合物より製造された非水電解質二次電池用電極を用いて作製した二次電池における正電極と負電極の電気容量の比は、下記式（ａ）を満たすことが望ましい。

０．７≦Ｂ／Ａ≦１．３　　（ａ）

但し、上記式（ａ）中、Ａは正電極１ｃｍ^{2}あたりの電気容量を示し、Ｂは負電極１ｃｍ^{2}あたりの電気容量を示す。

【００８２】

Ｂ／Ａが０．７未満である場合は、過充電時に負電極の電位が負電極集電体とリチウムが反応する電位又はリチウムの析出電位になる場合があり、一方、Ｂ／Ａが１．３より大きい場合は電池反応に関与しない負極活物質多いために副反応が起こる場合がある。

本発明の非水電解質二次電池における正電極と負電極との面積比は、特に限定されないが、下記式（ｂ）を満たすことが好ましい。

【００８３】

１≦Ｄ／Ｃ≦１．２　　（ｂ）

但し、Ｃは正電極の面積、Ｄは負電極の面積を示す。Ｄ／Ｃが１未満である場合は、例えば前述のＢ／Ａ＝１の場合、負電極の容量が正電極よりも小さくなるため、過充電時に負電極の電位がリチウムの析出電位になる恐れがある。一方、Ｄ／Ｃが１．２より大きい場合は、正電極と接していない部分の負電極が大きいため、電池反応に関与しない負極活物質が副反応を起こす場合がある。正電極及び負電極の面積の制御は特に限定されないが、

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例えば、電極作製の際、塗工幅を制御することによって行うことができる。

【００８４】

本発明の非水電解質二次電池に用いるセパレータと負電極との面積比は特に限定されないが、下記式（ｃ）を満たすことが好ましい。

$$1 \leqq F/E \leqq 1.5 \qquad (c)$$

但し、Ｅは負電極の面積、Ｆはセパレータの面積を示す。Ｆ／Ｅが１未満である場合は、正電極と負電極とが接触し、１．５より大きい場合は外装に要する体積が大きくなり、電池の容量密度及び出力密度が低下する場合がある。

【実施例】

【００８５】

以下、実施例により本発明をさらに具体的に説明するが、本発明はこれらの実施例によって限定されるものではなく、その要旨を変更しない範囲において適宜変更実施が可能である。

（正電極の製造）

正電極用活物質の$Li_{1.1}Al_{0.1}Mn_{1.8}O_4$を、文献（"Lithium Aluminum Manganese Oxide Having Spinel-Framework Structure for Long-Life Lithium-Ion Batteries" Electrochemical and Solid-State Letters Volume9, Issue12, Pages A557 (2006)）に記載されている方法で作製した。

【００８６】

すなわち二酸化マンガン、炭酸リチウム、水酸化アルミニウム、及びホウ酸の水分散液を調製し、スプレードライ法で混合粉末を作製した。このとき、二酸化マンガン、炭酸リチウム及び水酸化アルミニウムの量は、リチウム、アルミニウム及びマンガンのモル比が１．１：０．１：１．８となるように調製した。次に、この混合粉末を空気雰囲気下９００℃で１２時間加熱した後、再度６５０℃で２４時間加熱した。最後に、この粉末を９５℃の水で洗浄後、乾燥させることによって正極活物質を作製した。

この正極活物質を、導電助材（アセチレンブラック）、及びバインダー（固形分濃度１２ｗｔ％、ＮＭＰ溶液）を８８／６／６の重量比で混合して、スラリーを作製した。このスラリーをアルミニウム箔（厚さ２０μｍ）に塗工し、１２０℃でＮＭＰを除去した後に、１５０℃で真空乾燥することによって正電極（面積５０cm^2）を作製した。

正電極の容量を、次の充放電試験で測定した。前述と同様にアルミニウム箔の片面に塗工した電極を１６ｍｍΦに打ち抜き動作極、Ｌｉ金属を１６ｍｍΦに打ち抜き対極とした。これらの電極を用いて、動作極（片面塗工）／セパレータ／Ｌｉ金属の順に試験セル（ＨＳセル、宝泉社製）内に積層し、非水電解質（プロピレンカーボネート／エチルメチルカーボネート＝３０／７０ｖｏｌ％、ＬｉＰＦ６　１ｍｏｌ／Ｌ）を０．１５ｍＬ入れ、半電池を作製した。この半電池を２５℃で一日放置した後、充放電試験装置（ＨＪ１００５ＳＤ８、北斗電工社製）に接続した。この半電池を２５℃、０．４ｍＡで定電流充電（終止電圧：５．０Ｖ）及び定電流放電（終止電圧：２．０Ｖ）を行い、初回の充電容量を正電極の容量とした。その結果、正電極の容量は、１．０ｍＡｈ／ｃｍ２であった。この半電池は、４．７V付近にプラトー領域を示した。この電圧４．７Ｖが、従来のコバルト酸リチウム等の４Ｖ（ｖｓ．Li^+／Ｌｉ）以下の領域で動作する物質を用いた正極活物質に比べて、高い電位（ｖｓ．Li^+／Ｌｉ）を有する正極活物質であることを裏付けている。

【００８７】

（負電極の製造）

負極活物質の$Li_4Ti_5O_{12}$を、文献（"Zero-Strain Insertion Material of Li[Li1/3Ti5/3] O4 for Rechargeable Lithium Cells" J. Electrochem. Soc., Volume 142, Issue 5, pp. 1431-1435 (1995)）に記載されている方法で作製した。

すなわち、まず二酸化チタンと水酸化リチウムを、チタンとリチウムとのモル比を５：４となるように混合し、次にこの混合物を窒素雰囲気下８００℃で１２時間加熱することによって負極活物質を作製した。

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【００８８】
この負極活物質を、導電助材（アセチレンブラック）、及びバインダー（固形分濃度１２ｗｔ％、ＮＭＰ溶液）を８８／６／６の重量比で混合してスラリーを作製した。このスラリーをアルミニウム集電体（厚さ２０μｍ）に塗工し、１２０℃でＮＭＰを除去した後に、１５０℃で真空乾燥することによって負電極（面積６６ｃｍ^2）を作製した。
負電極の容量は次の充放電試験で測定した。前述と同様の条件でアルミニウム箔の片面に電極を塗工し、１６ｍｍΦに打ち抜き動作極を作製した。Ｌｉ金属を１６ｍｍΦに打ち抜き対極とした。これらの電極を用いて、動作極（片面塗工）／セパレータ／Ｌｉ金属の順に試験セル（ＨＳセル、宝泉社製）内に積層し、非水電解質（プロピレンカーボネート／エチルメチルカーボネート＝３０／７０ｖｏｌ％、ＬｉＰＦ６　１ｍｏｌ／Ｌ）を０．１５ｍＬ入れ、半電池を作製した。この半電池を２５℃で一日放置した後、充放電試験装置（ＨＪ１００５ＳＤ８、北斗電工社製）に接続した。この半電池を２５℃、０．４ｍＡで定電流放電（終止電圧：１．０Ｖ）及び定電流充電（終止電圧：２．０Ｖ）を行い、初回の充電容量を負電極の容量とした。その結果、負電極の容量は、１．１ｍＡｈ／ｃｍ２であった。
【００８９】
（非水電解質二次電池の製造）
非水電解質二次電池を次のとおりに作製した。
＜実施例１＞
前記作製した正電極（片面塗工）、負電極（片面塗工）、およびセパレータを、正電極（片面塗工）／セパレータ／負電極（片面塗工）の順に積層し、水素吸蔵合金を含む固定テープにより電極群を固定した。セパレータには、セルロース不織布（２５μｍ）を用いた。
【００９０】
水素吸蔵合金を含む固定テープは、ポリイミドテープの接着樹脂に平均粒子径30μｍのLaMgNi合金系水素吸蔵合金を5wt%混入して作製した。固定テープのサイズは3cmｘ4cmで、これにより極板群を二箇所固定した。
次に、両端の正電極および負電極にアルミニウムタブを振動溶着させた後に、袋状のアルミラミネートフィルムに入れた。非水電解質（プロピレンカーボネート／エチルメチルカーボネート＝３０／７０ｖｏｌ％、$LiPF_6$　１ｍｏｌ／Ｌ）を２ｍＬ入れた後に、減圧しながら封止することによって非水電解質二次電池を作製した。
【００９１】
＜実施例２＞
前記作製した正電極（片面塗工）、負電極（片面塗工）、およびセパレータを、正電極（片面塗工）／セパレータ／負電極（片面塗工）の順に積層し、固定テープにより電極群を固定した。セパレータには、セルロース不織布（２５μｍ）を用いた。次に、正電極及び負電極の集電箔とアルミニウムタブとを振動溶着させた後に、正電極の集電箔とアルミニウムタブとの接合部、及び負電極の集電箔とアルミニウムタブとの接合部に、水素吸蔵合金を含む短絡防止用樹脂を形成した。
【００９２】
短絡防止樹脂にはポリイミドテープを用いた。このポリイミドテープの接着樹脂に平均粒子径30μｍのLaMgNi合金系水素吸蔵合金を5wt％混入させた。このポリイミドテープ（サイズ1.5cmｘ4cm）を用いて、正負極タブリード溶接部の上下に計4枚貼り付けた。
袋状のアルミラミネートフィルムに入れて、非水電解質（プロピレンカーボネート／エチルメチルカーボネート＝３０／７０ｖｏｌ％、$LiPF_6$　１ｍｏｌ／Ｌ）を２ｍＬ入れた後に、減圧しながら封止することによって非水電解質二次電池を作製した。
【００９３】
＜比較例１＞
水素吸蔵合金を用いない以外は実施例１と同様に非水電解質二次電池を作製した。
（ガス量の測定）

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実施例１，２及び比較例１で作製された非水電解質二次電池を、充放電装置（ＨＪ１００５ＳＤ８、北斗電工社製）に接続し、５０ｍＡ定電流充電、５０ｍＡ定電流放電を６０℃で１００回繰り返し、サイクル直後、一ヶ月間室温で静置後、六ヶ月間室温で静置後に前後の体積変化からガス量を測定した。このときの充電終止電圧および放電終止電圧は３．４Ｖおよび２．５Ｖとした。充放電サイクルの前後の体積変化から測定したガス発生量を表１に示す。

【００９４】

【表１】

表1

	水素吸蔵合金	配置場所	100サイクル後のガス量（cc/Ah）	静置一ヶ月後のガス量（cc/Ah）	静置六ヶ月後のガス量（cc/Ah）
実施例1	有	電極群の固定テープ	18.2	16.5	4.1
実施例2	有	合剤端部の短絡防止樹脂	17.9	16.2	3.7
比較例1	無	-	18.9	18.5	18.3

【００９５】

表１から明らかなとおり、本発明の実施例１，２の非水電解質二次電池は、同じ条件で測定した比較例１の非水電解質二次電池よりも残留ガス量が減少している 。例えば、実施例１の残留ガス量は４．１ｃｃ／Ａｈ、実施例２の残留ガス量は３．７ｃｃ／Ａｈであるのに対して、比較例１の残留ガス量は１８．３ｃｃ／Ａｈである。一ヶ月放置する間に、実施例１では、１６．５－４．１＝１２．４ｃｃ／Ａｈのガスが水素吸蔵合金に吸収されたものと考えられる。実施例２では、１６．２－３．７＝１２．５ｃｃ／Ａｈのガスが水素吸蔵合金に吸収されたものと考えられる。

【符号の説明】

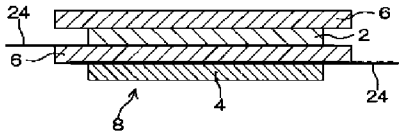
【００９６】

２…正電極、４…負電極、６…セパレータ、８…内部発電体、１０…外装体、１４…金属タブリード、１６…熱融着樹脂、２０…電解液、２２…電極固定テープ、２４…集電箔、２６，２８，３０…短絡防止樹脂

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【図１】

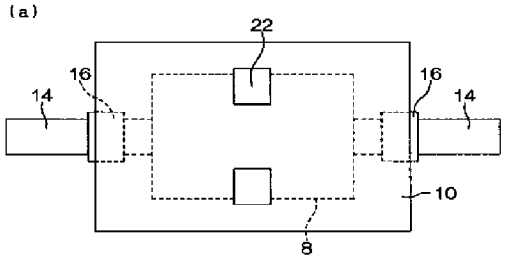
図1



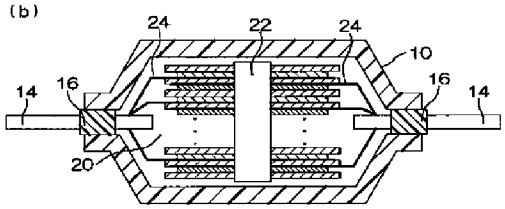
【図２】

図2

(a)



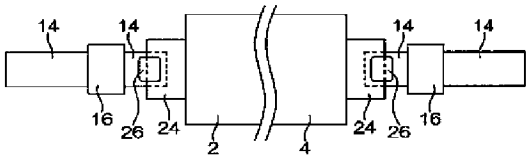
(b)



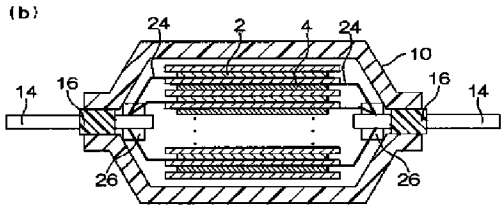
【図３】

図3

(a)



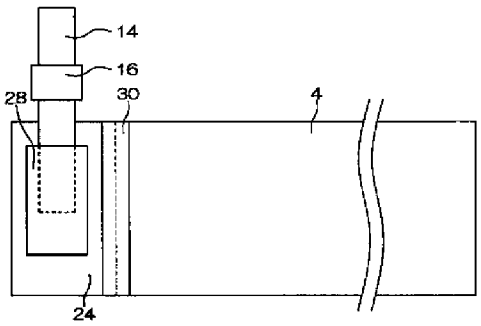
(b)



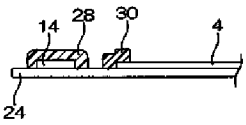
【図４】

図4

(a)

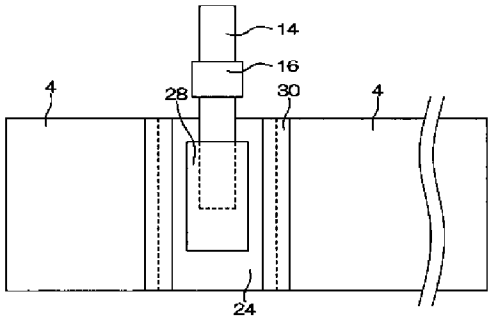


(b)



【図５】

図5



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EA23 FA02 FA05 GA02 GA22 HA18

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Espacenet

CN204113515U Remote control vehicle storage battery auxiliary starting device

Applicants: ZHANG KAILONG

Inventors: ZHANG KAILONG

Classifications:
IPC ***F02N11/08;***

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Remote control vehicle storage battery auxiliary starting device

Abstract

The utility model provides a remote control vehicle storage battery auxiliary starting device which is characterized by comprising a lithium battery pack, a control chip, a power management chip, a first controllable switch circuit, a second controllable switch circuit, a battery voltage detection circuit, a storage battery voltage detection circuit, a starting circuit, an electric heater, a wireless receiving head and a remote controller corresponding to the wireless receiving head, a negative electrode of the lithium battery pack is connected with a negative electrode of a vehicle storage battery, a positive electrode of the lithium battery pack is connected with a positive electrode of the vehicle storage battery through the first controllable switch circuit, the vehicle storage battery, the second controllable switch circuit and the electric heater form a circuit loop, and connection and disconnection of the loop are controlled by the second controllable switch circuit. The remote control vehicle storage battery auxiliary starting device effectively solves the problem that a vehicle cannot be started due to insufficient power supply caused by low temperature or aging of the vehicle storage battery, a remote control heating function is added, the vehicle storage battery is preheated in advance, and the remote control vehicle storage battery auxiliary starting device has high practicability in actual life.

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代理人 邹常友

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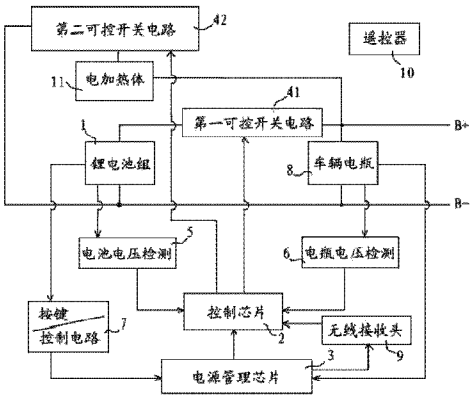
权利要求书2页 说明书4页 附图2页

(54)实用新型名称

遥控型车辆电瓶辅助启动装置

(57)摘要

本实用新型提出一种遥控型车辆电瓶辅助启动装置，其特征在于：包括锂电池组、控制芯片、电源管理芯片、第一可控开关电路、第二可控开关电路、电池电压检测电路、电瓶电压检测电路、启动电路、电加热体、无线接收头及与所述无线接收头对应的遥控器；所述锂电池组的负极与车辆电瓶的负极连接，锂电池组的正极经第一可控开关电路与车辆电瓶正极连接；所述车辆电瓶、第二可控开关电路及电加热体构成电路回路，并由所述第二可控开关电路控制其所在回路的通断。本实用新型很好地解决了车辆电瓶因温度低或老化而供电不足导致的车辆不能启动的问题，同时增添遥控加热功能，实现车辆电瓶的提前预热，在实际生活中具有较高的实用性。



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1. 一种遥控型车辆电瓶辅助启动装置，其特征在于：包括锂电池组、控制芯片、电源管理芯片、第一可控开关电路、第二可控开关电路、电池电压检测电路、电瓶电压检测电路、启动电路、电加热体、无线接收头及与所述无线接收头对应的遥控器；所述锂电池组的负极与车辆电瓶的负极连接，锂电池组的正极经第一可控开关电路与车辆电瓶正极连接；所述车辆电瓶、第二可控开关电路及电加热体构成电路回路，并由所述第二可控开关电路控制其所在回路的通断；所述第一可控开关电路和第二可控开关电路由控制芯片控制其通断；所述电源管理芯片分别连接锂电池组与车辆电瓶，电源管理芯片与锂电池组之间设有启动电路，所述启动电路控制电源管理芯片与锂电池组线路的通断；所述电池电压检测电路用于获取锂电池组两端输出的实时电压，并将其反馈至控制芯片；所述电瓶电压检测电路用于获取车辆电瓶两端输出的实时电压，并将其反馈至控制芯片；所述无线接收头的输出端与所述控制芯片连接。

2. 根据权利要求 1 所述的遥控型车辆电瓶辅助启动装置，其特征在于：所述启动电路包括接于电源管理芯片与锂电池组之间的按键开关 K1、NPN 晶体管 Q2 与 PNP 晶体管 Q3；所述 PNP 晶体管 Q3 的发射极连接锂电池组的正极，其集电极连接电源管理芯片的输入端，其基极连接 NPN 晶体管 Q2 的集电极；所述 NPN 晶体管 Q2 的发射极接地，其基极通过按键开关 K1 与锂电池组的正极连接。

3. 根据权利要求 1 或 2 所述的遥控型车辆电瓶辅助启动装置，其特征在于：所述第一可控开关电路包括继电器 T1、NPN 晶体管 Q1、二极管 D1 以及电阻 R3、R4、R5，所述二极管 D1、电阻 R3 与 NPN 晶体管 Q1 依次串接；所述二极管 D1 的阴极与锂电池组的正极连接，其阳极与电阻 R3 连接；所述 NPN 晶体管 Q1 的集电极与电阻 R3 连接，其发射极接地，其基极经电阻 R5 与控制芯片连接，所述 NPN 晶体管 Q1 的发射极与基极之间接有电阻 R4；所述继电器 T1 的开关部接于锂电池组正极与车辆电瓶正极之间的线路上，其电磁部与所述二极管 D1 并联。

4. 根据权利要求 3 所述的遥控型车辆电瓶辅助启动装置，其特征在于：所述第二可控开关电路包括继电器 T2、NPN 晶体管 Q31、二极管 D31 以及电阻 R33、R34、R35，所述二极管 D31、电阻 R33 与 NPN 晶体管 Q31 依次串接；所述二极管 D31 的阴极与车辆电瓶的正极连接，其阳极与电阻 R33 连接；所述 NPN 晶体管 Q31 的集电极与电阻 R33 连接，其发射极接地，其基极经电阻 R35 与控制芯片连接，所述 NPN 晶体管 Q31 的发射极与基极之间接有电阻 R34；所述车辆电瓶与电加热体两端并联，所述继电器 T2 的开关部接于车辆电瓶与电加热体之间的线路上，其电磁部与所述二极管 D31 并联。

5. 根据权利要求 4 所述的遥控型车辆电瓶辅助启动装置，其特征在于：所述电池电压检测电路包括与锂电池组并联连接两个分压电阻 R1、R2，电阻 R1 与 R2 串联，二者的连结点与控制芯片连接。

6. 根据权利要求 5 所述的遥控型车辆电瓶辅助启动装置，其特征在于：所述电瓶电压检测电路包括与车辆电瓶并联连接两个分压电阻 R6、R7，电阻 R6 与 R7 串联，二者的连结点与控制芯片连接。

7. 根据权利要求 6 所述的遥控型车辆电瓶辅助启动装置，其特征在于：所述无线接收头包括无线收发芯片、匹配电路及天线，所述匹配电路包括电感 L、电容 C24 和下拉电阻 R26，所述电感 L 两端分别连接天线和无线收发芯片，所述电感 L 与天线连接的一端接有电容 C24，所述电感 L 与无线收发芯片连接的一端接有下拉电阻 R26。

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8. 根据权利要求 7 所述的遥控型车辆电瓶辅助启动装置，其特征在于：所述电加热体包括内置有电热丝或电热膜层的电加热垫。

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遥控型车辆电瓶辅助启动装置

技术领域

[0001] 本实用新型涉及一种遥控型车辆电瓶辅助启动装置。

背景技术

[0002] 目前，车辆基本上都是通过电子打火的方式启动，而电子点火装置是靠蓄电池来供给电源的。蓄电池的内阻较大，从而导致其在启动时瞬时电流输出值偏小，且其内阻的阻值会随使用时间或气温的下降而变大。因此，在使用较长时间后或是在气温较低的情况下，蓄电池输出的启动电流显著变小，常常导致车辆很难打着火。特别是在低温条件下，车辆的电子点火装置对启动电流的要求比平时更高，而此时蓄电池的输出电流又比平时小，因而会造成点火失败，车辆不能启动。

实用新型内容

[0003] 针对背景技术中提及的问题，本实用新型提出一种带遥控型车辆电瓶辅助启动装置，旨在解决车辆电瓶因温度低或老化而供电不足导致的车辆不能启动的问题，同时，有效延长车辆电瓶的使用寿命。其采用的技术方案如下：

[0004] 一种遥控型车辆电瓶辅助启动装置，包括锂电池组、控制芯片、电源管理芯片、第一可控开关电路、第二可控开关电路、电池电压检测电路、电瓶电压检测电路、启动电路、电加热体、无线接收头及与所述无线接收头对应的遥控器；所述锂电池组的负极与车辆电瓶的负极连接，锂电池组的正极经第一可控开关电路与车辆电瓶正极连接；所述车辆电瓶、第二可控开关电路及电加热体构成电路回路，并由所述第二可控开关电路控制其所在回路的通断；所述第一可控开关电路和第二可控开关电路由控制芯片控制其通断；所述电源管理芯片分别连接锂电池组与车辆电瓶，电源管理芯片与锂电池组之间设有启动电路，所述启动电路控制电源管理芯片与锂电池组线路的通断；所述电池电压检测电路用于获取锂电池组两端输出的实时电压，并将其反馈至控制芯片；所述电瓶电压检测电路用于获取车辆电瓶两端输出的实时电压，并将其反馈至控制芯片；所述无线接收头的输出端与所述控制芯片连接。

[0005] 上述方案的原理：所述启动电路接通，由锂电池组为电源管理芯片供电，从而唤醒控制芯片；所述控制芯片分别获取的锂电池组与车辆电瓶两端电压，并作判比；在车辆电瓶电两端电压较低的情况下，所述控制芯片令继电器开关电路导通，从而使得锂电池组与车辆电瓶并联，同时向点火装置供电；同时，在接收到所述遥控器的控制信号（启动加热）时，所述控制芯片令继电器开关电路导通，闭合电加热体所在回路，实现对车辆电瓶的加热。随着电瓶温度的回升，电瓶电压趋于正常（即比锂电池组两端电压高）的情况下，所述控制芯片令继电器开关电路断开，仅由车辆电瓶为电源管理芯片和点火装置供电。

[0006] 本实用新型的技术方案进一步包括：

[0007] 所述启动电路包括接于电源管理芯片与锂电池组之间的按键开关 K1、NPN 晶体管 Q2 与 PNP 晶体管 Q3；所述 PNP 晶体管 Q3 的发射极连接锂电池组的正极，其集电极连接电源

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管理芯片的输入端，其基极连接 NPN 晶体管 Q2 的集电极；所述 NPN 晶体管 Q2 的发射极接地，其基极通过按键开关 K1 与锂电池组的正极连接。

[0008] 作为优选方案，所述第一可控开关电路包括继电器 T1、NPN 晶体管 Q1、二极管 D1 以及电阻 R3、R4、R5，所述二极管 D1、电阻 R3 与 NPN 晶体管 Q1 依次串接；所述二极管 D1 的阴极与锂电池组的正极连接，其阳极与电阻 R3 连接；所述 NPN 晶体管 Q1 的集电极与电阻 R3 连接，其发射极接地，其基极经电阻 R5 与控制芯片连接，所述 NPN 晶体管 Q1 的发射极与基极之间接有电阻 R4；所述继电器 T1 的开关部接于锂电池组正极与车辆电瓶正极之间的线路上，其电磁部与所述二极管 D1 并联。

[0009] 作为优选方案，所述第二可控开关电路包括继电器 T2、NPN 晶体管 Q31、二极管 D31 以及电阻 R33、R34、R35，所述二极管 D31、电阻 R33 与 NPN 晶体管 Q31 依次串接；所述二极管 D31 的阴极与车辆电瓶的正极连接，其阳极与电阻 R33 连接；所述 NPN 晶体管 Q31 的集电极与电阻 R33 连接，其发射极接地，其基极经电阻 R35 与控制芯片连接，所述 NPN 晶体管 Q31 的发射极与基极之间接有电阻 R34；所述车辆电瓶与电加热体两端并联，所述继电器 T2 的开关部接于车辆电瓶与电加热体之间的线路上，其电磁部与所述二极管 D31 并联。

[0010] 作为优选方案，所述电池电压检测电路包括与锂电池组并联连接两个分压电阻 R1、R2，电阻 R1 与 R2 串联，二者的连结点与控制芯片连接。

[0011] 作为优选方案，所述电瓶电压检测电路包括与车辆电瓶并联连接两个分压电阻 R6、R7，电阻 R6 与 R7 串联，二者的连结点与控制芯片连接。

[0012] 作为优选方案，所述无线接收头包括无线收发芯片、匹配电路及天线，所述匹配电路包括电感 L、电容 C24 和下拉电阻 R26，所述电感 L 两端分别连接天线和无线收发芯片，所述电感 L 与天线连接的一端接有电容 C24，所述电感 L 与无线收发芯片连接的一端接有下拉电阻 R26。

[0013] 作为优选方案，所述电加热体包括内置有电热丝或电热膜层的电加热垫。

[0014] 本实用新型采用锂电池组与车辆电瓶配合供电结构，很好地解决了车辆电瓶因温度低或老化而供电不足导致的车辆不能启动的问题，延长车辆电瓶的使用寿命。同时，更增添遥控加热功能，实现车辆电瓶的提前预热。本实用新型电路结构简单，在实际生活中具有较高的实用性与良好的应用前景，十分适合推广使用。

附图说明

[0015] 图 1 为本实用新型的结构框架示意图。

[0016] 图 2 为本实用新型的电路结构示意图。

具体实施方式

[0017] 如下结合附图，对本申请方案作进一步描述：

[0018] 如图 1 至 2 所示，一种遥控型车辆电瓶辅助启动装置，包括锂电池组 1、控制芯片 2、电源管理芯片 3、第一可控开关电路 41、第二可控开关电路 42、电池电压检测电路 5、电瓶电压检测电路 6、启动电路 7、电加热体 11、无线接收头 9 及与所述无线接收头 9 对应的遥控器 10；

[0019] 所述锂电池组 1 的负极与车辆电瓶 8 的负极连接，锂电池组 1 的正极经第一可控

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开关电路 41 与车辆电瓶 8 正极连接；所述车辆电瓶 8、第二可控开关电路 42 及电加热体 11 构成电路回路，并由所述第二可控开关电路 11 控制其所在回路的通断；所述第一可控开关电路 41 和第二可控开关电路 42 由控制芯片 2 控制其通断；所述电源管理芯片 3 分别连接锂电池组 1 与车辆电瓶 8，电源管理芯片 3 与锂电池组 1 之间设有启动电路 7，所述启动电路 7 控制电源管理芯片 3 与锂电池组 1 线路的通断；所述电池电压检测电路 5 用于获取锂电池组 1 两端输出的实时电压，并将其反馈至控制芯片 2；所述电瓶电压检测电路 6 用于获取车辆电瓶 8 两端输出的实时电压，并将其反馈至控制芯片 2；所述无线接收头 9 的输出端与所述控制芯片 2 连接。

[0020] 上述方案为本实用新型的优选实施方式之一，可以理解，所述启动电路 7 还可以为具有控制电源管理芯片 3 与锂电池组 1 线路通断功能的其它开关电路，该开关电路可由车载系统控制。

[0021] 所述启动电路 7 包括接于电源管理芯片 3 与锂电池组 1 之间的按键开关 K1、NPN 晶体管 Q2 与 PNP 晶体管 Q3；所述 PNP 晶体管 Q3 的发射极连接锂电池组的正极，其集电极连接电源管理芯片的输入端，其基极连接 NPN 晶体管 Q2 的集电极；所述 NPN 晶体管 Q2 的发射极接地，其基极通过按键开关 K1 与锂电池组的正极连接。

[0022] 所述第一可控开关电路 41 包括继电器 T1、NPN 晶体管 Q1、二极管 D1 以及电阻 R3、R4、R5，所述二极管 D1、电阻 R3 与 NPN 晶体管 Q1 依次串接；所述二极管 D1 的阴极与锂电池组的正极连接，其阳极与电阻 R3 连接；所述 NPN 晶体管 Q1 的集电极与电阻 R3 连接，其发射极接地，其基极经电阻 R5 与控制芯片连接，所述 NPN 晶体管 Q1 的发射极与基极之间接有电阻 R4；所述继电器 T1 的开关部接于锂电池组正极与车辆电瓶正极之间的线路上，其电磁部与所述二极管 D1 并联。

[0023] 所述第二可控开关电路 42 包括继电器 T2、NPN 晶体管 Q31、二极管 D31 以及电阻 R33、R34、R35，所述二极管 D31、电阻 R33 与 NPN 晶体管 Q31 依次串接；所述二极管 D31 的阴极与车辆电瓶 8 的正极连接，其阳极与电阻 R33 连接；所述 NPN 晶体管 Q31 的集电极与电阻 R33 连接，其发射极接地，其基极经电阻 R35 与控制芯片 2 连接，所述 NPN 晶体管 Q31 的发射极与基极之间接有电阻 R34；所述车辆电瓶 8 与电加热体 11 两端并联，所述继电器 T2 的开关部接于车辆电瓶 8 与电加热体 11 之间的线路上，其电磁部与所述二极管 D31 并联。

[0024] 所述电池电压检测电路 5 包括与锂电池组 1 并联连接两个分压电阻 R1、R2，电阻 R1 与 R2 串联，二者的连结点与控制芯片 2 连接。

[0025] 所述电瓶电压检测电路 6 包括与车辆电瓶 8 并联连接两个分压电阻 R6、R7，电阻 R6 与 R7 串联，二者的连结点与控制芯片 2 连接。

[0026] 上述实施方案中，控制芯片 2 对应附图 2 中的 U1，控制电源管理芯片 3 对应附图 2 中的 U2。

[0027] 所述无线接收头 9 包括无线收发芯片 U3、匹配电路及天线，所述匹配电路包括电感 L、电容 C24 和下拉电阻 R26，所述电感 L 两端分别连接天线和无线收发芯片，所述电感 L 与天线连接的一端接有电容 C24，所述电感 L 与无线收发芯片连接的一端接有下拉电阻 R26。

[0028] 所述无线收芯片 U3 的型号为 LT8900。

[0029] 所述电加热体 11 包括内置有电热丝 RL 的电加热垫。

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[0030] 上述优选实施方式应视为本申请方案实施方式的举例说明，凡与本申请方案雷同、近似或以此为基础作出的技术推演、替换、改进等，均应视为本专利的保护范围。

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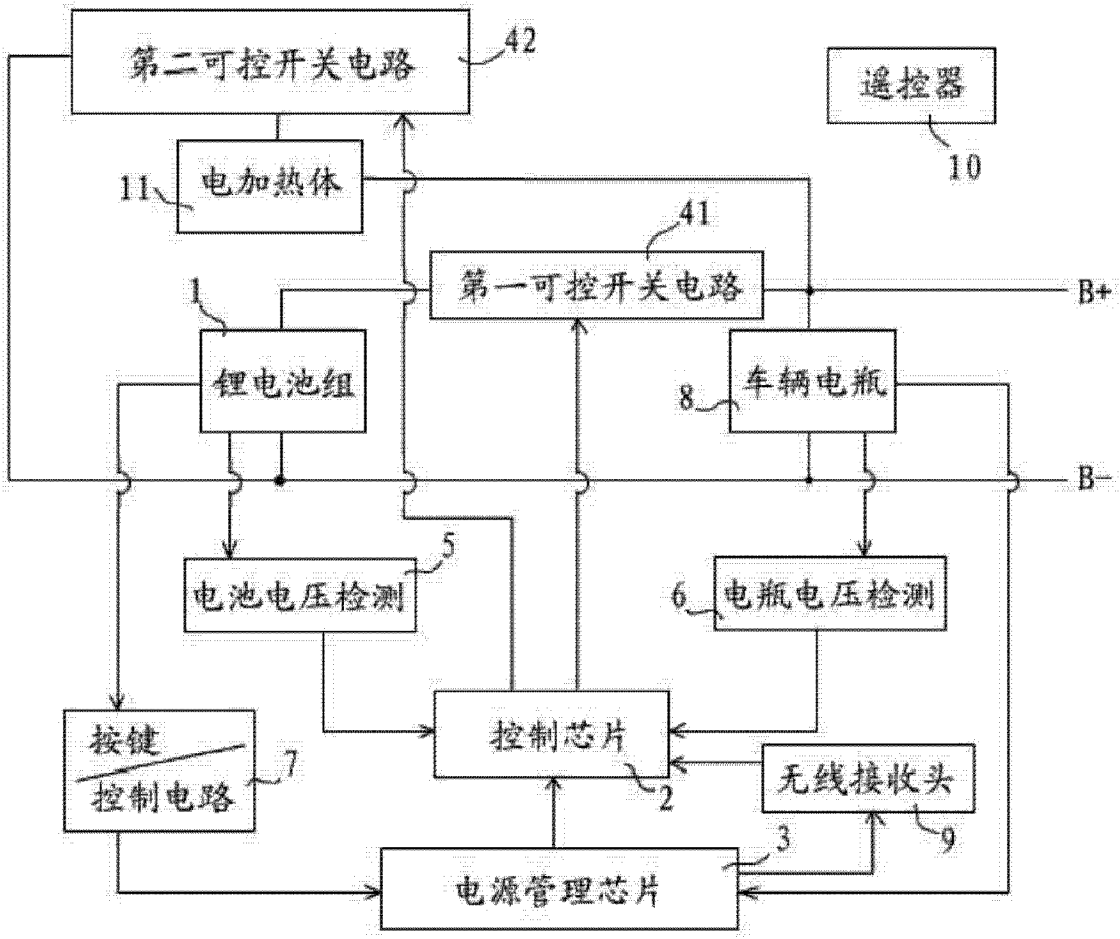


图 1

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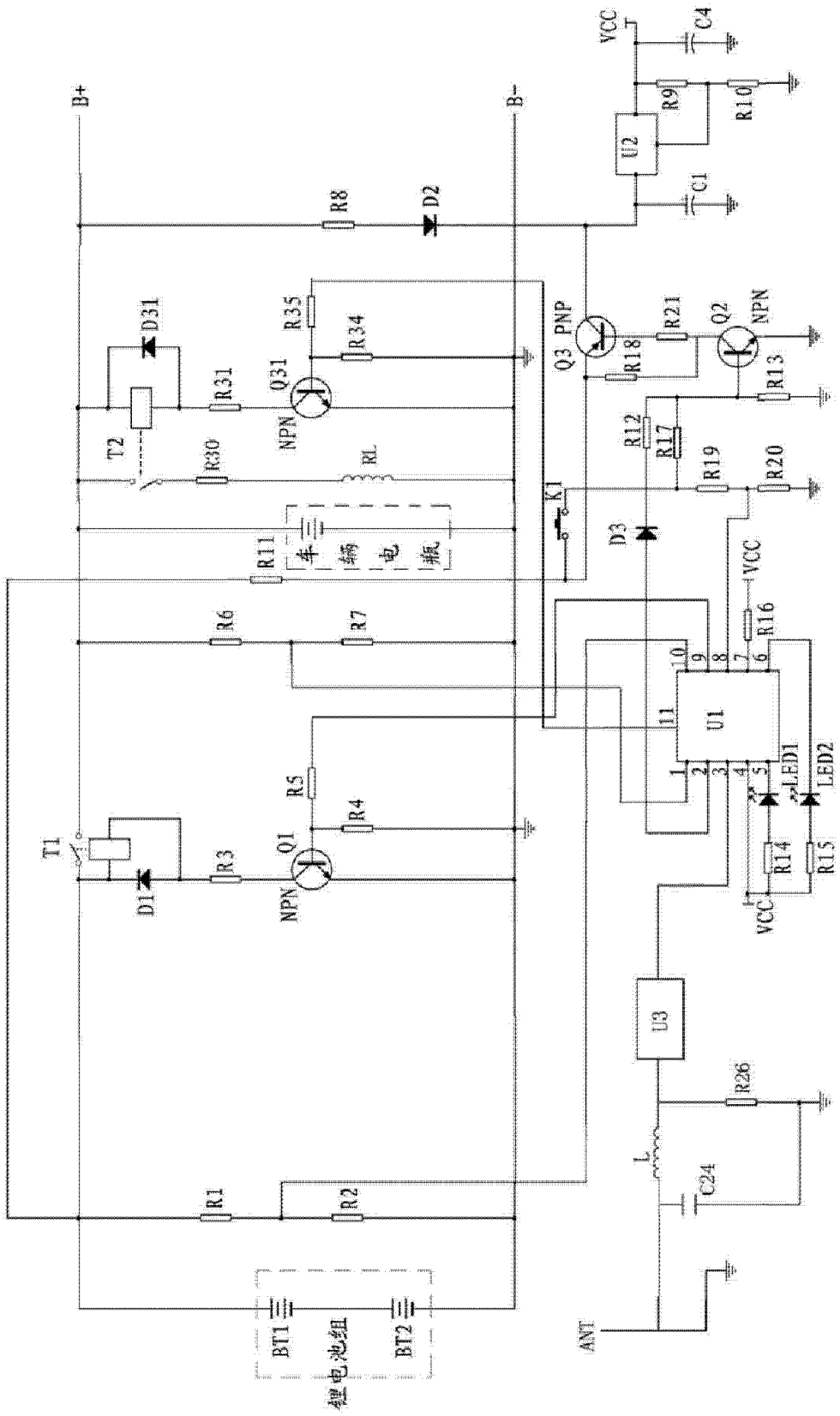


图 2

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APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
16/450,422	**06/10/2022 04:32:55 PM ET**	**054985-000055-US-05**

Title of Invention

PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION AND JUMPER CABLE DEVICE THEREOF

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	1008	FILED BY	Lisa Elliott
PATENT CENTER #	60713392	FILING DATE	06/24/2019
CUSTOMER #	20230	FIRST NAMED INVENTOR	Jonathan Lewis Nook
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	William Klima

Documents

TOTAL DOCUMENTS: 63

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
2022-06-10 - IDS - 3-4 - 16450422 - 054985-000055-US-05.pdf	9	Information Disclosure Statement (IDS) Form (SB08)	1486 KB
FOR--CN103035874A.pdf	22	Foreign Reference	3369 KB
FOR--CN104795527A.pdf	13	Foreign Reference	2064 KB
FOR--CN202696190U.pdf	23	Foreign Reference	2797 KB
FOR--CN204516832U.pdf	8	Foreign Reference	1182 KB
FOR--CN204966731U.pdf	9	Foreign Reference	1210 KB

FOR--DE102010062708A1.pdf	7	Foreign Reference	1202 KB
FOR--EP2105980A1.pdf	13	Foreign Reference	807 KB
FOR--EP2605313A1.pdf	13	Foreign Reference	921 KB
FOR--JP3185027U.pdf	17	Foreign Reference	1742 KB
FOR--JP2001069673A.pdf	6	Foreign Reference	664 KB
FOR--JP2011023249A.pdf	21	Foreign Reference	2144 KB
FOR--JP2012169161A.pdf	21	Foreign Reference	2160 KB
FOR--JP2014232666A.pdf	22	Foreign Reference	2576 KB
FOR--WO2006057497A1.pdf	16	Foreign Reference	874 KB
FOR--WO2012074548A1.pdf	29	Foreign Reference	2059 KB
FOR--WO2014206323A1.pdf	25	Foreign Reference	1424 KB
NPL--Defendent TIITrading Invalidity Contentions_USPatent9007015_8pages_2020-06-11_Defendent-TIITrading.pdf	8	Non Patent Literature	267 KB
NPL--GB70_GeniusBoostHD JumpStarter_2pages.pdf	2	Non Patent Literature	1448 KB
NPL--GB40_GeniusBoost plus JumpStarter_2pages.pdf	2	Non Patent Literature	1477 KB
NPL--MemorandumOpinionandOrder_Filed2020-04-16_35pages_Defendents-SmartechProducts.pdf	35	Non Patent Literature	316 KB

NPL--Defendent DeltonaTransformer Invalidity Contentions_2020-05-13_141pages_Defendent-DeltonaTransformer and DeltranUSA.pdf	141	Non Patent Literature	4969 KB
2022-06-10 - IDS - 4-4 - 16450422 - 054985-000055-US-05.pdf	12	Information Disclosure Statement (IDS) Form (SB08)	1242 KB
NPL--Defendents Invalidity and Unenforceability Contentions_USPatent900701 5_197pages_2020-09-18_Defendent-ShenzhenLianfaTongTechnol ogy.pdf	197	Non Patent Literature	10044 KB
FOR--CN103066662A.pdf	15	Foreign Reference	1714 KB
FOR--EP0616409A2.pdf	7	Foreign Reference	576 KB
FOR--CN202918052U.pdf	8	Foreign Reference	1414 KB
NPL--BatteryCharging_2010-12-07_71pages - Exhibit 1009.pdf	71	Non Patent Literature	24897 KB
FOR--CN204113515U.pdf	10	Foreign Reference	1561 KB
NPL--Grounds of Invalidity w Annex 1-7_GB2527858_2020-05-21_63pages_Defendent-Noco_Claimant-ShenzhenCarkuTechnology.p df	63	Non Patent Literature	21223 KB
FOR--GB2584424A.pdf	21	Foreign Reference	1271 KB

FOR--WO2012036556A1.pdf	19	Foreign Reference	1117 KB
FOR--WO2012080996A1.pdf	29	Foreign Reference	1641 KB
FOR--WO2011113734A1.pdf	18	Foreign Reference	952 KB
FOR--WO2019021007A1.pdf	29	Foreign Reference	1090 KB
FOR--WO2012160292A2wTranslation.pdf	61	Foreign Reference	2651 KB
FOR--WO2014106407A1.pdf	30	Foreign Reference	2114 KB
FOR--WO2016025869A1.pdf	38	Foreign Reference	2726 KB
NPL--Carku-Power21_Exhibit 1013.pdf	2	Non Patent Literature	479 KB
NPL--Defendent Smartech Invalidity and Unenforceability Contentions_8pages_2019-06-19_Defendent-SmarTech.pdf	8	Non Patent Literature	159 KB
NPL--Defendents Invalidity and Unenforceability Contentions_USPatent9007015_5pages_2020-09-18_Defendent-ShenzhenLianfaTongTechnology.pdf	5	Non Patent Literature	193 KB
FOR--WO2021242833A1.pdf	52	Foreign Reference	10242 KB
NPL--Declaration_MaxDirnberger_AU2016269555_2019-09-06_24pages.pdf	24	Non Patent Literature	5062 KB

NPL--Farah.pdf	4	Non Patent Literature	303 KB
NPL--ISR_PCTUS2014045434_2014-11-03_2pages.pdf	2	Non Patent Literature	95 KB
NPL--Defendent DeltranUSA Invalidity Contentions_USPatent9007015_141pages_2020-05-13_Defendent-DeltonaTransformer and DeltranUSA.pdf	141	Non Patent Literature	4969 KB
NPL--ElectronicsHub_Exhibit 1009.pdf	17	Non Patent Literature	2745 KB
NPL--NoticePTAB_Petitionfiled_IPR2018-00503_9007015_2018-01-15.pdf	1	Non Patent Literature	21 KB
NPL--Mubdir.pdf	6	Non Patent Literature	534 KB
NPL--Declaration_MDirnberger_AU2016269555 - Annexure MD-1_2019-09-06_166pages.pdf	166	Non Patent Literature	8034 KB
NPL--ReportFiled2017-10-19_Defendent-ShenzhenAnbandTechnology_1page.pdf	1	Non Patent Literature	33 KB
NPL--PetitionIPRUSPatent9007015-p3_NoticeFilingDate and TimeforFilingPatentOwnerPreIResp_4pages_2020-05-21_Petitioner-	4	Non Patent Literature	139 KB

ShenzhenCarkuTechnology.pdf			
NPL--ReportFiled2017-10-19_Defendent-ShenzhenChangXinYangTechnology_1page.pdf	1	Non Patent Literature	33 KB
NPL--PetitionIPRUSPatent9007015_105pages_2020-05-14_Petitioner-ShenzhenCarkuTechnology.pdf	105	Non Patent Literature	1065 KB
NPL--PetitionIPRUSPatent9007015_49pages_2018-01-15_Petitioner-DongguanJuxingPower.pdf	49	Non Patent Literature	2032 KB
NPL--ReportFiled2017-10-19_Defendent-ShenzhenValuelinkECommerce_1page.pdf	1	Non Patent Literature	33 KB
NPL--ReportFiled2017-10-30_Defendent-ShenzhenDikaNaerECommerce_1page.pdf	1	Non Patent Literature	33 KB
NPL--ReportFiled2017-10-19_Defendent-SZJingxinghuiElectronicsTechnology_1page.pdf	1	Non Patent Literature	33 KB
NPL--Statement of Grounds of Particulars_AU2019201559_2020-05-21_8pages.pdf	8	Non Patent Literature	244 KB

NPL--ReportFiled2018-09-13_Defendent-Halo2Cloud-and-QVC_1page.pdf	1	Non Patent Literature	31 KB
NPL--Statement of Grounds of Particulars_AU2016269555_2019-06-06_6pages.pdf	6	Non Patent Literature	197 KB
NPL--Statement of Defence and Counterclaim_2020-08-04_17pages_Defendent-CanadianTire.pdf	17	Non Patent Literature	2242 KB
NPL--XCAR360_Exhibit 1008.pdf	4	Non Patent Literature	1989 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
2022-06-10 - IDS - 3-4 - 16450422 - 054985-000055-US-05.pdf	83A159B1032E150CD40105B4011EFE5DCEAAB16B4AF8B9FEE4BC6320765610CDAE06E9FEBE6829556ACDC2327A219EC69CC1B5DE9583E6F259C7F68895F4769F
FOR--CN103035874A.pdf	93199B2F776F95FF2F85903B980791AD58403BCDCE48E48AB5A7E20E12BD27D9059FE1FA2FFF23A815FEF952A28A2CA529AA38E4E3A02D05B6043FF88F2AB1BB
FOR--CN104795527A.pdf	62AA189135F0544BA34F50EFB919F6391FC7041ABF4670475FDFD37739DA168776283E814E2EA928BCF94D3D3BCCDE13259B0365539360072E287590A3687923
FOR--CN202696190U.pdf	9C6B53C7B3A73829DA04D6B6314D6E4935F632EA8CDABC447D7A900AD97809BE0FDB6D89F0E42688B2B68A95E4A4F168BFBB1759AB98D0100316CD5CE5D3FB3D
FOR--CN204516832U.pdf	267B92204B1581D434725F7463F9BF2F87988BA4D165EE38F1

	8749F66E00F8FECA5FF11F3B2E8E40BF576D20D2447C0A005B483D6305A69D4073DF5F56764EEC
FOR--CN204966731U.pdf	63F1D37A4BC274F0EAC4F447261517BB9FB9EDEDB577D10B132EA25B86EE2CB987EA16C9DBACA54FEB21C5F02134C2CE8963733F9638335DD11122993CBCA746
FOR--DE102010062708A1.pdf	52214E98D2717E18DD42D902F91D1BB860C4052918EA58652FF18CC0F07AF19B6F7D4C2A6F99919ECE19FDD77702C555EE32AE150A13885522079B65CA52C316
FOR--EP2105980A1.pdf	FCBF214DB54C748C469768143F6F98D01F555798F9779D1B4E13A951E50C8366F6EE28B14D617715FB5DDC91318F800D3B555D745D1E7982FE49D7A015FCC262
FOR--EP2605313A1.pdf	F2C80A5C51239BAC949F731E7A6EEEAD07A1B971ED681545C539BF2A835BB52EC1BFE3B34BC8444290A26E47D32F93D6DA3E6692008F27F0D33C100279AF0554
FOR--JP3185027U.pdf	AA19B09A4AC07368F58241EF49CDAFD37BD791A3ECEFD3CA576CA668485E93F35BE6195663480A6B66180680ACBD226A4408985D65EFDB27E0262811E54FD59B
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FOR--JP2011023249A.pdf	6A7C083CE9E88995CA40643CB8212C4DAB9F48BD1D5704F0249AA637CF8E94042CCB54AD087E64876814D7934F17EA3C4CFF5CD2BC683FCCAD77F26230A0688B
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FOR--JP2014232666A.pdf	8EB4E9886978A20A12E6CD90A9D76A19438455BFD339B926B7A540EDB1AE664740C852B03862BE1823E38B8ADB764F7A125CD238850E84A1E75362CBB7F41DDA
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1_2019-09-06_166pages.pdf	
NPL--ReportFiled2017-10-19_Defendent-ShenzhenAnbandTechnology_1page.pdf	43258347C70551F0EEFF8BCEA2FD96AA97A4D59D6E9E85270F5817626330FF6A0B32A2B2E71D3EDA67F968DE59C9DC00369EA47CBAEC18A47FBB3F7E1C717901
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NPL--ReportFiled2018-09-13_Defendent-Halo2Cloud-and-QVC_1page.pdf	184F1A220668C53D601C75F0970F6063385E91E6473C7D5F9A475A1A253E02E882C532C2B93C3DCA563C57000418OFBDE02B192A51222FF72E2CADE7170BDC8A
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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Espacenet

CN104795527A Battery module

Applicants: MICROVAST POWER SYSTEMS CO LTD

Inventors: DENG GUOYOU,GUO FENG,WU YANG

Classifications:

IPC ***H01M10/058; H01M2/26;***

CPC **H01M10/04 (CN); H01M10/0486 (EP,US); H01M10/0525 (US); H01M10/058 (CN); H01M10/0585 (US); H01M10/482 (US); H01M10/486 (EP,US); H01M2/0237 (EP,US); H01M2/1077 (EP,US); H01M2/18 (EP,US); H01M2/26 (CN,US); H01M2/266 (EP,US); H01M2/305 (US); H01M4/661 (EP,US);** H01M10/052 (EP,US); H01M10/647 (EP,US); H01M10/654 (EP,US); H01M2/1235 (EP,US); H01M2004/027 (US); H01M2004/028 (US); H01M2220/20 (EP,US); Y02E60/10 (EP,US);

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Published as: CN104795527A;**CN104795527B; US2017084899A1; US9819001B2**

Battery module

Abstract

The invention discloses a battery module. The battery module comprises battery units and current collectors; the opposite two ends of each battery unit are provided with a cathode electrode ear and an anode electrode ear respectively; adjacent battery units are connected in a Z-shaped pattern by series connection of the electrode ears with the current collectors. The cathode electrode ears are aluminium foil electrode ears or copper foil electrode ears; the anode electrode ears are copper foil electrode ears or aluminium foil electrode ears; the cathode electrode ears and the anode electrode ears are made of different materials; the current collectors are combined current collectors, and are composed of aluminium sheets and copper sheets.

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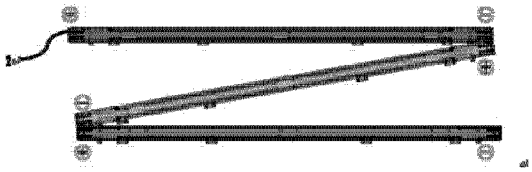
权利要求书1页 说明书6页 附图4页

(54)发明名称

电池模块

(57)摘要

本发明公开了一种电池模块，它包括电池单元和集流片，所述电池单元设置正极极耳及负极极耳，所述正极极耳及负极极耳分别位于电池单元的相对两端，相邻的电池单元通过集流片将极耳串联连接形成Z型排列。所述电池单元的正极极耳为铝箔极耳或铜箔极耳，负极极耳为铜箔极耳或铝箔极耳，且正极极耳和负极极耳的材料不相同，所述集流片为组合式集流片，所述集流片由铝片和铜片组合而成。



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1. 一种电池模块，包括电池单元和集流片，所述电池单元设置正极极耳及负极极耳，所述正极极耳及负极极耳分别位于电池单元的相对两端，相邻的电池单元通过集流片串联或并联连接形成 Z 型排列。

2. 根据权利要求 1 所述的电池模块，其特征在于：所述电池单元的长宽比为 2:1 至 8:1。

3. 根据权利要求 1 所述的电池模块，其特征在于：所述电池单元的长宽比为 4:1 至 6:1。

4. 根据权利要求 1 所述的电池模块，其特征在于：所述电池单元的正极极耳为铝箔极耳或铜箔极耳，负极极耳为铜箔极耳或铝箔极耳，且单个电池单元的正极极耳和负极极耳的材料不相同，所述集流片为组合式集流片，所述集流片由铝片和铜片组合而成。

5. 根据权利要求 4 所述的电池模块，其特征在于：所述铝片和铜片之间铆接固定或焊接固定。

6. 根据权利要求 5 所述的电池模块，其特征在于：所述铝片和铜片上分别设置焊接槽。

7. 根据权利要求 6 所述的电池模块，其特征在于：所述铜箔极耳焊接在铜片的焊接槽上，所述铝箔极耳焊接在铝片的焊接槽上。

8. 根据权利要求 1 所述的电池模块，其特征在于：所述相邻电池单元之间设置隔片，所述隔片的表面积大于电池单元的表面积。

9. 根据权利要求 8 所述的电池模块，其特征在于：所述隔片上设置凹凸纹，所述凹凸纹分布在整个隔片上。

10. 根据权利要求 9 所述的电池模块，其特征在于：所述凹凸纹选自菱形凹凸纹、方形凹凸纹、三角形凹凸纹、条形凹凸纹和橘纹中的至少一种。

11. 根据权利要求 1 所述的电池模块，其特征在于：所述电池模块上还设置温度传感器，温度传感器设置在电池模块的极耳处。

12. 根据权利要求 1 所述的电池模块，其特征在于：所述电池模块两端极耳的位置设置线束部件，线束部件上设置线束通道。

13. 根据权利要求 1 所述的电池模块，其特征在于：所述电池单元的极耳两端均设置固定框，固定框上设置夹持电池单元极耳的阻挡部分，将电池单元夹持在两个固定框的中间。

14. 根据权利要求 13 所述的电池模块，其特征在于：所述固定框之间设置缓冲环，所述缓冲环套设在电池单元上。

15. 根据权利要求 1 所述的电池模块，其特征在于：所述电池模块的两个端面分别设置缓冲垫。

16. 根据权利要求 1 至 15 任一所述的电池模块，其特征在于：所述电池模块被设置在电池箱内，所述电池箱的开口由盖板密封。

17. 根据权利要求 16 所述的电池模块，其特征在于：所述箱体的外壁上设置数根纵向加强筋。

18. 根据权利要求 16 所述的电池模块，其特征在于：所述箱体的外表面设置防爆槽，所述防爆槽的切口深度为箱体壁厚度的 20% ～ 50%。

19. 根据权利要求 18 所述的电池模块，其特征在于：所述防爆槽包括 U 型槽。

20. 根据权利要求 16 所述的电池模块，其特征在于：所述箱体上设置与盖板连接的柔性连接条。

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电池模块

技术领域

[0001] 本发明涉及一种软包电池模块。

背景技术

[0002] 锂离子电池是一种平均输出电压高，输出功率大，自放电小，无记忆效应，工作温度范围宽(为 -20℃～ 60℃)，循环性能优越，允放电效率高，使用寿命长，不含有毒有害物质的绿色电池。它是依靠锂离子在正、负极之间的往返嵌入、脱嵌完成电池充电和放电工作的。

[0003] 虽然电动汽车与传统汽车相比存在诸多优势，但是将锂离子电池组应用到电动汽车中还存在诸多问题，其中最待解决的就是锂离子电池的成组技术，其中涉及最多的就是电池组的能量密度问题，直接影响电动汽车的续航里程。

[0004] 锂离子电池组的能量密度主要由电池组的构架决定，一般是先将锂离子电池单元并联之后，再将并联模块串联组成，而电池单元的极耳的连接需要使用集流片，现有技术中，电池单元的并联是直接将电池单元的极耳焊接在集流片上，而串联是使用导线将集流片连接起来；但是这种电池模块的组合存在以下缺点：1、电池组在运行过程中，容易将导线与集流片的焊点震松，从而导致虚焊和脱焊；2、由于电池组中还存在其他采样用的采样线等线材，再加入导线，使得电池组内部较为凌乱，占用过多空间。

[0005] 申请号为 CN201010142205.5，名称为“电池组”的发明专利公开了一种由数个软包电池单元构成的电池组，包括与两电池连接的连接装置，通过导线的作用将电池和连接装置连接在一起，大大占用了电池组的空间，降低了能量密度，且导线与连接装置为点焊接，在使用过程中，容易被震松，导致虚焊和脱焊的发生。

[0006] 又如，Tesla 公司投放在市场上，能量密度最大的产品 ModelS 采用的电池模块，其尺寸为长 2.7m，宽 1.5m，厚度为 0.1m 至 0.18m，由 7600 个 18650 电池组成，一节 18650 电池单元中，电池外壳大约为 0.02dm，去除电池顶部和底部的部件之后极片的长度为 0.65-0.05，故单节 18650 电池单元的极片的体积为 $3.14*((0.18-0.004)/2)^2*(0.6)=0.0146$ 升，整个车辆所用的电池的极片的体积为 0.0146*7600=111 升，电池模块的体积为 27*15*1+3*15*0.8=441L。综上，此电池组中极片所占体积比(Electrode Volume Ratio 下文简称 EVR)为 111/441=25.2%，在其他材料相同的情况下，极片所占比例越高，电池组的能量密度越高，反之也就越低，25.2% 的 EVR 对于电动体积能量密度的提高制约较大，不利于动力电池的布置使电动车行驶里程达到传统燃油车的指标从而满足顾客的需求(传统汽车单次加油行驶里程大多在 600 公里左右，而 Tesla 的行驶里程最长的也只有单次充电 400 公里左右)。

[0007] 而且此电池组采用的是圆柱型电池单元，将圆柱型电池单元焊接到连接片上只能通过点焊的方式，且由于电池单元两极与连接片的接触面积较小，减小了电流通过能力，也增加了发热量，而将如此数量的圆柱型电池单元组合成电池组，产生的热量将非常巨大，用于散热的设计也更加复杂，浪费的电能也就更多，又进一步降低了整个锂离子动力电池组

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能量的有效利用。

发明内容

[0008] 本发明的目的是提供一种电池模块，包括电池单元和集流片，所述电池单元设置正极极耳及负极极耳，所述正极极耳及负极极耳分别位于电池单元的相对两端，相邻的电池单元通过集流片将极耳串联或并联连接形成 Z 型排列。

[0009] 根据本发明的电池模块，其中，电池单元的长宽比为 2:1 至 8:1；采用长宽比为 2:1 至 8:1 的软包电池单元有利于提高体积密度，进而提高整个电池组的能量密度。优选地，电池单元的长宽比为 4:1 至 6:1。

[0010] 所述电池单元的正极极耳为铝箔极耳或铜箔极耳，负极极耳为铜箔极耳或铝箔极耳，且正极极耳和负极极耳的材料不相同，所述集流片为组合式集流片，所述集流片由铝片和铜片组合而成。根据本发明的另一种实施方式，电池单元的正极极耳和负极极耳可以同时为铝箔极耳或铜箔极耳，此时，集流片可以采用单一金属铝或铜的集流片。

[0011] 当电池单元的正极极耳为铝箔极耳或铜箔极耳，负极极耳为铜箔极耳或铝箔极耳，且正极极耳和负极极耳的材料不相同，在组装成电池组的过程中，将电池单元并联连接，仅需将相同材料的极耳焊接在一起；若要对电池单元进行串联，则需要将铜箔极耳和铝箔极耳焊接到集流片上，由于集流片由铝片和铜片组合而成，故只需将铜箔极耳焊接到铜片上，将铝箔焊接到铝片上，电池单元之间通过集流片串联连接并形成 Z 型排列。此种电池组结构增加了电池组的 EVR（Electrode Volume Ratio），从而增加了电池组的能量密度，下文的实施例将通过对传统圆柱形电池组与本方案中的电池组的 EVR 作对比来做进一步说明。

[0012] 作为优选，所述铝片和铜片之间可以铆接固定，也可以焊接固定在一起。

[0013] 将铝片和铜片连接在一起，而铆接的方式既能保证连接的稳定性，也能保证大电流的通过能力。

[0014] 作为优选，所述铝片和铜片上分别设置焊接槽。

[0015] 在铝片和铜片上分别设置焊接槽，便于电池单元的正极极耳和负极极耳的焊接。

[0016] 作为优选，所述铜箔极耳焊接在铜片的焊接槽上，所述铝箔极耳焊接在铝片的焊接槽上。

[0017] 将铜箔极耳焊接在铜片的焊接槽上，铝箔极耳焊接在铝片的焊接槽上可以保证电池单元的极耳与集流片的焊接强度。作为优选，所述铜箔极耳与铜片的焊接槽完全焊接，所述铝箔极耳与铝片的焊接槽完全焊接。

[0018] 现有技术中，极耳与集流片的焊接多为点焊，而且使用导线连接集流片的方式必须通过导线才能实现串并联，而点焊在长期使用之后存在虚焊或脱焊现象，极大影响了电池组的使用寿命，也容易导致危险的发生；本方案中由于采用新型集流片的缘故，可以避免导线连接的传统方式，将极耳与集流片上的焊接槽完全焊接，增加了接触面积，减小内阻，对于抑制电池组的产热有优异效果。并且使用独特涉及的电池单元和集流片，配合 Z 型排列极大提高了电池组的能量密度。

[0019] 作为优选，所述相邻电池单元之间设置隔片，所述隔片的表面积大于电池单元的表面积。

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[0020] 将电池单元成组设计之后，为了追求电池组的稳定性并兼顾电池组的能量密度电池单元之间的间距尽可能压缩，容易导致热量散布不均。在电池单元之间设置隔片，有助于将电池单元产生的热量均匀分布。

[0021] 作为优选，所述隔片上设置凹凸纹，所述凹凸纹分布在整个隔片上。在隔片上设置凹凸纹，有利于增加隔片的表面积，增大了隔片与电池单元的接触面积，增强了隔片的散热能力，有利于使得电池组内部温度更均匀。

[0022] 作为优选，所述凹凸纹选自菱形凹凸纹、方形凹凸纹、三角形凹凸纹、条形凹凸纹和橘纹中的至少一种。

[0023] 凹凸纹选自菱形凹凸纹、方形凹凸纹、三角形凹凸纹、条形凹凸纹和橘纹中的至少一种，纹路从隔片的底部延伸至顶部，便于加工，同时增大隔片表面积以获得更好的散热效果。

[0024] 电池单元的极耳两端均设置固定框，固定框上设置夹持电池单元极耳的阻挡部分，将电池单元夹持在两个固定框的中间。同时在固定框之间设置套设在电池单元上的缓冲环。

[0025] 由于本技术方案中使用软包电池单元，缓冲环可以为橡胶制成，将缓冲环套设在电池单元上，对电池单元起到缓冲作用，将其夹在两个固定框的中间，保证在使用过程中位置固定不移动，可以达到如下效果：在电池组受到冲击时，可以有效地起到缓冲作用；在电池单元成组过程中，收紧电池模块的过程中，保护软包电池单元不受挤压。

[0026] 作为优选，电池模块上还设置温度传感器。当电池组发生异常时，温度传感器可以监测到电池单元的温度参数变化。电池组在正常工作时，其各项参数都是稳定的，一旦发生故障后，电池组内的某个电池单元可能会发生膨胀，温度急剧上升，在电池组内设置温度传感器可以检测这些变化，并且在温度传感器预设几组对比数值，可以根据温度传感器的检测结果对电池组作出相应的调整，例如使得电池组从供电电路中断路或者减小电池组的放电电压等。

[0027] 作为优选，温度传感器设置在电池模块的极耳处。对于软包电池来说，其发热量最大的部位位于极耳周围，若其发生故障，温度变化最为剧烈的也是这个部位，将温度传感器设置在电池模块的极耳处可以在电池单元发生异常的初期就发现，在及时做出补救措施之后，可以避免危险的扩散，保证电池组的安全。

[0028] 作为优选，所述电池模块两端极耳的位置设置线束部件，线束部件上设置线束通道，从电池模块上引出的采样线束从线束通道内穿过，比如温度传感器线束等。

[0029] 作为优选，所述电池单元的极耳两端均设置固定框，固定框上设置夹持电池单元极耳的阻挡部分，将电池单元夹持在两个固定框的中间；这种设计可以将电池单元夹在固定框中间，使得电池单元保持较好的稳定性，并且使得极耳露出，便于连接。

[0030] 作为优选，所述固定框之间设置缓冲环，所述缓冲环套设在电池单元上。

[0031] 本发明中使用软包电池单元，缓冲环为橡胶制成，将缓冲套套设在电池单元上，对电池单元起到缓冲作用，将其夹在两个固定框的中间，保证在使用过程中位置固定不移动，可以达到如下效果：在电池组受到冲击时，可以有效地起到缓冲作用；在电池单元成组过程中，收紧电池模块的过程中，保护软包电池单元不受挤压。

[0032] 作为优选，所述电池模块的两个端面分别设置缓冲垫。

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[0033] 电池组在充电时会发生膨胀，在电池模块的两个端面分别设置缓冲垫可以起到缓冲的作用，避免将电池箱胀破后发生事故。

[0034] 作为优选，所述箱体的外壁上设置数根纵向加强筋。

[0035] 当电池箱由铝合金制成时，在箱体的外壁上设置数根纵向加强筋可以增加电池箱的强度，加强抗压和抗扭曲能力，同时也增大了箱体的表面积，优化了散热性能。当电池箱由强度较高的不锈钢制成时，箱体外壁上可以不另设置加强筋。

[0036] 作为优选，所述箱体的外表面设置防爆槽，所述防爆槽的切口深度为箱体壁厚度的 20% ～ 50%。

[0037] 作为优选，所述防爆槽包括 U 型槽。

[0038] 当电池组内部发生异常，体积急剧膨胀的时候防爆槽，比如 U 型槽，可以在达到箱体破裂压力前提前破开以达到泄压的目的，并且可以引导爆破方向，从而避免电池箱的内压积聚过大而发生更剧烈的爆炸，同时也可防止端板与箱体分离被炸飞。

[0039] 作为优选，所述箱体上设置与两块盖板连接的柔性连接条。

[0040] 箱体上设置柔性连接条，柔性连接条的另一端固定在盖板上，并且两块盖板均通过柔性连接条与箱体连接，当电池箱内压过大，防爆槽也不能完全保证不发生爆炸时，为防止端板被炸飞伤及人员，柔性连接条能够将端板牢牢锁住，即使电池箱爆炸也能保证端板不炸飞，进一步提升电池组的安全性能。

[0041]

附图说明

[0042] 图 1 是电池模块的结构示意图；

图 2 是电池模块的集流片的结构示意图；

图 3 是 Z 字型电池模块的俯视图；

图 4 是本发明的一种实施方式的电池模块的结构示意图；

图 5 是本发明的一种实施方式的电池模块的爆炸图；

图 6 是本发明的一种实施方式的电池模块的结构示意图；

图 7 是本发明公开的一种实施方式的电池箱的结构示意图；

图 8 是本发明公开的一种实施方式的电池箱的爆炸图；

其中 1、电池模块，11、电池单元，2、集流片，21、铜片，22、铝片，23、焊接槽，12、固定框，13、线束部件，132、线束通道，14、缓冲环，15、温度传感器，16、密封片， 3、电池箱， 33、加强筋，34、箱体，35、盖板，36、柔性连接条，37、U 型槽。

[0043] 实施方式

实施例 1

如图 1 至图 3 所示，本实施例提供一种电池模块 1，包括电池单元 11 和集流片 2，电池单元 11 设置正极极耳及负极极耳，正极极耳及负极极耳分别位于电池单元 11 的相对两端，电池单元 11 的正极极耳为铝箔极耳，负极极耳为铜箔极耳，集流片 2 为组合式集流片，集流片 2 由铝片 22 和铜片 21 组合而成，铝片 22 和铜片 21 之间铆接固定，铝片 22 和铜片 21 上分别设置焊接槽 23。

[0044] 在组装电池模块 1 的过程中，首先将电池单元 11 串联连接，把需要串联的电池单

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元 11 的铝箔极耳焊接在铝片 22 的焊接槽 23 上，将铜箔极耳焊接在铜片 21 的焊接槽 23 上，使得电池模块中的电池单元首尾连接形成 Z 字型。

[0045] 此实施例的优点在于超高的能量密度和电池组结构的稳定性；本实施例中电池组的长为 14dm、宽为 4.3dm、高为 1dm，电池组由 3 并，96 串电池单元组成，电池单元中极片的长为 3.6dm、宽为 0.8dm、厚为 0.036dm，电池箱 3 的容量为 14*4.3*1=60L，电池组中所有极片体积为 3.6*0.8*0.036*3*96=30L，故 EVR 为 30/60=50%，远大于背景技术中 Tesla 使用的 EVR 仅为 25.2% 的电池组，在极片隔膜等材料完全一致前提下，极大提高了电池组的能量密度。

[0046] 实施例 2

如图 1 至图 4 所示，本实施例提供一种电池模块 1，包括电池单元 11 和集流片 2，电池单元 11 设置正极极耳及负极极耳，正极极耳及负极极耳分别位于电池单元 11 的相对两端，电池单元 11 的正极极耳为铝箔极耳，负极极耳为铜箔极耳，集流片 2 为组合式集流片，集流片 2 由铝片 22 和铜片 21 组合而成，铝片 22 和铜片 21 之间铆接固定，铝片 22 和铜片 21 上分别设置焊接槽 23；电池单元 1 的长宽比为 4:1。

[0047] 在组装电池模块 1 的过程中，首先将三个同样的电池单元 11 并联连接，把需要并联的电池单元 11 的铝箔极耳焊接在铝片 22 的焊接槽 23 上，将铜箔极耳焊接在铜片 21 的焊接槽 23 上。然后再将并联好的电池单元的铜箔极耳焊接在上一个并联好的电池单元正极集流片的铜片 21 的焊接槽 23 上，铝箔极耳焊接在下一个并联好的电池单元正极集流片的铝片 22 的焊接槽 23 上。使得电池模块中并联后的电池单元首尾连接形成 Z 字型。

[0048] 电池模块 1 的末端均设置固定框 12，将电池单元夹持在两个固定框 12 的中间，同时在固定框 12 之间设置套设在电池单元上的缓冲环 14，固定框 12 上设置夹持电池单元极耳的阻挡部分。

[0049] 此实施例的优点在于保证较高的能量密度情况下，设计的缓冲结构使得电池组具备一定的防震和抗冲击能力。

[0050] 实施例 3

如图 1 至图 8 所示，本实施例提供一种电池模块 1，包括电池单元 11、集流片 2 和电池箱，盖板将电池箱的开口密封，箱体 34 的外壁上设置数根纵向加强筋 33，箱体 34 和盖板 35 之间设置缓冲环 14 和密封片 16，电池单元 11 设置正极极耳及负极极耳，正极极耳及负极极耳分别位于电池单元 11 的相对两端，电池单元 11 的正极极耳为铝箔极耳，负极极耳为铜箔极耳，集流片 2 为组合式集流片，集流片 2 由铝片 22 和铜片 21 组合而成，铝片 22 和铜片 21 之间铆接固定，铝片 22 和铜片 21 上分别设置焊接槽 23；箱体 34 的外表面设置切口深度为箱体 34 壁厚度的 20% 的 U 型槽 37；箱体 34 上设置与盖板 35 连接的柔性连接条 36；电池单元 1 的长宽比为 4:1。

[0051] 在组装电池模块 1 的过程中，首先将三个同样的电池单元 11 并联连接，把需要并联的电池单元 11 的铝箔极耳焊接在铝片 22 的焊接槽 23 上，将铜箔极耳焊接在铜片 21 的焊接槽 23 上。然后再将并联好的电池单元的铜箔极耳焊接在上一个并联好的电池单元正极集流片的铜片 21 的焊接槽 23 上，铝箔极耳焊接在下一个并联好的电池单元正极集流片的铝片 22 的焊接槽 23 上。使得电池模块中并联后的电池单元首尾连接形成 Z 字型；相邻电池单元 11 之间设置表面积大于电池单元 11 的铝制隔片，隔片上设置条形凹凸纹。

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[0052] 电池模块 1 的末端均设置固定框 12，将电池单元夹持在两个固定框 12 的中间，同时在固定框 12 之间设置套设在电池单元上的缓冲环 14，固定框 12 上设置夹持电池单元极耳的阻挡部分；固定框之间设置缓冲环，缓冲环套设在电池单元上，电池模块的两个端面分别设置缓冲垫。

[0053] 电池模块 1 上还设置温度传感器 15，温度传感器 15 设置在电池模块 1 的极耳处，当电池组发生异常时，温度传感器 15 可以监测到电池单元的温度参数变化。电池模块 1 两端极耳的位置设置线束部件 13，线束部件 13 上设置线束通道 132，从电池模块 1 上引出的采样线束从线束通道 132 内穿过。

[0054] 此实施例的优点在于保证较高的能量密度情况下，同时可以提供对电池模块温度的检测，更有利于提高电池模块的安全性能。

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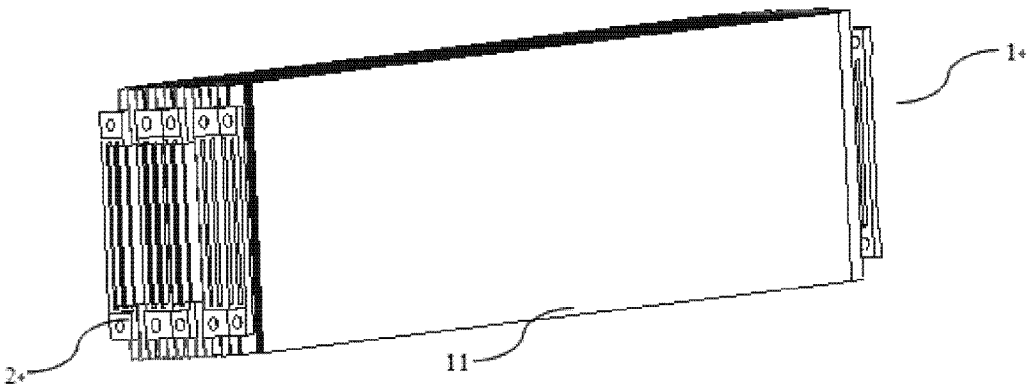


图 1

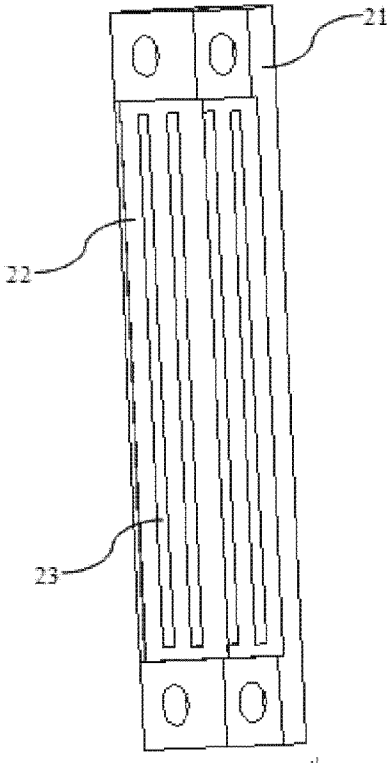


图 2

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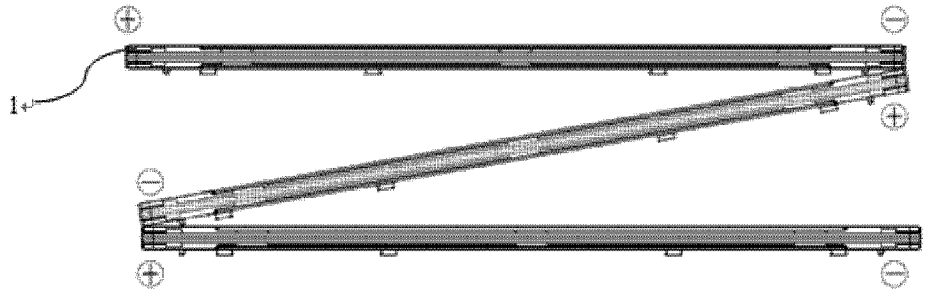


图 3

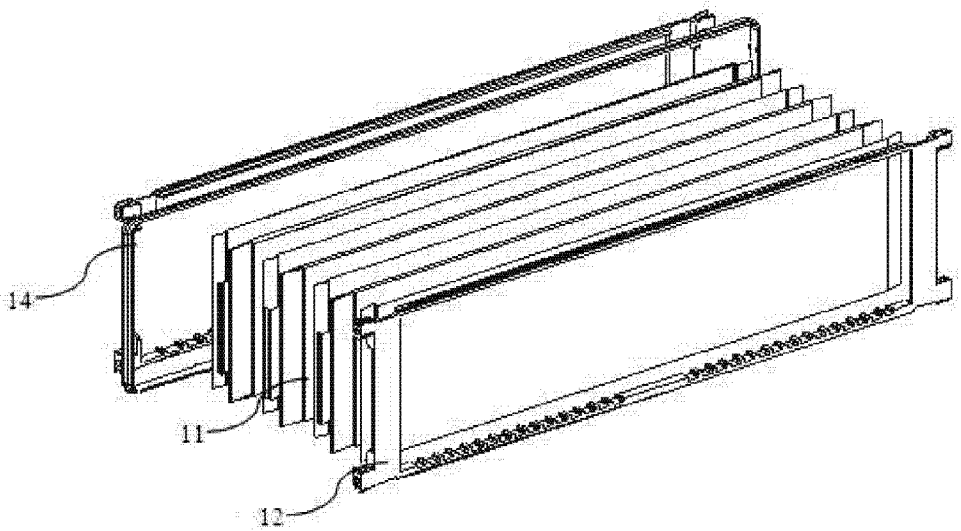


图 4

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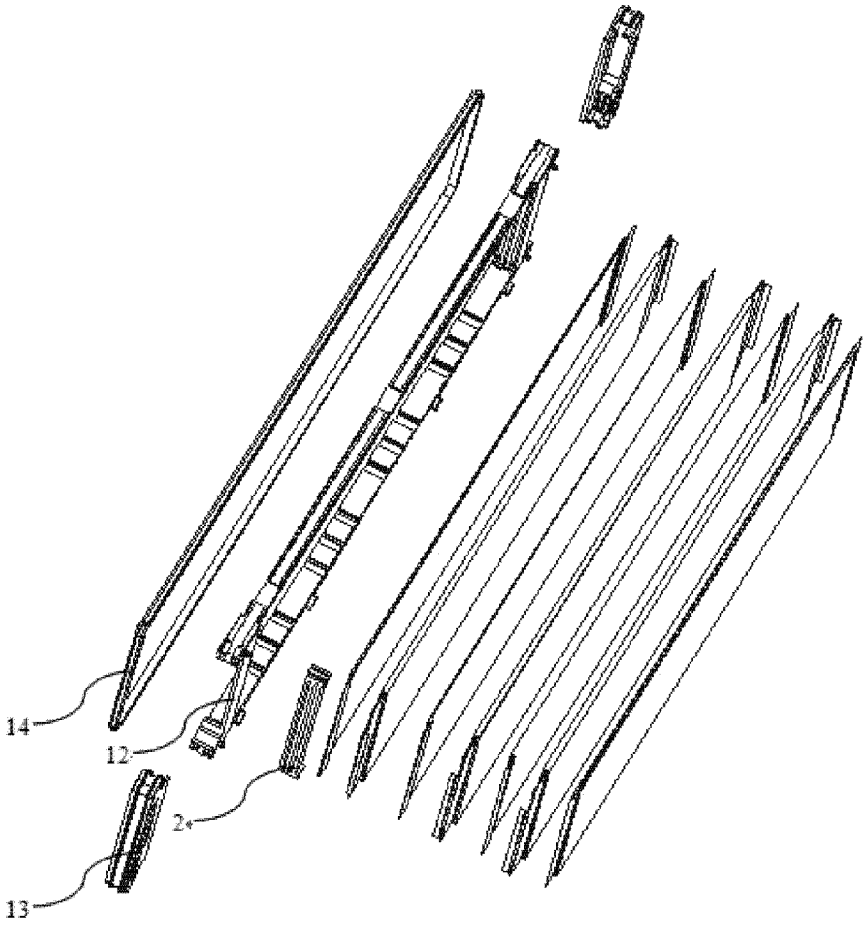


图 5

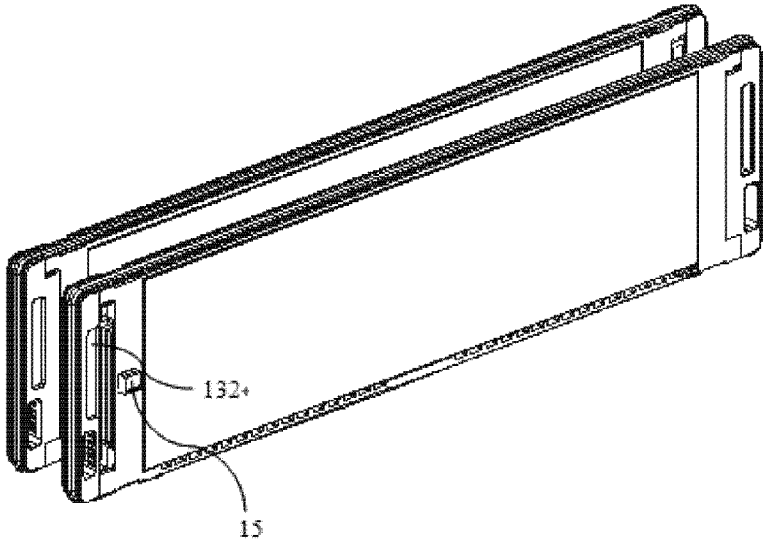


图 6

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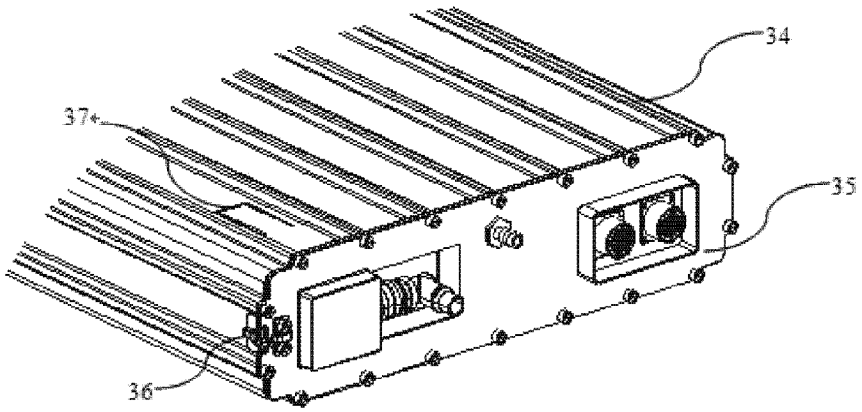


图 7

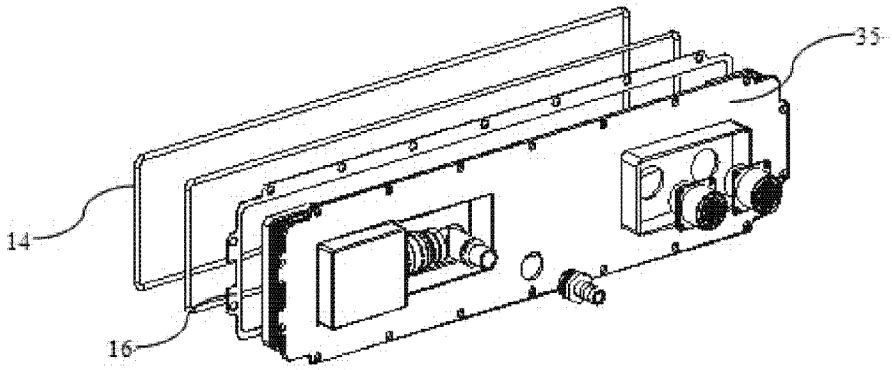


图 8

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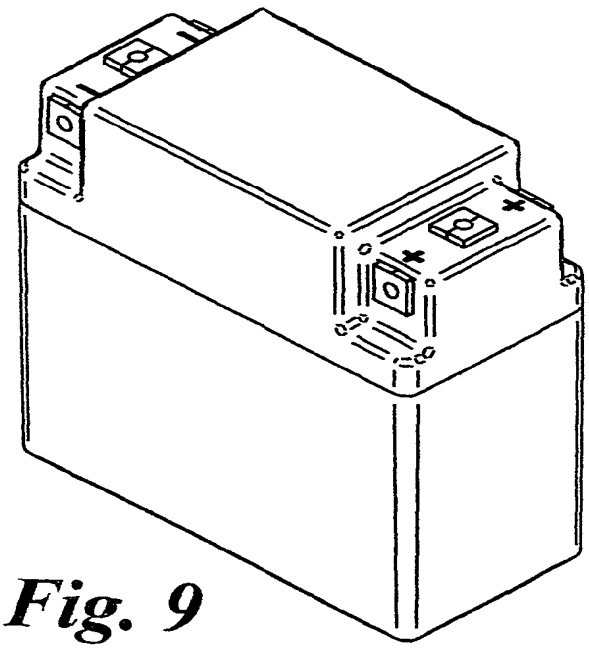


Fig. 9

(57) **Abstract**: Apparatus for increasing the efficiency of a starter battery for a starter motor of an internal combustion engine in a battery pack arrangement with one or more lithium based cells. The invention includes a solid state switching configuration for high powered battery systems for protecting against over-charging, over- discharging and short circuiting of batteries, especially starter batteries for internal combustion engines.

WO 2012/074548 A1

LITHIUM STARTER BATTERY AND SOLID STATE SWITCH THEREFOR

FIELD OF THE INVENTION

The present invention relates to a method and apparatus for starting an internal combustion (IC) engine. More particularly, the invention is a lithium-based cell for starting such engines. The invention includes a solid state switching configuration for high powered battery systems for protecting against over-charging, over- discharging and short circuiting of batteries, especially starter batteries for internal combustion engines (ICE).

BACKGROUND OF THE INVENTION

Presently, internal combustion engines use a starter battery comprised of lead-acid to turn over an electric motor to start an IC engine. Lead-acid batteries are heavy, bulky, and have short cycle life, short calendar life, and low turn around efficiency. Lead-acid batteries also have a high internal impedance (resistance) that is greater in cold weather making it more difficult to start an IC engine in cold weather with less current available. To overcome these variables, lead-acid starter batteries are provided with oversized battery capacity in order to produce the necessary current needed for an electric starter to start an IC engine. The oversized lead-acid battery increases the weight, space requirement, and cost needed to start an IC engine.

In order to turn off power terminals in presently known starter batteries, expensive electronic/electrical components are required to handle the high current loads that a starter motor needs to turn over an IC engine. These embody electronic protection circuitry for upper voltage cut-off (overcharging), lower level voltage cut-off (over discharging) and temperature measurements. These circuits also induce heat losses and electrical losses that can be large, as well as taking up additional space. (Noise) spikes can trigger false voltage, temperature or current readings that can terminate the battery system's operation, when in fact all the cells are working within safe specifications. Some of these protection circuits are temperamental and difficult to reactivate once they have been triggered. For example, if an under-voltage condition happens and the cells are still in under-voltage condition with a relay approach, current can not be provided to the cells since a path has been broken thus another button needs to be pressed to activate the system for a short duration in order to allow the cells to charge. Also, in some cases such as a military application or racing application, every last bit of

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energy needs to be extracted, even if it damages the battery.

With any type of rechargeable (secondary) battery used, the battery does not operate well in a low state of charge (SOC), which in most cases is a low battery voltage. Whenever a battery is at a low voltage level, the battery can suffer internal damage permanently or the battery life can be drastically reduced. With battery chemistries such as lithium, over-charging a battery can be even more dangerous, potentially leading to an exothermal runaway reaction, which can create a fire. With a solid state switch placed in-line with the battery output power terminals, the solid state switch can be electronically controlled to open or close the current pathway leaving or entering the battery. This can prevent battery damage from happening if the battery voltage is brought too low or too high. This can be applied to any type of battery chemistry at any voltage. An example is to apply the solid state switch to a 12V car battery that starts a vehicle. A vehicle might have a voltage drain source left on, in which case the solid state switch would automatically turn off the current flow from the battery before the battery is damaged.

A relay or contactor could be used as well, but has the following disadvantages:

1) A relay or contactor continuously needs current to keep the contactor open or closed. That requires energy to do so.

2) A relay or contactor having a closed pathway allows current to flow in both directions and can not be controlled for a single direction.

3) A relay or contactor can only be ON or OFF. During a switching process for large currents large arcing can occur inside the relay or contactor, and that can cause the relay or contactor to "weld" shut. Once a relay or contactor is welded shut, no switching can occur at that point, which can be a safety issue, i.e., by not allowing switching to occur when needed.

4) Relays and contactors are large and bulky for larger current applications.

A better approach is to use a solid state switch either a FET, a MOSFET (metal–oxide–semiconductor field-effect transistor), or IGBT (insulated gate bipolar transistor) format, but not limited to these, in a unique configuration. The unique configuration involves connecting two solid state devices such as MOSFET or IGBT with the "Sources" or "Drains" tied together electrically. These solid state devices can be either N or P type. A doped semiconductor containing excess holes is called "p-type", and when it contains excess free electrons it is known as "n-type", where p (positive for holes) or n (negative for electrons) is the sign of the charge of the majority mobile charge carriers. This arrangement simplifies the control electronics needed and also allows current to flow in one direction but not the other with the internal diode. An FET (field-effect transistor) is a

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majority-charge-carrier device having an active channel through which majority charge carriers, electrons or holes, flow from the source to the drain. Source and drain terminal conductors are connected to semiconductor through ohmic contacts. The majority charge carriers enter the channel through the source and leave the channel through the drain. Figure 15 shows the "Drain" of each terminal being connected, and Figure 16 shows the "Source" of each terminal being connected.

The advantages of a solid state switch are:

1) A solid state switch needs very little energy to activate an allowed pathway to be open or close.

2) A solid state device can gradually increase current, controlling inrush current that might occur switching ON large power applications or providing instant short circuit protection if the current is too high.

3) A solid state switch can be very compact and light for higher power applications.

DESCRIPTION OF THE PRIOR ART

Applicant is aware of the following U. S. Patent concerning battery packs for starting engines:

US Patent No.	Issue Date	Inventor	Title
7,525,287	April 28, 2009	Miyashi	BATTERY PACK FOR DRIVING ELECTRIC MOTOR OF COMPACT ENGINE STARTING DEVICE, ENGINE STARTING DEVICE DRIVEN BY THE BATTERY PACK, AND MANUAL WORKING MACHINE HAVING THE ENGINE STARTING DEVICE

SUMMARY OF THE INVENTION

The invention provides means for increasing the efficiency of a starter battery for a starter motor of an internal combustion engine. By replacing a lead-acid starter battery with a lithium base or lithium-iron-phosphate ($LiFePO_4$ or LiFePO) or $LiFeMgPO_4$ or $LiFeYPO_4$ cell, the needed capacity, weight and size is drastically reduced while increasing the cycle life, calendar life and turn around efficiency for a starter battery. The lithium iron phosphate ($LiFePO_4$) cell is a type of rechargeable cell, specifically a lithium ion cell, which uses $LiFePO_4$ as a cathode material. It may also include magnesium or yttrium in the lithium iron compound. Connecting four cylindrical cells in series, each of which has a standard industry

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cell format size of both 18650 (less than 3Ah) or 26650 (less than 4Ah), or prismatic flat or other type cells, enough current is available to penetrate to a starter motor rated for 12V system to start large IC engines that use 1, 2, 3, 4, 5, 6, 8, or 12 cylinders. Larger cells may be utilized in the invention, from 1 Ah to 5000 Ah, common sizes being 5Ah, 10Ah, 20 Ah, 50Ah, 100Ah, 400Ah, and 500 Ah.

With a configuration of 4 cells in series, no protection circuit board is needed to protect the individual cells from over-voltage or undervoltage, unlike larger system using more cells which require a protection circuit board in them for safety protection. Individual cell balancing is also not needed for such a small starter battery but may be included to increase the product life. A smaller and lighter starter battery increases the performance of mobile systems that use starter batteries. The resulting increase of cycle life and calendar life reduces user costs.

No separate nor special charging system is needed with the invented system

The invention also comprises a housing for the lithium-based cells, with upper and lower mating casings, a contoured pad within the lower casing for receiving at least one lithium-based cell, and electrical connections from the at least one lithium-based batter to the exterior of the housing. Optionally, an upper battery pad may be placed in the upper casing, and, if desired, a protection circuit board, such as a balancing board or a cut-off circuit, may be placed within the upper casing for safety protection.

The invented solid state switch apparatus allows current to flow in one direction and not the other. A minimum of two solid state switches are arranged in a unique configuration, which allows current to flow in a controlled manner bidirectionally when needed. This is particularly useful for preventing overcharging or over- discharging an entire battery pack. A separate cell balancing circuit is used to balance out the individual cells. The solid state switch can be used on each individual cell, if desired, to prevent overcharging or over-discharging of the individual cell. It can be used with any battery application in which charging and discharging is required, and is particularly useful with lithium-based batteries. It can also be used with lead-acid batteries, nickel-cadmium (NiCd) batteries, and low self-discharge nickel metal hydride (NiMH) batteries. More sophisticated items of equipment to which a battery may be attached have programmable shut-off settings, but less sophisticated equipment does not have shut-off parameters in place. Using a battery in a starter applications (for instance, to start an IC engine) will prevent the battery from overcharging, as well as prevent the battery from being discharged to too low a level if a current drain (leakage) is present in the system, even though everything is turned off.

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By connecting the "Sources" or the "Drains" together using a minimum of two solid state devices allows for automation and simplification to fully and partially switch the batteries power terminals ON and OFF. The two solid state devices can either be N or P type and connected either on the Positive or Negative side of the battery terminal and controlled by simple electronic circuit to control the drivers of the solid state devices.

This invented switch configuration also allows for short circuit protection across the battery power terminals, along with allowing the maximum current control when charging.

OBJECTS OF THE INVENTION

The principal object of the present invention is to provide means for increasing the performance of a starter battery for a starter motor of an internal combustion engine.

Another object of the invention is to provide a starter battery for an internal combustion engine that is lighter, more reliable, has less bulk, longer cycle life, longer calendar life, and higher turn around efficiency than lead-acid batteries.

A further object of this invention is to provide a starter battery system for an internal combustion engine that is easy to assemble, waterproof, and maintenance free.

Another object of the invention is to provide a starter battery for an internal combustion engine that can be used in existing vehicles.

Another object of the invention is to provide a starter battery for an internal combustion engine that has a wide operating temperature range with exceptional cold-weather cranking performance.

Another object of the invention is to provide an improved apparatus for protecting a single cell or battery from being overcharged or over-discharged.

Another object of the invention is to provide apparatus for charging a cell having a very low charge.

Another object of the invention is to provide apparatus for short circuit protection for one or more cells or batteries.

Another object of the invention is to provide apparatus for discharging a cell having too high a charge.

A further object of the invention is to provide an apparatus for short circuit protection in case a metal object causes a short circuit across the terminals.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects will become more readily apparent by referring to the

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following detailed description and the appended drawings in which:

Figure 1 is an exploded isometric view of one embodiment of the invention, in which 4 cells are arranged into a starter battery pack.

Figure 2 is an exploded isometric view of another embodiment of the invention, in which 8 cells are arranged into a starter battery pack.

Figure 3 is an exploded isometric view of another embodiment of the invention, in which a prismatic cell is arranged into a starter battery pack.

Figure 4 is a front view of the assembled battery pack of Figure 3, the rear view being identical.

Figure 5 is a top view of the assembled battery pack of Figure 3.

Figure 6 is a right end view of the assembled battery pack of Figure 3, the left end view being a mirror image thereof.

Figure 7 is a schematic diagram of a block of 4 lithium prismatic cells in series connected to a balancing circuit board.

Figure 8 is a schematic diagram of a block of 4 lithium prismatic cells in series connected to a balancing and cutoff circuit board

Figure 9 is an isometric view of an alternative embodiment of a housing showing contacts for switches.

Figure 10 is a top view of the housing of Figure 9 showing the contact locations.

Figure 11 is a front view of the housing of Figure 9, the rear view being identical.

Figure 12 is an end view of the housing of Figure 9, the opposite end being identical.

Figure 13 is an exploded isometric view of an alternative embodiment of the invention of Figure 3, in which 2 blocks of prismatic cells and a control board of cutoff switch are arranged into the housing of Figure 9.

Figure 14 is a schematic diagram of a Solid State Switch with "Drain" connection.

Figure 15 is a schematic diagram of a Solid State Switch with "Source" connection.

Figure 16 is a schematic diagram showing a preferred embodiment of the invention in which the "Drain" of each gate is connected together using N type MOSFET or IGBT with the cells being above the solid state switches.

Figure 17 is a schematic diagram example of connecting the "Drain" of each gate together using N type FET, MOSFET, or IGBT with the cells being below the solid state switches.

Figure 18 is a schematic diagram illustrating connecting the "Source" of each gate together using N type FET, MOSFET or IGBT with the cells being above the solid state

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switches.

Figure 19 is a schematic diagram illustrating connecting the "Source" of each gate together using N type FET, MOSFET or IGBT with the cells being below the solid state switches.

Figure 20 is a schematic diagram illustrating connecting the "Drain" of each gate together using P type FET, MOSFET or IGBT with the cells being above the solid state switches.

Figure 21 is a schematic diagram illustrating connecting the "Drain" together using P type FET, MOSFET or IGBT with the cells being below the solid state switches.

Figure 22 is a schematic diagram illustrating connecting the "Source" together using P type FET, MOSFET or IGBT with the cells being above the solid state switches.

Figure 23 is a schematic diagram illustrating connecting the "Source" together using P type FET, MOSFET or IGBT with the cells being below the solid state switches.

Figure 24 is a schematic diagram illustrating the invention utilized in engine restarting.

Figure 25 is a schematic diagram illustrating short circuit protection of a battery.

DETAILED DESCRIPTION

Lithium containing LiFePO, $LiFePO_4$, $LiFeMgPO_4$, and $LiFeYPO_4$ cells have a low nominal cell voltage (3.2V-3.3V) that match directly with existing 12V lead-acid equivalent systems. Four LiFePO cells in series have a nominal voltage of 13.2V. Thus they can directly replace existing 12V lead-acid equivalent systems without requiring any electrical modification.

Other lithium chemistries have a higher nominal voltage, such as: lithium-cobalt (3.6V), lithium-manganese (3.7V-3.8V), lithium-nickel-cobalt-manganese (3.7V). Each of these thus have a higher system voltage when 4 cells are used in series. With the higher cell voltages, most existing 12V direct replacement systems will not be able to charge other lithium cell chemistries above 60% of their capacity. Other lithium-based cells that can be utilized in this invention are lithium-cobalt-oxide ($LiCoO_2$), lithium-manganese-oxide ($LiMn_2O_4$), lithium-nickel-cobalt-manganese-oxide ($LiNiCoAlO_2$), lithium-nickel-manganese-cobalt-oxide ($LiNiMnCoO_2$), and lithium-titanate ($Li_4Ti_5O_{12}$).

LiFePO, $LiFePO_4$, $LiFeMgPO_4$, and $LiFeYPO_4$ cells also have a higher thermal runaway condition than lead-acid cells. For a thermal runaway to occur, the cell temperature must be extremely hot (over 200°C). When a cell reaches a certain temperature, mostly caused by overcharging, then the cell will start producing more heat by an internal reaction

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that fuels itself in most cases with a fire, which phenomenon is known as "thermal runaway". All other Lithium cell chemistries have a lower thermal runaway temperature making those cells more prone to catch on fire.

A thermal venting cap is usually placed inside each individual cylindrical cell casing to minimize the chances of explosion. The venting cap allows the electrolyte of a cell to leak out before an internal fire can occur.

Although it is advantageous to use protective circuitry, it is possible to operate the present invention without protective circuitry, which simplifies the system to allow charging or discharging. Omitting all of the electronic protection circuitry for upper voltage cut-off (overcharging), lower level voltage cut-off (over discharging) and temperature measurements reduces the overall manufacturing cost of the starter battery. This also simplifies the system to allow charging or discharging in all conditions and not be restricted by any suggested or specified operating range.

By using lithium cells, a battery housing structure is both smaller and lighter than with lead-acid cells. Any time less internal mass is involved the housing structure size can be reduced, which also results in reducing cost.

The housing structure of the embodiment of Figures 1 and 2 may vary in depth to accommodate varying numbers of cells which provides for different capacity. The lid structure of the housing (or casing) for cylindrical cells is the same for most battery packs, as shown. Such cells can be stacked in parallel to allow for larger capacity for different battery packs to be assembled. The lid of the housing also incorporates a threaded bushing made from aluminum to minimize weight, but that has similar electrical properties to aluminum, copper or brass, or an internally threaded hole to receive an electrical connector screw.

Referring now to the drawings, and particularly to Figure 1, the invented battery pack 10 comprises a housing12, having a lower receptacle 14 and a mating top 16, at least one lithium-based rechargeable battery 18, or cell, within the housing, with appropriate electrical connections. The total discharging amount of each lithium-based cell in the battery pack is one (1) to 5000 Ah, and charging voltage per one cell is 3.0 to 4.2 V.

The lower portion of the housing 16 can be provided with bottom padding 20 which fits therein, receives the cell or cells, and mates with the lower receptacle 14. A top pad 22 can be provided in the top 16 of the housing, as desired.

Electrical connections 24 are provided between the cells, as shown, positive to negative, with screws 26 connecting the cells through holes 28 the bottom of the housing to electrical leads, not shown, but which leads connect to bottom screws 30. Alternatively, a

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welded connection can be used instead of screws.

Optionally, a protection circuit board 32 may be placed within the upper casing or top 14 for safety protection. Such a protection circuit board may be a cutoff board or a cell-balancing circuit board. A cell-balancing circuit board may include a cutoff function. A lithium iron battery having two or more cells in series has a battery voltage equal to the sum of the individual cell voltages. Over the life of the battery, it may be charged and discharged for hundreds or thousands of cycles. The individual cells may age differently. Some cells may become mismatched with respect to the others. This phenomenon is corrected, by balancing. Balancing is the process of forcing all of the cells to have identical voltages. This is accomplished by a balancing circuit.

Starter battery systems can utilize a greater number of lithium cells as desired for greater capacity.

Lithium cells have substantially less weight than a lead-acid cell, and are 80% smaller. A lithium cell will last about 3 times as long as a lead-acid cell with 100% full discharge cycles. Lithium cells are maintenance free, whereas lead-acid cells need to be refilled with distilled water to maintain the acid level above the plates. Lithium cells do not freeze. They have a discharge power 8 times that of lead-acid. Their charging time is less than 2 hours.

Lithium cell self discharge rate is less than 2% monthly, whereas the self discharge rate for a lead-acid cell is 10% monthly.

Lithium cells can operate at very high temperature, up to 70°C without major degradation. They can also operate at very low temperature, down to -30°C with slight capacity degrade at that temperature, but power is available.

Lithium cells are 98% energy efficient (energy going in and out of the cell), whereas lead-acid cells are only 90% energy efficient.

For each 12 volt increment, four $LiFePO_4$ cells are required in series, and some cases fewer cells with other lithium chemistries. The following Table I compares lead-acid battery voltages to the $LiFePO_4$ cell requirements and for other lithium-based battery cells:

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TABLE I

Nominal Lead-Acid Voltage	$LiFePO_4$ (3.3V nominal)	$(LiCoO_2)$, $(LiMn_2O_4)$, $(LiNiCoAlO_2)$, $(LiNiMnCoO_2)$, or $(Li_4Ti_5O_{12})$ (3.7V nominal)
12V	3 to 4 cells in series	2 to 4 cells in series
24V	5 to 9 cells in series	5 to 8 cells in series
36V	8 to 13 cells in series	7 to 12 cells in series
48V	11 to 17 cells in series	10 to 16 cells in series
60V	14 to 22 cells in series	12 to 19 cells in series
72V	16 to 26 cells in series	15 to 23 cells in series
84V	19 to 31 cells in series	17 to 27 cells in series
96V	22 to 35 cells in series	19 to 31 cells in series
108V	25 to 39 cells in series	22 to 35 cells in series
120V	27 to 44 cells in series	24 to 39 cells in series

As shown in Figures 3 through 6, a block 40 formed of one or more flat prismatic cells connected in series is fitted into a housing 12, each block of cells having a common set of electrical connections 42A and 42B. A protection circuit board 30 is provided within the housing, and is electrically connected to the block. Figures 4 through 6 show the assembled housing with the electrical connections 24A and 24B in the top thereof.

Figure 7 shows a block of 4 flat lithium based prismatic cells connected to a balancing circuit board 46, which has a balancing controller or microprocessor 60. Figure 8 shows a block of 4 flat prismatic cells connected to a balancing and cutoff circuit board 48, which includes a controller 60 and a solid state cutoff switch 62, such as an FET. Figures 9 through 12 show the housing 12 for the battery pack 10 with positive terminal 34 and negative terminal 36.

Figure 13 shows multiple blocks 40 of flat cells along with bottom padding, packing, or spacers 50, flat packing 52, and large packing blocks 54, all of which packing is optional. The upper portion or top section 56 of the housing is advantageously provided with three contacts on each end thereof, as shown.

An auto-detect restart feature is especially useful for a motorcycle: "IQ Restart technology" protects the battery from a deep cycle discharge by monitoring battery voltage level and shutting the battery power off prior to a full discharge, such as in the case of leaving

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a headlight or electrical component on for an extended period of time while the engine is off. Enough reserve power is left in the battery, to automatically detect (by measuring a change in resistivity) a starting effort and allow the user to start the engine again. This avoids the cyclist being stranded or the headache of replacing a battery. The auto-detect apparatus has at least one lithium-based cell, a voltage detector, an associated switch such as a cutoff board, or a micro-controller in a balancing circuit connected to a solid state switch, such as an FET. One function turns off an FET in the circuit when the voltage drops to a preselected level, leaving sufficient reserve capacity for starting the engine. A second function detects a "keying cycle" or the resistance change upon attempting to start the engine, which turns on the FET. This resistance change is a reaction to a key turn, push button, or remote activator.

To control the solid state switches, electronic controls are needed for the different voltages, currents and/or temperature with specified parameters in which cells work to prevent damage. The control electronics used in battery systems are often referred to a Battery Management System (BMS) or Battery Management Unit (BMU). The BMS or BMU can individual monitor all the cell or battery voltages, and/or temperatures. To protect a single cell or battery from being over charged, that might lead to an exothermal runaway reaction creating a fire and/or to prevent the cell from damaging when discharging them too low, the solid state switch would close or open the current pathway to prevent cell damage from occurring.

The arrangement of devices shown in Figures 15 and 16 are examples of how solid state switches can be configured to connect the "Drains" or "Sources" together which is an unconventional approach. The solid state switches in parallel are examples to increase the current capabilities.

Referring particularly to Figure 17, under normal operations both T1 and T2 are ON allowing power pathway to go in both directions: discharge and charge. Should a cell be outside of its specified working specification (cell voltage), both D1 and D2 can be turned off but current can still flow through the internal diode to allow for added functionality.

In the event that the cell voltage drops too low, below the set voltage configuration, from a drain on the battery, T1 will turn off, preventing further discharge from occurring. However, with the internal diode in place of T1, and T2 still on, the circuit will allow charging to occur.

If the cell voltage goes too high, above the set voltage configuration, T2 will turn off, preventing further over charging from occurring. However, with the internal diode in place of T2, and T1 still on, the circuit will allow discharging to occur.

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Using solid state switching in the configuration shown in Figure 17 allows for user friendly reactivation of the circuit without any pushbuttons or reset buttons. Both Charge and Discharge current can go through the internal MOSFET or IGBT diode to bring the cell back to the specified operating voltage.

Alternative switch and gate arrangements are set forth in Figures 18 through 23. Each such arrangement works in a similar manner as that describing the Figure 17 operation.

The invention's restart function is illustrated by Figure 24. Controller 60 is connected to a battery pack having a block of cells 64 and to MOSFETs Q1 and Q2. After a low voltage cutoff, the controller periodically tests the load to detect a change in the load impedance. When an abrupt change in the load impedance is detected, for example connecting or disconnecting a load such as the headlight(s), the ignition switch, or the starter switch, the controller 60 turns on power MOSFETs Q1 and Q2, which reconnects the battery to the vehicle and allows the vehicle to be restarted.

When the controller drives the base of Q3 high through R1, Q3 and Q4 turn on. When Q4 turns on, it connects the battery to the load through R4 and D1. R4 and the load impedance form a voltage divider, and the resulting voltage at node A will depend on the load impedance. D2 steers the node A voltage to the R5/R6 voltage divider which scales down the voltage at node B to a level that the controller can read using an analog-to-digital converter (ADC). The ADC may be of the type commonly included as a built-in peripheral in a micro-controller or a digital signal processor; alternatively the ADC may be a standalone device. After turning on Q4, the controller may make one or more ADC readings after one or more fixed or variable delay periods. By reading the ADC at different times after turn-on, the controller can infer not only the resistive, but also the inductive and/or capacitive components of the load impedance. By tracking the periodic ADC readings and applying the appropriate digital filtering, abrupt changes in the load impedance can be determined. Gradual changes in the ADC readings, which may be caused for example by temperature changes or battery charge depletion, are disregarded (i.e., filtered out). Immediately after making the required ADC reading(s) the Controller turns off Q3 and Q4 to minimize battery drain. It should be noted that while Q3 and Q4 are shown here as bipolar junction transistors, a number of other types of electronic devices could be used to accomplish the switching function of Q4, including but not limited to one or more MOSFETs or a relay.

In order to conserve battery charge as long as possible in low voltage cutoff mode, the controller tests the load impedance only as often as necessary. The testing period is determined by the application, and is approximately 1 to 5 seconds. In a vehicle application,

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this period represents the maximum time that a user would have to hold a starter switch in the start position in order to effect a restart after a low voltage cutoff. To further reduce drain on the battery, the testing period may be extended if the battery remains in low voltage shutdown mode for a long time, or if the battery voltage (in one or more cells) continues to drop.

The invention is useful for short circuit protection as shown in Figure 25. Cross-coupled NAND gates E and F form a set-reset (SR) latch that controls the gate drive of power MOSFET Q2. The latch is set when the controller 60 drives Q2 ENABLE low. When Q2 ENABLE is driven high again, the output of NAND gate G is low and NAND gate H turns on Q3, which turns on Q4, which supplies the boosted gate drive voltage to turn on Q2. C3 and C4 help ensure fast turn-on of Q2 even with the relatively high value resistors for R4, R5, and R8 required to satisfy the application's low power requirements.

Current monitor A monitors the voltage drop across the drain-source ON resistance ($R_{DS(on)}$) of power MOSFET Q1 and sources a current into node B that is proportional to the MOSFET current. R1 converts this current to a voltage that is compared to VREF at comparator D. When a short circuit occurs, the voltage at node B will exceed VREF (at least momentarily) and cause the output of D to go low, resetting the S-R latch. When the S-R latch is reset the output of G will go high, and C2 will differentiate a positive going pulse into the base of Q5, causing Q5 to turn on for a few microseconds and rapidly discharge the gate of Q2. Rapid turn-off of Q2 is essential to limiting the energy associated with a short circuit event. By monitoring the status of the S-R latch, the controller 60 can determine when a short circuit cut-off event has occurred. C1 low pass filters the signal at node B so that extremely short duration overcurrent conditions can be tolerated if desired. The controller 60 may adjust VREF to compensate for Q2's $R_{DS(on)}$ variation with temperature if desired, or to adjust the over current trip threshold.

The solid state switches can be transistors, FET (field-effect transistors), JFET or JUGFET (junction gate field-effect transistors), BJT bipolar junction transistors, CMOS (complementary metal–oxide–semiconductors), VMOS (Vertical Metal Oxide Silicon), TMOS transistors, vertical DMOS (Double-Diffused MOS), or HEXFET.(hexagonal shape MOSFET).

It should be noted that the invented solid state switch apparatus can also be used in any battery system that requires charging and discharging in order to extend the battery life, and for safety. This is extremely useful and is a first for starter batteries.

The solid state devices all must be the same (N) or (P) type used in the same circuit, as illustrated.

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SUMMARY OF THE ACHIEVEMENT OF THE OBJECTS OF THE INVENTION

From the foregoing, it is readily apparent that I have invented an improved means for increasing the performance of a starter battery for a starter motor of an internal combustion engine, and a starter battery for an internal combustion engine that is lighter, more reliable, has less bulk, longer cycle life, longer calendar life, and higher turn around efficiency than lead-acid batteries. The starter battery system for an internal combustion engine is easy to assemble, waterproof, and maintenance free, can be used in existing vehicles, and has a wide operating temperature range with exceptional cold-weather cranking performance. The invention also apparatus for protecting a single cell or battery from being over charged, as well as providing apparatus for charging a cell having a very low charge, more effectively, and more economically than heretofore has been possible.

It is to be understood that the foregoing description and specific embodiments are merely illustrative of the best mode of the invention and the principles thereof, and that various modifications and additions may be made to the apparatus by those skilled in the art, without departing from the spirit and scope of this invention, which is therefore understood to be limited only by the scope of the appended claims.

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What is claimed is:

1. A battery pack for driving an electrical device, said battery pack comprising:

a housing; and

at least one lithium-based rechargeable cell within said housing;

wherein a total discharging amount of each lithium-based cell in the battery pack is from one (1) Ah to 5000 Ah, and charging voltage per one cell is 3.0 to 4.2 V.

2. A battery pack according to claim 1 wherein the lithium-based cell is a lithium iron phosphate cell.

3. A battery pack according to claim 2, wherein the lithium iron phosphate cell is selected from the group consisting of LiFePO, $LiFePO_4$, $LiFeMgPO_4$, and $LiFeYPO_4$ cells.

4. A battery pack according to claim 1 wherein the lithium-based cell is selected from the group consisting of $LiCoO_2$, $LiMn_2O_4$, $LiNiCoAlO_2$, $LiNiMnCoO_2$, and $Li_4Ti_5O_{12}$ cells.

5. A battery pack according to claim 1, wherein said battery pack comprises four lithium-based rechargeable cells in series in said housing.

6. A battery pack according to claim 1, wherein said battery pack comprises an even number of lithium-based rechargeable cells in said housing.

7. A battery pack according to claim 1 wherein said electrical device is an internal combustion engine starting device connected to an internal combustion engine.

8. A battery pack according to claim 1, further comprising a protection circuit board within said housing.

9. A battery pack according to claim 8, wherein said protection circuit board is a cut-off board or a cell balancing circuit board.

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10. A battery pack according to claim 9, wherein said protection circuit board is a cut-off board comprising a controller, said controller having associated means for periodically measuring a load to detect a change in load impedance, further comprising a switch between said battery pack and said device, and means for turning on said switch to provide power to the electrical device to restart the device.

11. A battery pack according to claim 9 wherein said protection circuit board is a cut-off board comprising a controller, said battery pack being connected to a current monitor, said current monitor being connected to a current comparator and a set-reset latch,

whereby upon the occurrence of a short circuit, the set-reset latch will turn off an associated switch.

12. Solid state switching apparatus for one or more cells in a battery pack having a positive terminal and a negative terminal, each of said cells having a positive pole and a negative pole, said apparatus comprising:

at least a pair of solid state switches, each switch having a source and a drain, with drains connected;

said solid state switches being connected to the positive pole of said one or more cells in series, and to said positive terminal, the negative pole of said one or more cells being connected to said negative terminal.

13. Apparatus according to claim 12, wherein the solid state switches are MOSFETs or IGBTs.

14. Apparatus according to claim 13, wherein the solid state switches are transistors, FET, JFET, BJT, CMOS, VMOS, TMOS, vertical DMOS or HEXFET.

15. Apparatus according to claim 12, wherein the solid state switches are either n-type or p-type.

16. Apparatus according to claim 12, wherein said one or more cells are selected from the group consisting of LiFePO, $LiFePO_4$, $LiFeMgPO_4$, $LiFeYPO_4$, $LiCoO_2$, $LiMn_2O_4$, $LiNiCoAlO_2$, $LiNiMnCoO_2$, $Li_4Ti_5O_{12}$, lead-acid, NiCd, and nickel metal hydride (NiMH) batteries.

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17. Apparatus according to claim 12, further comprising a housing for said one or more cells, batteries, wherein said solid state switches are within said housing.

18. Solid state switching apparatus for one or more cells in a battery pack having a positive terminal and a negative terminal, each of said cells having a positive pole and a negative pole, said apparatus comprising:

at least a pair of solid state switches, each switch having a source and a drain, with sources connected;

said solid state switches being connected to the negative pole of said one or more cells in series, and to said negative terminal, the positive pole of said one or more cells being connected to said positive terminal.

19. Apparatus according to claim 18, wherein the solid state switches are transistors, FET, MOSFET, IGBT, JFET, BJT, CMOS, VMOS, TMOS, vertical DMOS or HEXFET.

20. Apparatus according to claim 18, wherein said one or more cells are selected from the group consisting of LiFePO, $LiFePO_4$, $LiFeMgPO_4$, $LiFeYPO_4$, $LiCoO_2$, $LiMn_2O_4$, $LiNiCoAlO_2$, $LiNiMnCoO_2$, $Li_4Ti_5O_{12}$, lead-acid, NiCd, and nickel metal hydride (NiMH) batteries.

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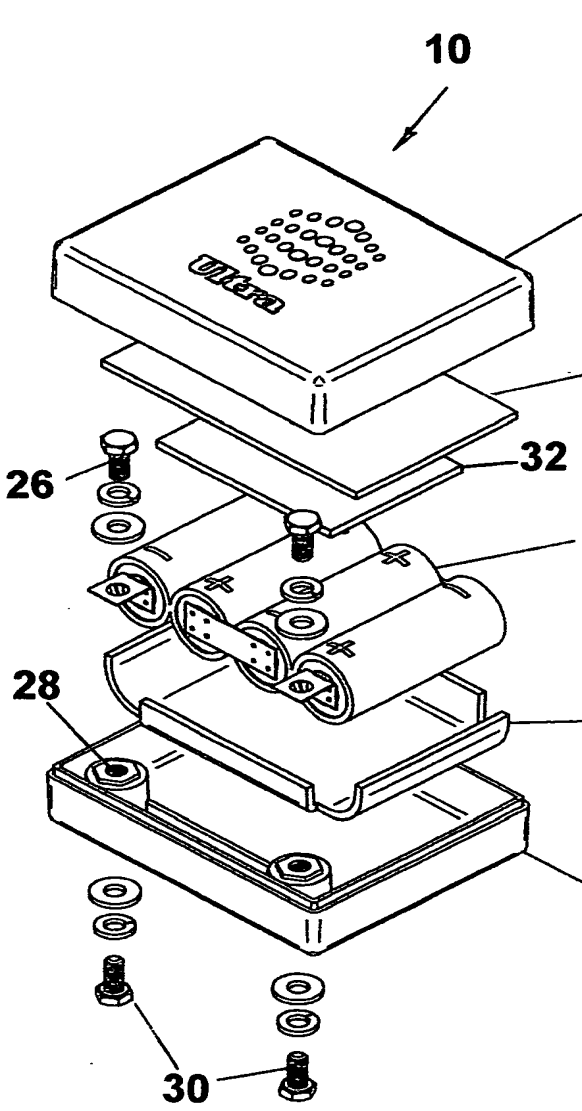


Fig. 1

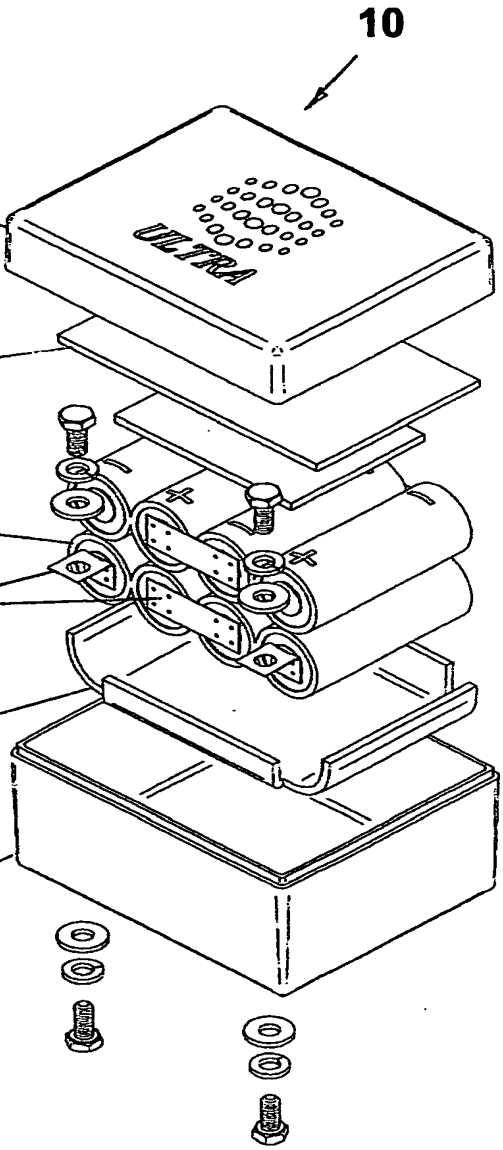


Fig. 2

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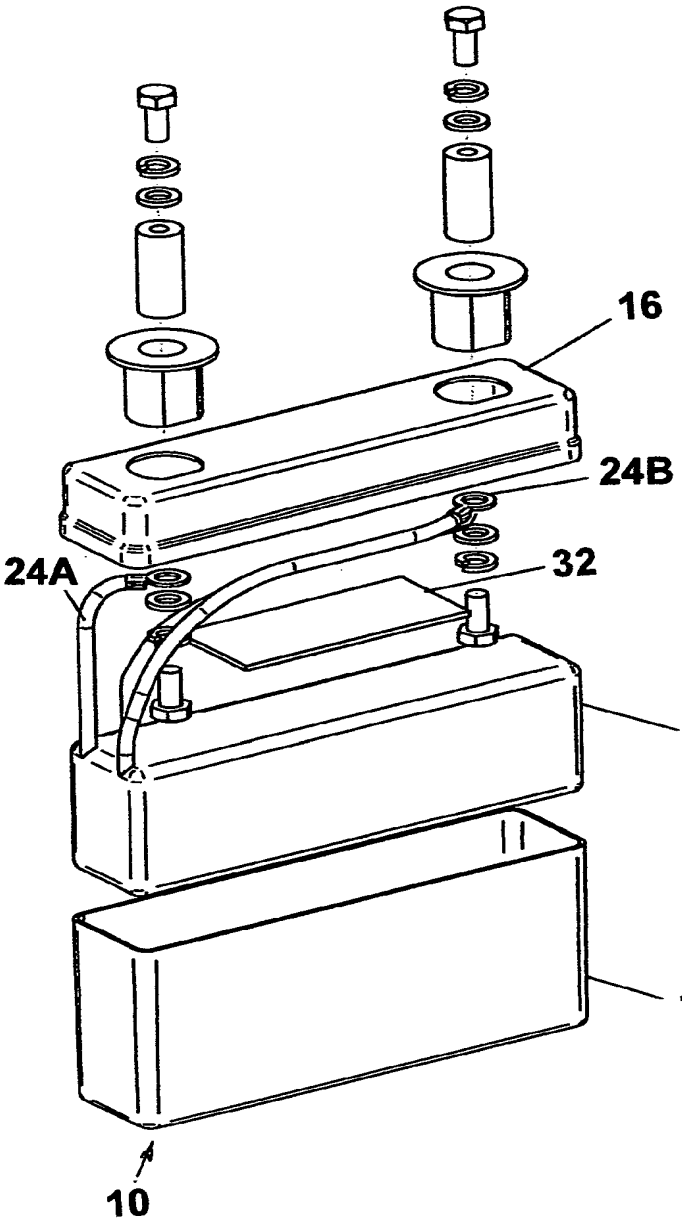


Fig. 3

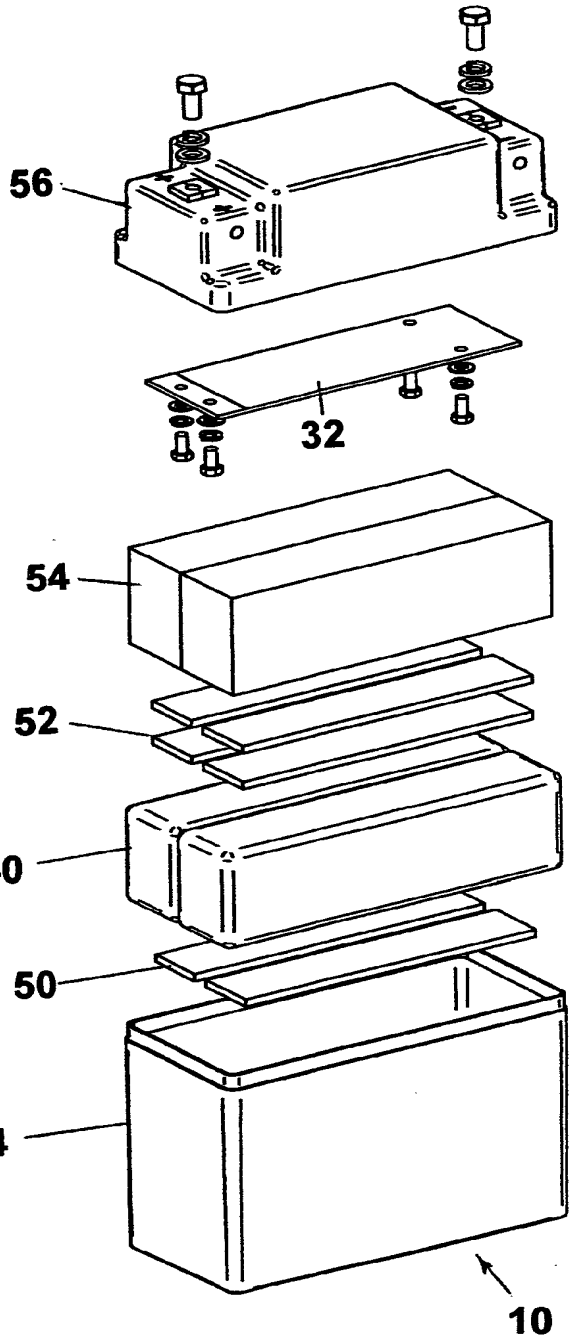


Fig. 13

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Fig. 5

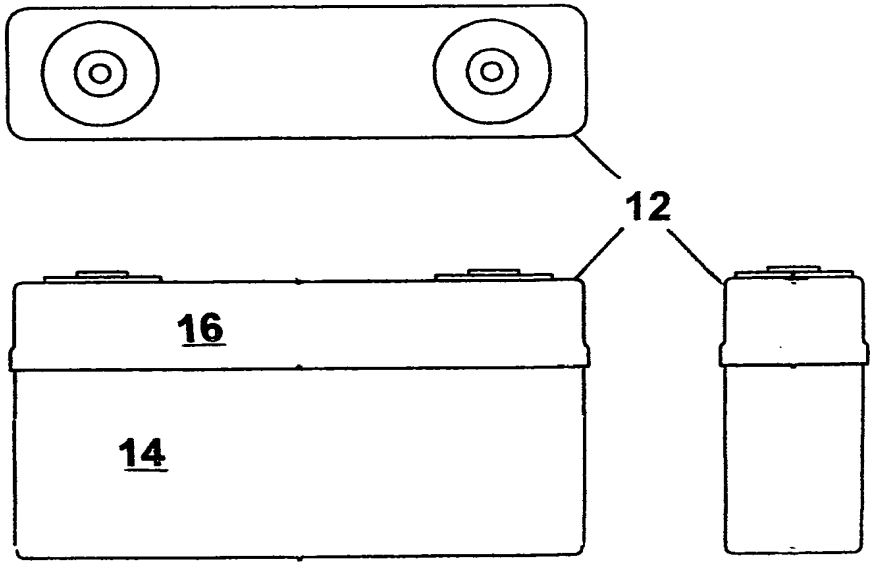


Fig. 4

Fig. 6

Fig. 7

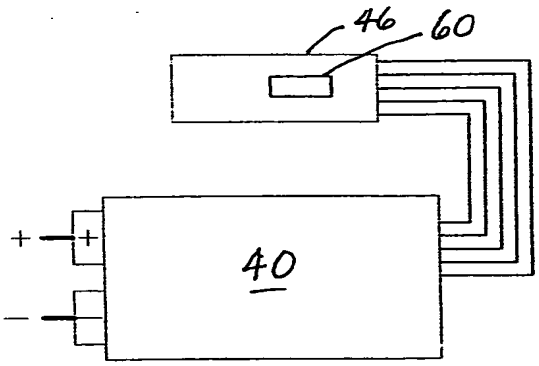
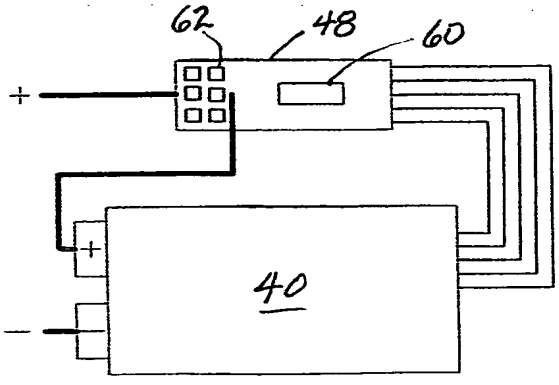


Fig. 8



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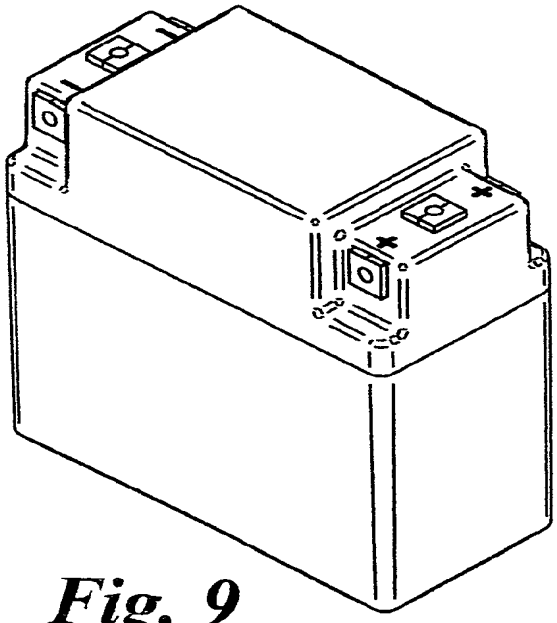


Fig. 9

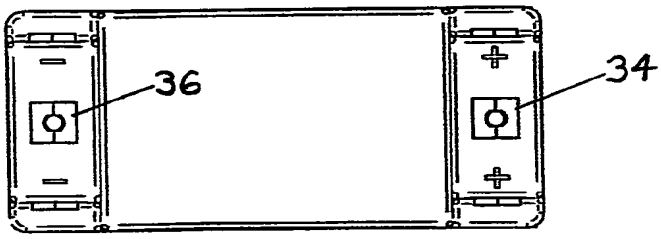


Fig. 10

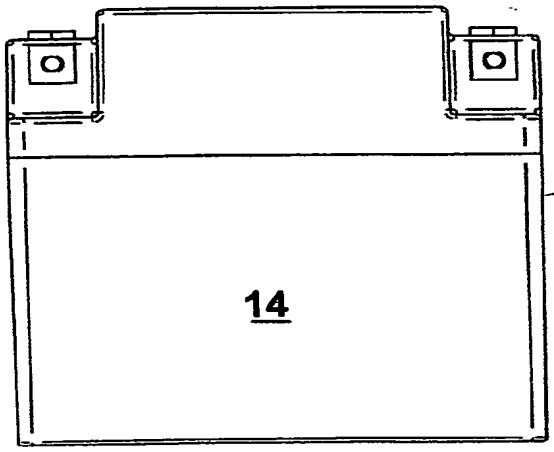


Fig. 11

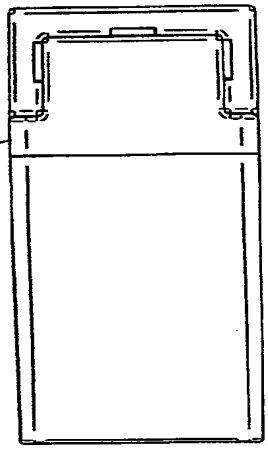


Fig. 12

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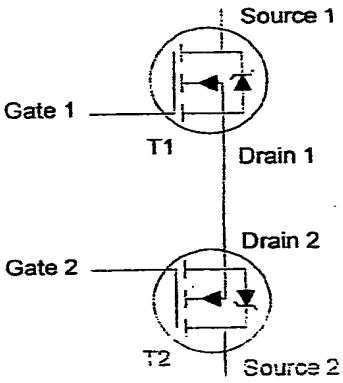


Fig. 14

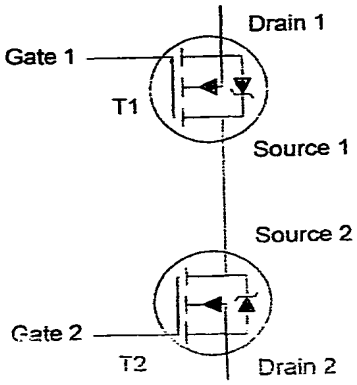


Fig. 15

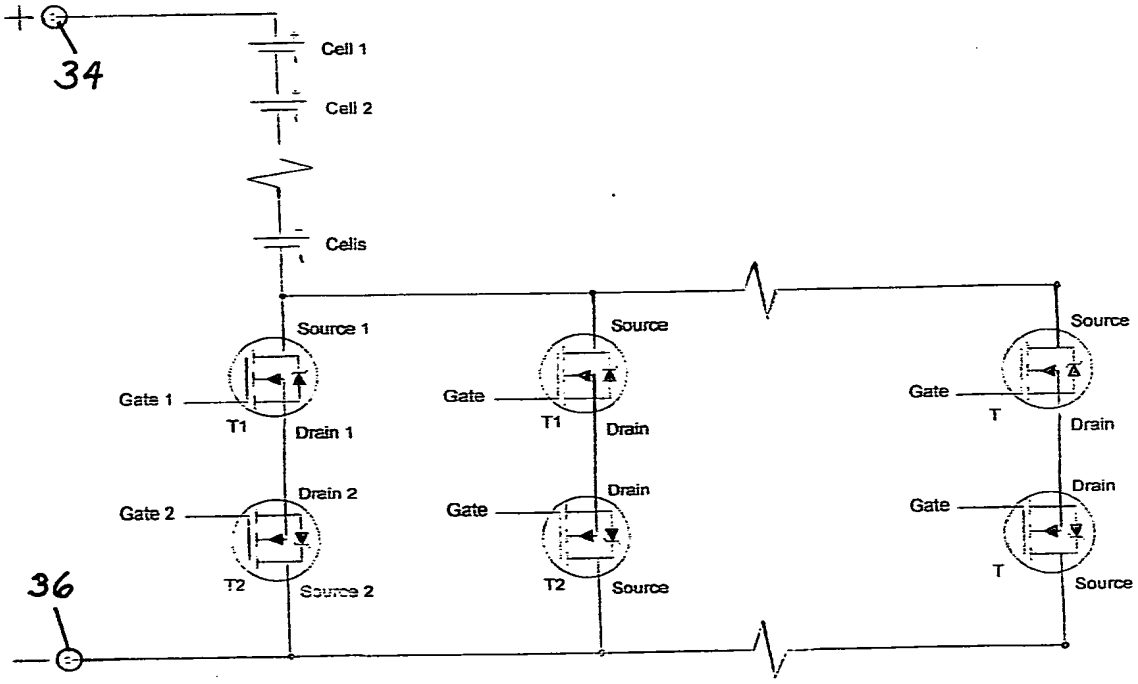


Fig. 16

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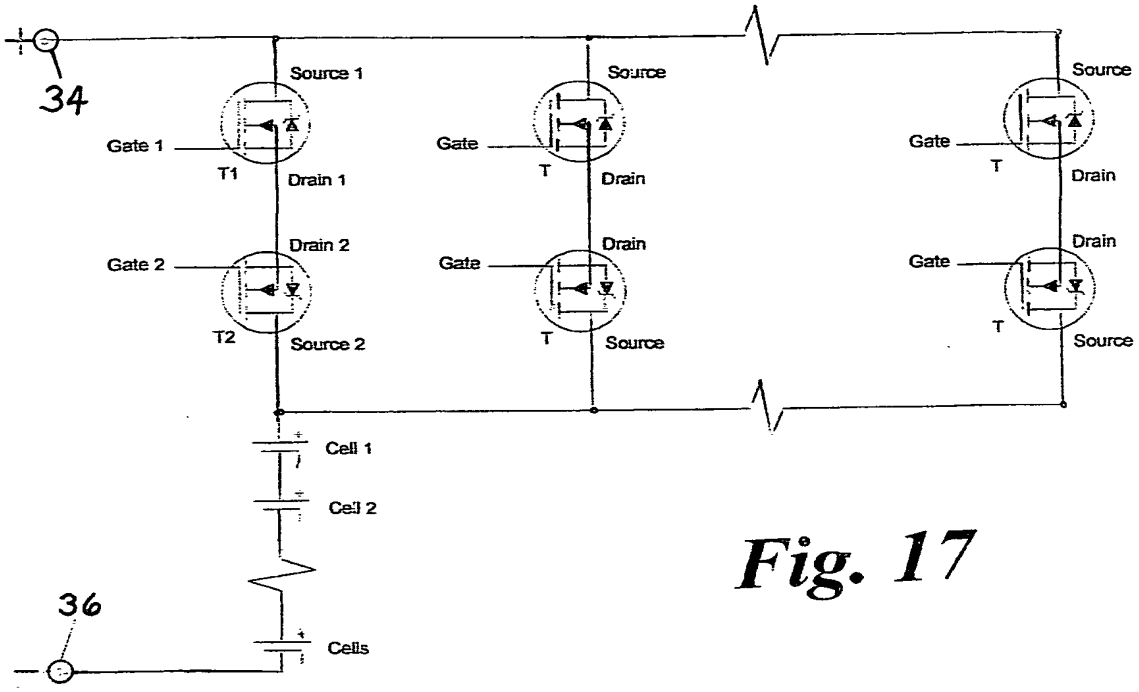

34
Source 1
Gate 1
T1
Drain 1
Drain 2
Gate 2
T2
Source 2
Source
Gate
T
Drain
Drain
Gate
T
Source
Source
Gate
T
Drain
Drain
Gate
T
Source
Cell 1
Cell 2
Cells
36

Fig. 17

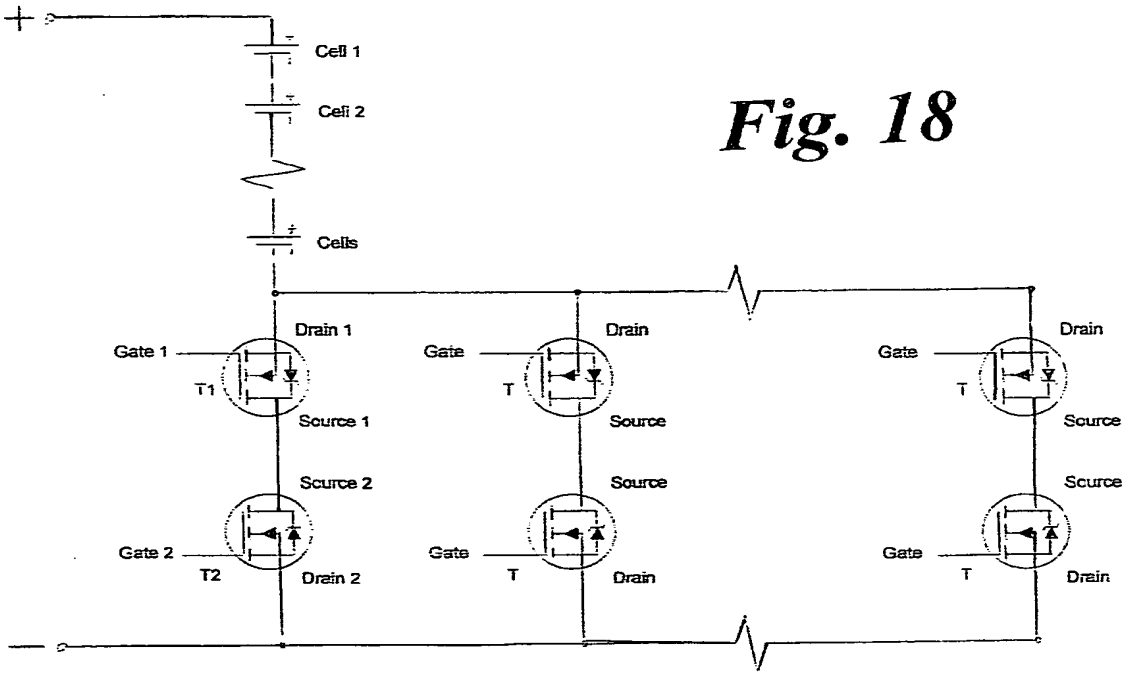

Cell 1
Cell 2
Cells
Drain 1
Gate 1
T1
Source 1
Source 2
Gate 2
T2
Drain 2
Drain
Gate
T
Source
Source
Gate
T
Drain
Drain
Gate
T
Source

Fig. 18

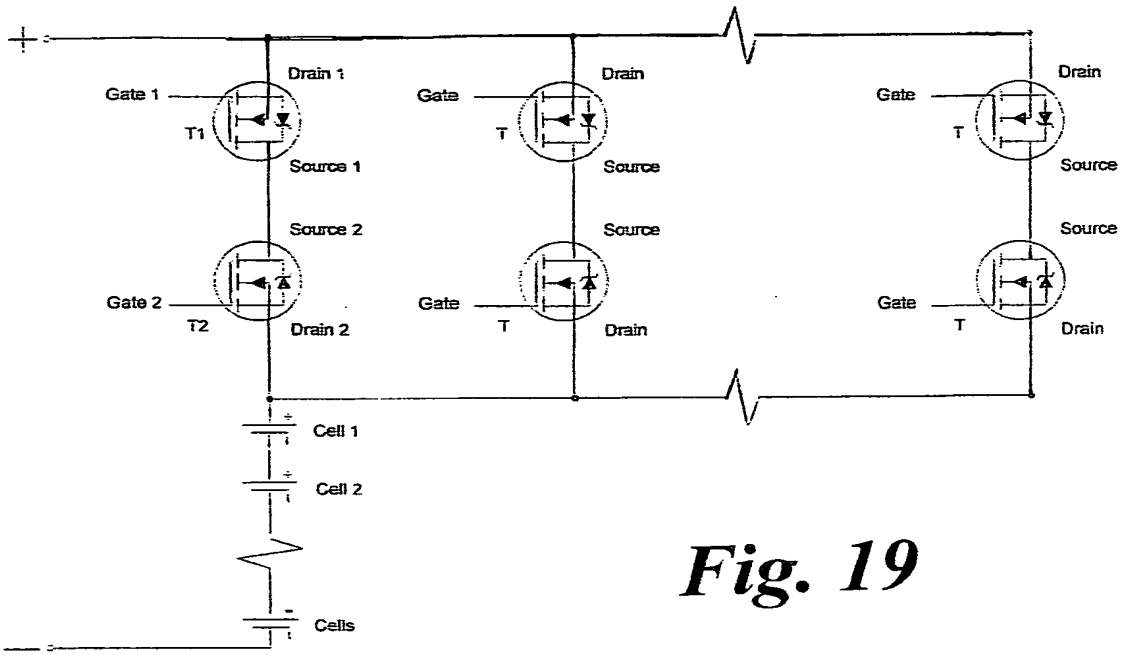

Drain 1
Gate 1
T1
Source 1
Source 2
Gate 2
T2
Drain 2
Gate
T
Drain
Source
Source
Gate
T
Drain
Gate
T
Source
Source
Gate
T
Drain
Cell 1
Cell 2
Cells

Fig. 19

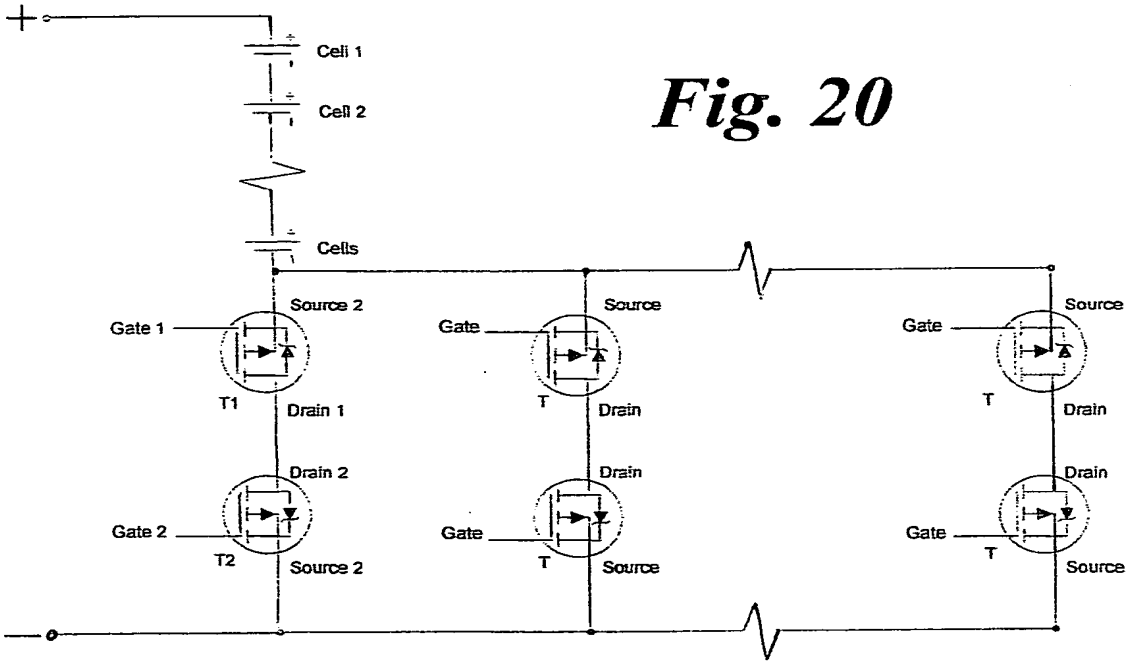

Cell 1
Cell 2
Cells
Source 2
Gate 1
T1
Drain 1
Drain 2
Gate 2
T2
Source 2
Source
Gate
T
Drain
Drain
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Source
Source
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Drain
Gate
T
Source

Fig. 20

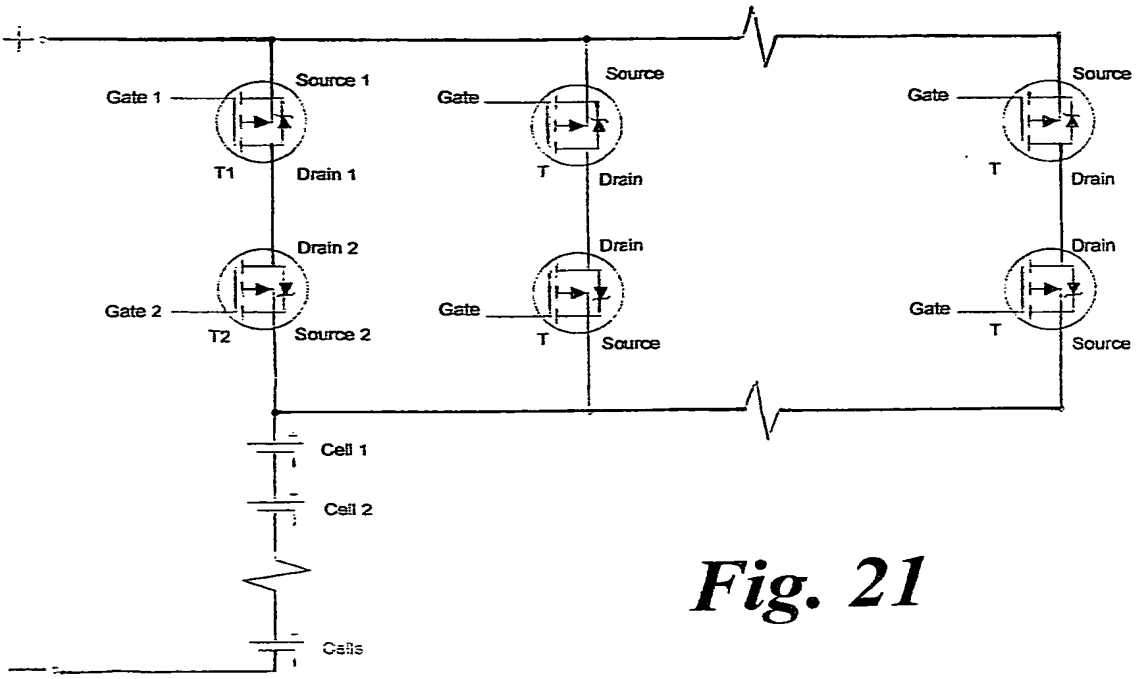

Gate 1
Source 1
T1
Drain 1
Drain 2
Gate 2
T2
Source 2
Gate
Source
T
Drain
Drain
Gate
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Source
Gate
Source
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Drain
Drain
Gate
T
Source
Cell 1
Cell 2
Cells

Fig. 21

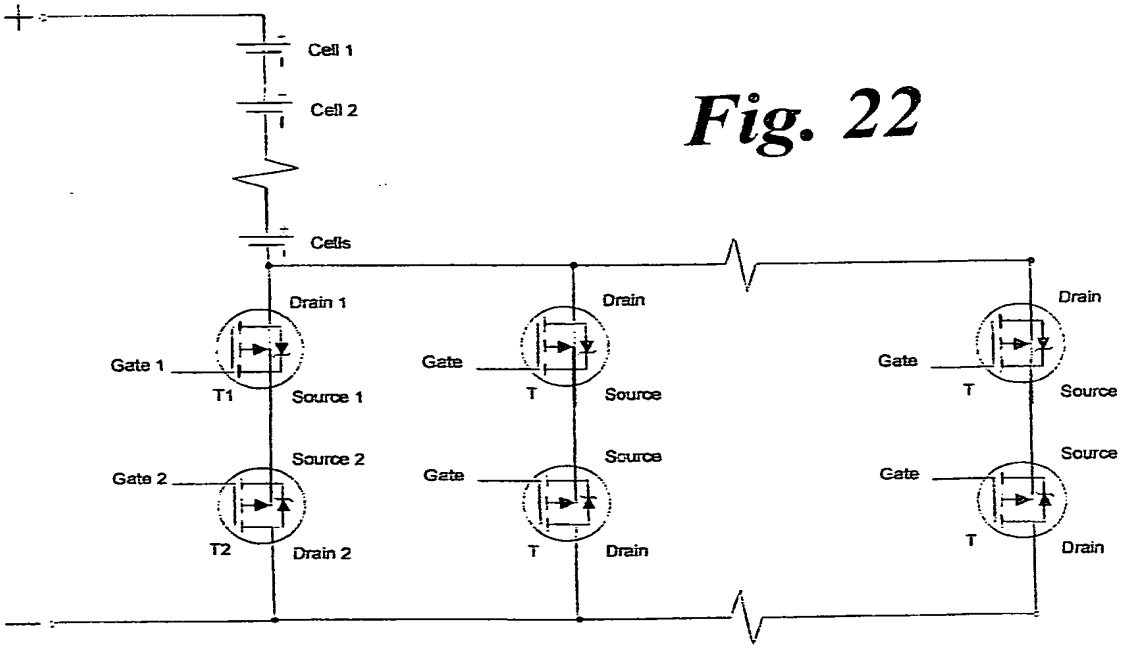

Cell 1
Cell 2
Cells
Drain 1
Gate 1
T1
Source 1
Source 2
Gate 2
T2
Drain 2
Gate
Drain
T
Source
Source
Gate
T
Drain
Drain
Gate
T
Source
Source
Gate
T
Drain

Fig. 22

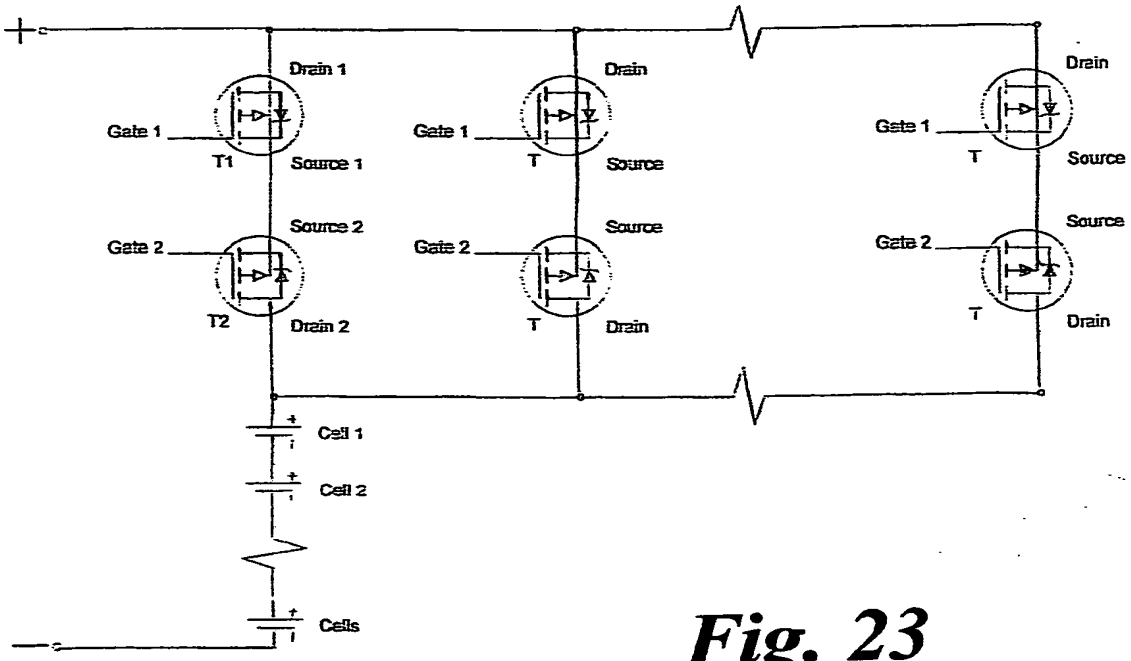

Drain 1
Gate 1
T1
Source 1
Source 2
Gate 2
T2
Drain 2
Drain
Gate 1
T
Source
Source
Gate 2
T
Drain
Drain
Gate 1
T
Source
Source
Gate 2
T
Drain
Cell 1
Cell 2
Cells

Fig. 23

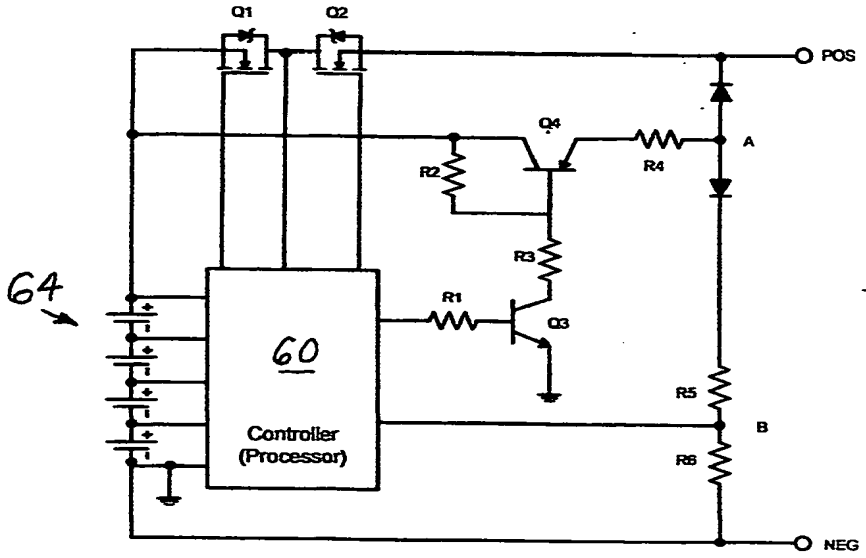

Q1
Q2
POS
Q4
R2
R4
A
R3
R1
Q3
64
60
Controller
(Processor)
R5
B
R6
NEG

Fig. 24

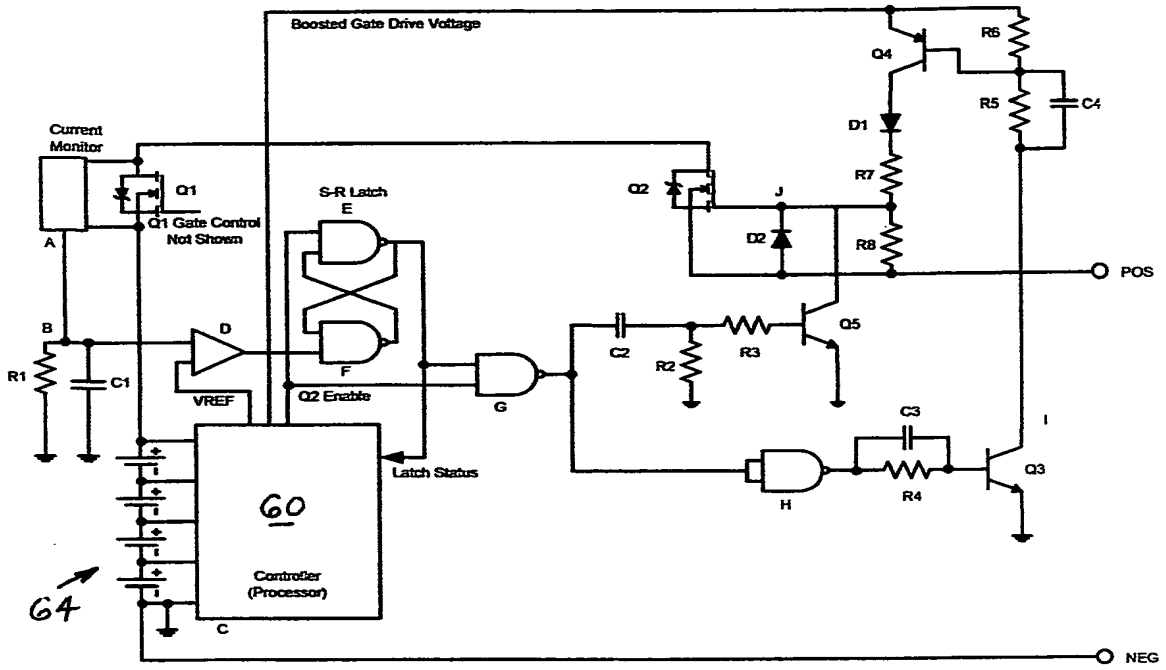


Fig. 25

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/001937

A. CLASSIFICATION OF SUBJECT MATTER
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USPC - 320/121
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(8) - H01M 10/42, 10/44; H02J 7/00 (2012.01)
USPC - 320/104, 110, 112, 116, 118, 121; 429/50, 122, 149, 150, 153, 322

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)
MicroPatent, Google Patents, Google Scholar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2006/0087280 A1 (MIYASHITA et al) 27 April 2006 (27.04.2006) entire document	1, 6-9 --- 2-5, 10-20
Y	US 2009/0123813 A1 (CHIANG et al) 14 May 2009 (14.05.2009) entire document	2-4, 16, 20
Y	US 5,635,821 A (SMITH) 03 June 1997 (03.06.1997) entire document	5, 11-20
Y	US 2007/0080662 A1 (WU) 12 April 2007 (12.04.2007) entire document	10

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"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
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 March 2012	26 MAR 2012
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

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(54) Title: A JUMP STARTER

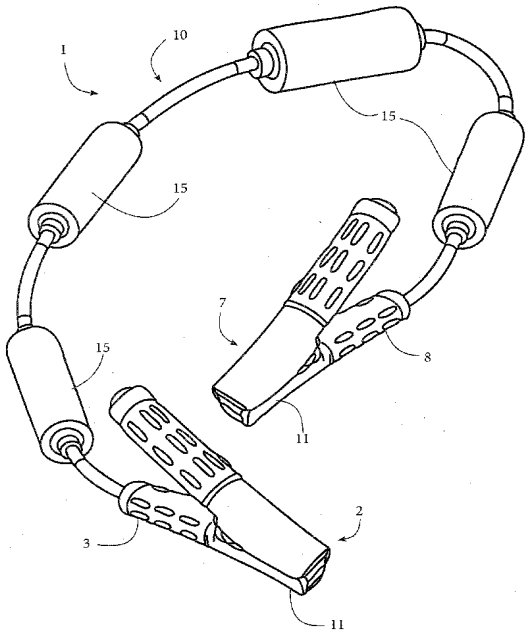


Fig.1

(57) Abstract: A jump starter (1, 30, 50) for a flat battery, such as a vehicle battery has a first clip (2, 20) having. a first handle (3, 25) for connection to one terminal (4) of a battery (5); a second clip (7, 21) having a second handle (15, 25) for connection to a second terminal of a battery, The clips are interconnected (10, 28, 53) and on-board starter batteries (15, 26) are provided along the interconnecting cable (10) and/or at least one of the clips (20, 21). The on-board starter battery (15, 26) may comprise a lithium iron phosphate battery. There may be a control circuit (100, 200) to prevent damage from events such as accidental shorting of the clips.

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"A Jump Starter"

INTRODUCTION

Field of the Invention

This invention relates to a jump starter system for a battery, especially a vehicle battery.

Prior Art Discussion

Jump starter systems for jump starting a flat vehicle battery comprise a pair of leads, each with a clip such as a crocodile clip at each end to connect with the terminals of the flat battery and a charged battery of another vehicle. One lead connects the positive terminal of the flat battery to the positive terminal of a charged battery and a second lead connects the negative terminal of the flat battery to the negative terminal of the charged battery.

Such systems are effective. However in many cases a vehicle with a charged battery is required and it is often difficult to arrange the vehicles to allow the leads to safely extend between the batteries.

It is also known to provide starter packs comprising a lead acid battery within a battery housing and leads for extending from the battery housing to the terminal of the flat battery. Such units are costly, bulky, and heavy, and can generally only be used for large scale commercial applications. Very often, the unit is not used for some time and the battery charge diminishes so that it is not effective when required.

US5607794, US6002235, US2006/0128209, and US2008/0241653 describe various portable starter systems. In these arrangements, starter cables are connected to a battery.

This invention is directed towards providing an engine jump starter system which will address these issues.

SUMMARY OF THE INVENTION

According to the invention, there is provided a jump starter for a battery such as a vehicle battery, the jump starter comprising:-

a first clip having a first handle for connection to one terminal of a battery;

a second clip having a second handle for connection to a second terminal of a battery;

an interconnection means extending between the first clip and the second clip; and

an on-board starter battery means provided along the interconnection means and/or adjacent at least one of the clips.

In one embodiment, the on-board starter battery means comprises a lithium iron phosphate battery.

In one embodiment, there is a plurality of on-board starter batteries along the interconnection means.

In one embodiment, the on-board starter battery means comprises a plurality of separate batteries which are electrically interconnected.

In one embodiment, at least some of the battery means comprises batteries housed within at least one of the first and second handles.

Preferably, said batteries are housed within both the first handle and the second handle.

In one embodiment, the first clip and the second clip are configured to nest together for storage in compact manner.

In one embodiment, the first clip has a housing within which there is a battery, and a pair of jaws linked with the housing; and the second clip is configured to fit alongside the jaws of the first clip in a manner without protruding parts.

Preferably, the first clip has a groove to accommodate the interconnection means during storage.

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In one embodiment, the jump starter further comprises a control circuit having positive and negative leads connected between the on-board starter battery and the clips, and protection means to provide over-voltage and/or over-current protection.

In one embodiment, the protection means comprises a current-limiting component.

In one embodiment, the control circuit further comprises a switch in the negative lead which is turned on for use. In one embodiment, the switch is a solid state switch. In one embodiment, the switch comprises a MOSFET switch. In one embodiment, the switch is an SCR. In one embodiment, there is a plurality of switches arranged in parallel.

In one embodiment, a gate of the switch is connected to the positive lead by a user-activated switch. In one embodiment, the user-activated switch is of the type for momentary closing. In one embodiment, the user-activated switch is connected to the gate via a diode, preferably a Zener diode. In one embodiment, the switch is solid state and is reverse biased to prevent current flow if a system to which the clamps are connected attempts to return charge.

In one embodiment, the protection means comprises a circuit to short gate current to ground in the event of accidental reverse polarity connection.

In one embodiment, the positive lead includes one or more positive thermal coefficient fuses protecting against short circuit conditions and excessive power demands by achieving a very high resistance, thus limiting current flow, and once normal conditions are restored dropping to a low resistance.

In one embodiment, there is a resistor and an LED in parallel with the fuse such that if the fuse resistance goes high almost all of the battery voltage will appear across the resistor thus providing a current flow to illuminate the LED, and when the fuse is in a low resistance state and operating normally the resistor and the fuse are effectively short circuited, providing a visual indication of overload conditions.

In one embodiment, the positive lead includes a bank of switches connected in such a way as to utilise their intrinsic diodes for the purposes of reverse blocking of current, in which gate to source is short circuited, thus holding the switches in a permanent OFF state.

In one embodiment, an RC time constant circuit is linked with the negative lead switch or switches, said time constant circuit being arranged to set the run time of the jump starter and preventing the jump starter from being left in a constant ON condition.

In one embodiment, the time constant circuit is arranged to provide a soft turn on of the jump starter power, preventing transient voltage damage as a result of arcing or high di/dt induced voltages in an electrical system to which the starter is connected.

DETAILED DESCRIPTION OF THE INVENTION

Brief Description of the Drawings

The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only with reference to the accompanying drawings in which:-

Fig. 1 is a perspective view of an engine jump starter system according to the invention;

Fig. 2 is an elevational view of the jump starter system of Fig. 1, in use;

Fig. 3 is a perspective view of another engine jump starter system according to the invention;

Fig. 4 is an enlarged view of the battery connection clips of the jump starter system of Fig. 3;

Fig. 5 is an elevational view of the starter system of Figs. 3 and 4, in use;

Figs. 6 and 7 are perspective views of an alternative starter system ready for use;

Figs. 8 and 9 are perspective views of this system when in the storage position; and

Figs. 10 to 12 are circuit diagrams for circuits of starter systems of various embodiments.

Description of the Embodiments

Referring to Figs. 1 and 2 there is illustrated a jump starter system 1 according to the invention. The jump starter system comprises a first crocodile clip 2 having a first handle 3 for connection to one terminal 4 of a flat vehicle battery 5. The system also comprises a second crocodile clip 7 having a second handle 8 for connection to another terminal 9 of the flat vehicle battery 5. An electrical interconnection lead 10 extends between the first clip 2 and the second clip 7. Each clip has spring biased jaws 11. In the invention there is an on-board starter battery which comprises a plurality of interconnected batteries 15 which may be of the lithium iron phosphate type. The battery cells can be of either cylindrical, prismatic or pouch type. The voltage is between 3.2 and 3.7 V nominal and of lithium iron chemistry.

As illustrated, the on-board starter batteries 15 extend along the interconnection lead 10. They are relatively small and lightweight and can be readily interconnected to form the jump starter system as illustrated.

To jump start a flat battery only one jump lead is required with two simple clip connections 2, 7 to the flat battery 5. Immediate power is supplied to the flat battery 5 without the requirement of another vehicle with a charged battery. The unit is lightweight and easily stored, for example, in a vehicle boot or glove compartment. The system has superior starting ability, lifespan, and energy retention than other jump starter systems.

Referring now to Figs. 3 to 5 there is illustrated another jump starter system, 30, according to the invention. In this case, clips 20, 21 have the clip jaws 11 and have handles 25 of cylindrical shape. In this embodiment there are two batteries 26 housed within each handle 25, and finger-gripping features 27 are provided to aid user operation. The clips are interconnected by a cable 28, with no need for batteries along the length of the cable in this case.

Referring to Figs. 6 to 9 an alternative jump starter, 50, is shown. The jump starter 50 comprises a first clip 51 and a second clip 52 interconnected by a power cable 53. The first clip 51 has a

housing 55 for a battery of sufficient capacity to provide the full starting power, in this embodiment of the lithium iron phosphate type. Also, the first clip 51 comprises a pair of jaws 56 having finger grips 57 for pressing together for opening and closing. The housing 55 has a groove along one side to accommodate the cable 53 during storage. The clip 52 has a similar pair of jaws 56 with finger grips 57.

The starter 50 is used with the clips 51 and 52 separate as shown in Figs. 6 and 7. Power is provided by the batteries within the housing 55. When not being used, the second clip 52 nests into the first clip 51 alongside the jaws 56 of the first clip 51, as shown in Figs. 8 and 9.

The jump starter 50 involves use of close-proximity high-power batteries of the lithium iron phosphate type. In this case it is more important to provide safety controls, and this is achieved by use of a control circuit in the housing 55. Figs. 10, 11, and 12 illustrate circuits 100, 200, and 300 respectively which may be used in the starter of any embodiment. In this case the starter 50 employs the circuit 300, however it may employ a different circuit depending on the safety requirements and battery types and capacities.

Referring to Fig. 10 the circuit 100 comprises batteries 102, a positive lead 103 with a clamp conductor 104, and a negative lead 105 with a clamp conductor 106. In the positive lead there is a light emitting diode LED2 and a resistor R3 in parallel with a positive thermal coefficient (PTC) resettable fuse 110.

An integrated circuit IC1 is connected via a resistor R2 to the positive lead 103 and is connected to the negative lead 105 via reverse polarity indicator (LED1). Also, a manual contact switch 115 (SW1) is connected on one side to the positive lead 3, and on the other to a Zener diode ZD1, a resistor R1, in turn linked with a bank of MOSFET switches Q1, Q2, and Q3.

The circuit of the jump starter circuit 100 protects from voltage mismatch, reverse polarity, short circuit, over-discharge, and over-use.

The over-current protection element PTC 110 comprises a number of parallel connected positive thermal coefficient PCB mounted resettable fuses. The number and type thereof is determined by the power output requirement. The PTC 110 enables normal usage but protects against short circuit conditions and excessive power demands by achieving a very high resistance, thus

limiting current flow. Once normal conditions are restored, the PTC 110 drops to a low resistance. Light emitting diode LED2 and 1k 0.25w resistor R3 provide an over-current indicator. When the PTC 110 goes high resistance, almost all of the jump starter battery 102 voltage will appear across this device thus providing a current flow to illuminate LED2. When the PTC 110 is in a low resistance state and operating normally, R3 and LED2 are effectively short circuited.

The battery 102 positive terminal is also connected to the momentary action single pole normally open switch SW1 115. This switch, the Zener diode ZD1, the resistor R1 and Metal Oxide Semiconductor Field Effect Transistors (MOSFETS) Q1 to Q3 comprise the power-switching and over-discharge elements.

To activate the jump-starter system it must be connected to a vehicle battery by means of the positive and negative jaws 56 linked to the conductors 104 and 106. The activation switch 115 (SW1) is then briefly depressed. This switch may be located at any convenient location of the housing Current flows from the battery (BAT) via ZD1 and R1 to the gates of International Rectifier IRF1324s MOSFETS (or alternates) Q1, Q2 and Q3 via their respective gate resistors R4, R5 and R6. Capacitor C1 is also charged. Once a Vgs of 10V is applied to the MOSFETS Q1, Q2, and Q3 they begin conducting from drain to source with a very low ON state resistance, typically about 0.00033 Ohms for three parallel connected parts.

After the PTC, the positive supply lead 103 is connected to another trio of International Rectifier IRF1324s MOSFETS (or alternates) Q4, Q5 and Q6. These devices are connected in such a way as to utilise their intrinsic diodes for the purposes of reverse blocking of current. The gate to source is short circuited, thus holding the devices in a permanent OFF state. Should the jump starter circuit 100 be connected to a vehicle with a greater voltage than the unit is intended for, the diodes become reverse biased and no current may flow. This feature protects the jump-starter's internal battery 102 from potentially dangerous overcharge conditions.

Once a successful start has been achieved, the vehicle alternator or charging system will attempt to return charge to the still-connected jump-starter battery 102 (BAT) via the crocodile clamp jaws 56. This could be undesirable for certain battery types. Should this situation occur, the intrinsic diodes in Q4, Q5 and Q6 will become reverse biased, thus preventing this condition

A resistor R7 and a capacitor C1 form an RC time constant circuit. When the switch 15 (SW1) is depressed, C1 rapidly charges via R1. Once in an ON state the gate to source resistance of the MOSFETS is very high, in the order of tens of mega Ohms. Thus the run time of the jump starter circuit 100 can be configured by choice of C1 and R7. Once SW1 is released, C1 begins to discharge via R7. When the voltage across C1 drops below the gate threshold voltage of the MOSFETS, they will rapidly come out of conduction and switch off the output. This auto – off feature prevents the unit from being left in a constant ON condition with resultant live crocodile clamps.

The RC circuit of R7 and C1 provides another important element. As the voltage across C1 will require a certain time to reach the gate threshold voltage of the MOSFETS Q1, Q2, and Q3, they will spend a small amount of time in their active region and provide a soft turn on of the jump starter circuit 100 power. This prevents transient voltage damage as a result of arcing or high di/dt induced voltages in the vehicle electrical system.

The circuit also protects against accidental reverse polarity connection. Should the operator inadvertently connect the jump starter circuit 100 backwards to the vehicle battery (i.e. positive clamp 4 to negative terminal and vice versa), the system offers two levels of protection. The first level is passive. As the MOSFETS Q1 through Q3 are non-conductive, no current flow takes place upon connection. This eliminates any potentially dangerous and destructive electrical arcing at the vehicle battery terminals. Such arcing conditions have been linked with the destruction of modern vehicle electronic controls. Secondly, current from the vehicle battery flows via the resistor R2, reverse polarity indicator LED1 and the input side of the semiconductor photo-relay type TLP222 (IC1) thus illuminating LED1 and the input photo LED in IC1. Even if the vehicle battery is severely discharged, the current requirement of IC1 is very small and will in most cases be less than 5 mA. Should the user ignore the reverse polarity indicator LED1 and depress SW1, MOSFET gate current is shunted to ground via an output MOSFET in IC1 thus preventing the successful triggering of Q1-Q3 and damage to the vehicle or to the jump starter 1.

The Zener diode ZD1 in the gate trigger circuit protects against excessive discharge of the jump starter battery 102 (BAT). If the battery has been drained past an acceptable point its potential is no longer sufficient to overcome ZD1 and thus no gate current reaches the MOSFETS Q1-Q3.

The jump starter circuit 100 may not then be used until it has been recharged, thus preserving the life of the battery 102.

Unlike other jump starter protection circuits that require a vehicle battery to be present for correct operation, this jump starter circuit 100 can operate with a completely dead battery or none at all. However in this case, reverse polarity detection is not available.

The following are advantageous aspects of the invention.

- Solid state switching. There are no contacts to weld, burn out, or arc.
- Soft switching.
- Electrical transient protection for modern motor vehicle electronics.
- Operator protection from arcing, explosion etc.
- Jump starter product protection from misuse.
- Battery protection. Ensures long life.
- Low component count
- Cost effective
- Passive safety
- Visual indicators of fault conditions
- No possibility of damage through operator error such as short circuit etc.
- Low power dissipation. Can be used with traditional lead acid batteries without power loss.

In other embodiments the role of the switches Q1-Q3 may alternatively be performed by a device such as s silicon controlled rectifier for example. This is a simpler circuit, and also would have the benefit of automatic power off upon disconnection and automatic reverse blocking. Referring to Fig. 11 a circuit 200 has a positive lead 203 with a clamp conductor 204 and a negative lead 205 with a clamp conductor 206. There are a PTC fuse 210, a battery 212, and a momentary switch 215 for performing the same functions as for the circuit 100. However, in this case the switch 215 is linked with an SCR. Other alternatives may include use of insulated gate bipolar transistors (IGBTs) or standard bipolar transistors.

In a still further embodiment, referring to Fig. 12, a 4-cell Lithium iron battery is connected to a positive jump-starter clamp by means of a number of parallel connected positive thermal coefficient (PTC) type resettable fuses. The negative battery lead is directly connected to the

negative jump starter clamp. A warning light emitting diode LED1 and its associated series limiting resistor are connected in parallel with the PTC devices. During normal engine starting operation the PTC devices are cold and exhibit a low resistance thus permitting normal current flow. As there is little voltage drop across the devices in this state, LED1 is extinguished.

Should any of the following fault conditions occur: clamp short circuit, reverse connection to vehicle or incorrect voltage selection, then a larger than normal current flow will result causing the PTC devices to rapidly warm up and exhibit a high resistance thus limiting current flow to a very low level and preventing damage to the jump starter unit or the flat battery. As most of the battery (BAT1) voltage will now be developed across the PTC devices, LED1 is illuminated thus informing the user that a fault condition has occurred. Once the fault is removed, LED1 is extinguished and after a short delay the PTCs return to normal temperature and resistance and normal operation is resumed.

Transient voltage suppression diodes (TVS) D1 and D2 are connected across the output leads. These devices (typical rating of 5kW each) prevent any transient or induced voltages from damaging the vehicle or the starter. Unlike the typical sure protection employed in a traditional jump starter which employs voltage dependent resistor (VDR) type devices, the TVS can respond much quicker and quench much more energy thus providing a better solution.

It will be appreciated that the invention provides for much more convenient jump starting. It allows a user to carry the starter in the vehicle, and avoids need to hook up to another vehicle and all of the attendant disadvantages.

The invention is not limited to the embodiments described but may be varied in construction and detail.

Claims

1. A jump starter for a battery such as a vehicle battery, the jump starter comprising:-

a first clip (2, 20) having a first handle (3, 25) for connection to one terminal (4) of a battery (5);

a second clip (7, 21) having a second handle (15, 25) for connection to a second terminal of a battery;

an interconnection means (10, 28) extending between the first clip and the second clip; and

an on-board starter battery means (15, 26) provided along the interconnection means (10) and/or adjacent at least one of the clips (20, 21).

2. A jump starter as claimed in claim 1, wherein the on-board starter battery means (15, 26) comprises a lithium iron phosphate battery.

3. A jump starter as claimed in claims 1 or 2, wherein there is a plurality of on-board starter batteries (15) along the interconnection means.

4. A jump starter as claimed in claim 1 or 2 or 3, wherein the on-board starter battery means (15, 26) comprises a plurality of separate batteries which are electrically interconnected.

5. A jump starter as claimed in claim 4, wherein at least some of the battery means comprises batteries (26) housed within at least one of the first and second handles.

6. A jump starter as claimed in claim 5, wherein said batteries are housed within both the first handle (25) and the second handle (25).

7. A jump starter as claimed in claims 5 or 6, wherein the first clip (56) and the second clip (56) are configured to nest together for storage in compact manner.

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8. A jump starter as claimed in claim 7, wherein the first clip (51) has a housing (55) within which there is a battery, and a pair of jaws (56) linked with the housing; and the second clip (52) is configured to fit alongside the jaws of the first clip in a manner without protruding parts.

9. A jump starter as claimed in claim 8, wherein the first clip (51) has a groove (60) to accommodate the interconnection means (53) during storage.

10. A jump starter as claimed in any preceding claims, further comprising a control circuit having positive and negative leads connected between the on-board starter battery and the clips, and protection means to provide over-voltage and/or over-current protection.

11. A jump starter as claimed in claim 10, wherein the protection means comprises a current-limiting component.

12. A jump starter as claimed in claims 10 or 11, wherein the control circuit further comprises a switch (Qi-Q3) in the negative lead which is turned on for use.

13. A jump starter as claimed in claim 12, wherein the switch is a solid state switch.

14. A jump starter as claimed in claims 12 or 13, wherein the switch comprises a MOSFET switch.

15. A jump starter as claimed in claim 13, wherein the switch is an SCR.

16. A jump starter as claimed in any of claims 12 to 15, wherein there is a plurality of switches (Q1-Q3) arranged in parallel.

17. A jump starter as claimed in any of claims 12 to 16, wherein a gate of the switch is connected to the positive lead by a user-activated switch (115, 215).

18. A jump starter as claimed in claim 17, wherein the user-activated switch is of the type for momentary closing.

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19. A jump starter as claimed in claims 17 or 18, wherein the user-activated switch is connected to the gate via a diode (ZD1), preferably a Zener diode.

20. A jump starter as claimed in any of claims 12 to 19, wherein the switch is solid state and is reverse biased to prevent current flow if a system to which the clamps are connected attempts to return charge.

21. A jump starter as claimed in any of claims 17 to 20, wherein the protection means comprises a circuit to short gate current to ground in the event of accidental reverse polarity connection.

22. A jump starter as claimed in any of claims 10 to 21, wherein the positive lead includes one or more positive thermal coefficient fuses (10, 110) protecting against short circuit conditions and excessive power demands by achieving a very high resistance, thus limiting current flow, and once normal conditions are restored dropping to a low resistance.

23. A jump starter as claimed in claim 22, wherein there is a resistor and an LED in parallel with the fuse such that if the fuse resistance goes high almost all of the battery voltage will appear across the resistor thus providing a current flow to illuminate the LED, and when the fuse is in a low resistance state and operating normally the resistor and the fuse are effectively short circuited, providing a visual indication of overload conditions.

24. A jump starter as claimed in any of claims 10 to 23, wherein the positive lead includes a bank of switches connected in such a way as to utilise their intrinsic diodes for the purposes of reverse blocking of current, in which gate to source is short circuited, thus holding the switches in a permanent OFF state.

25. A jump starter as claimed in any of claims 10 to 24, wherein an RC time constant circuit is linked with the negative lead switch or switches, said time constant circuit being arranged to set the run time of the jump starter and preventing the jump starter from being left in a constant ON condition.

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26. A jump starter as claimed in claim 25, wherein the time constant circuit is arranged to provide a soft turn on of the jump starter power, preventing transient voltage damage as a result of arcing or high di/dt induced voltages in a electrical system to which the starter is connected.

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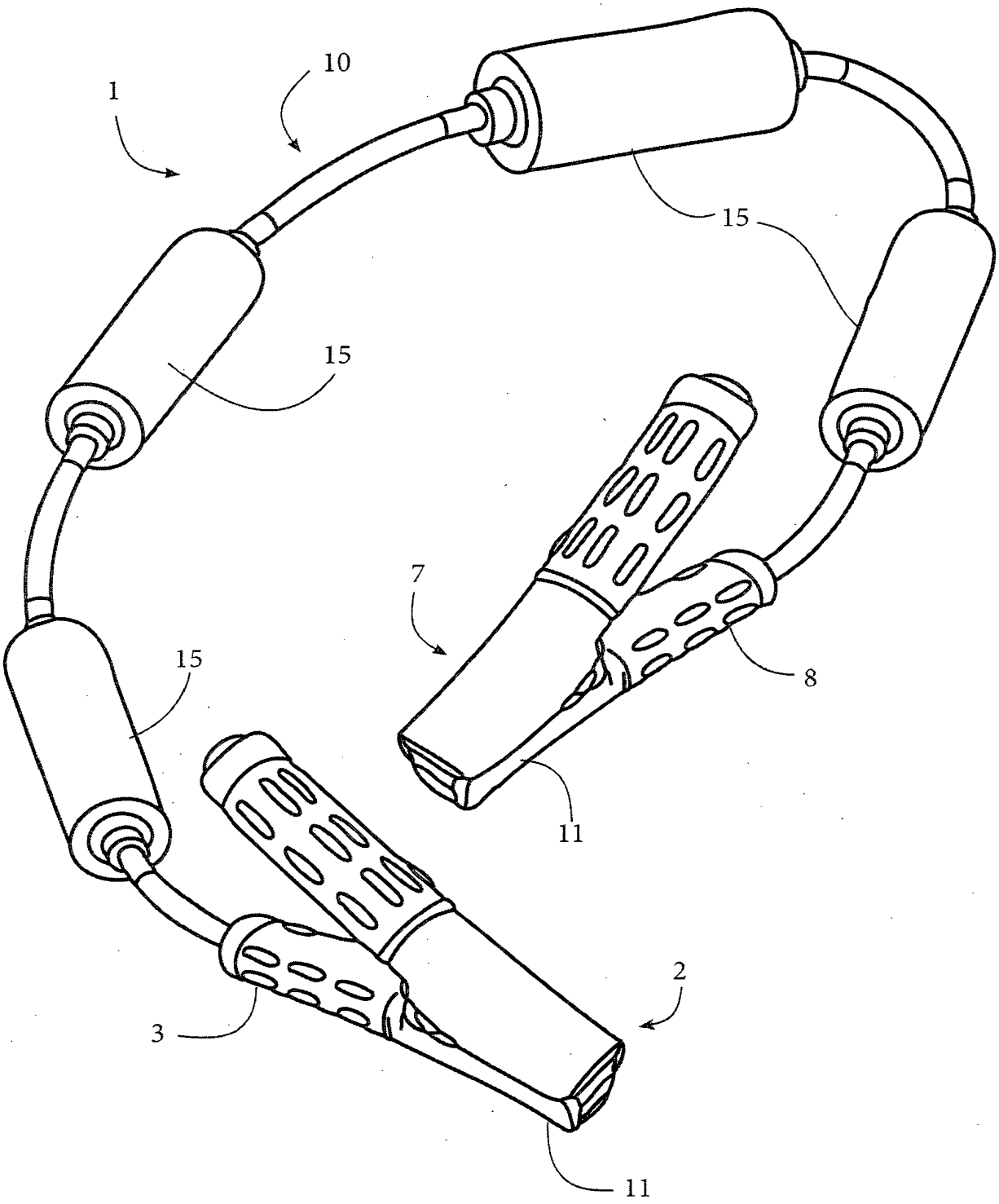


Fig.1

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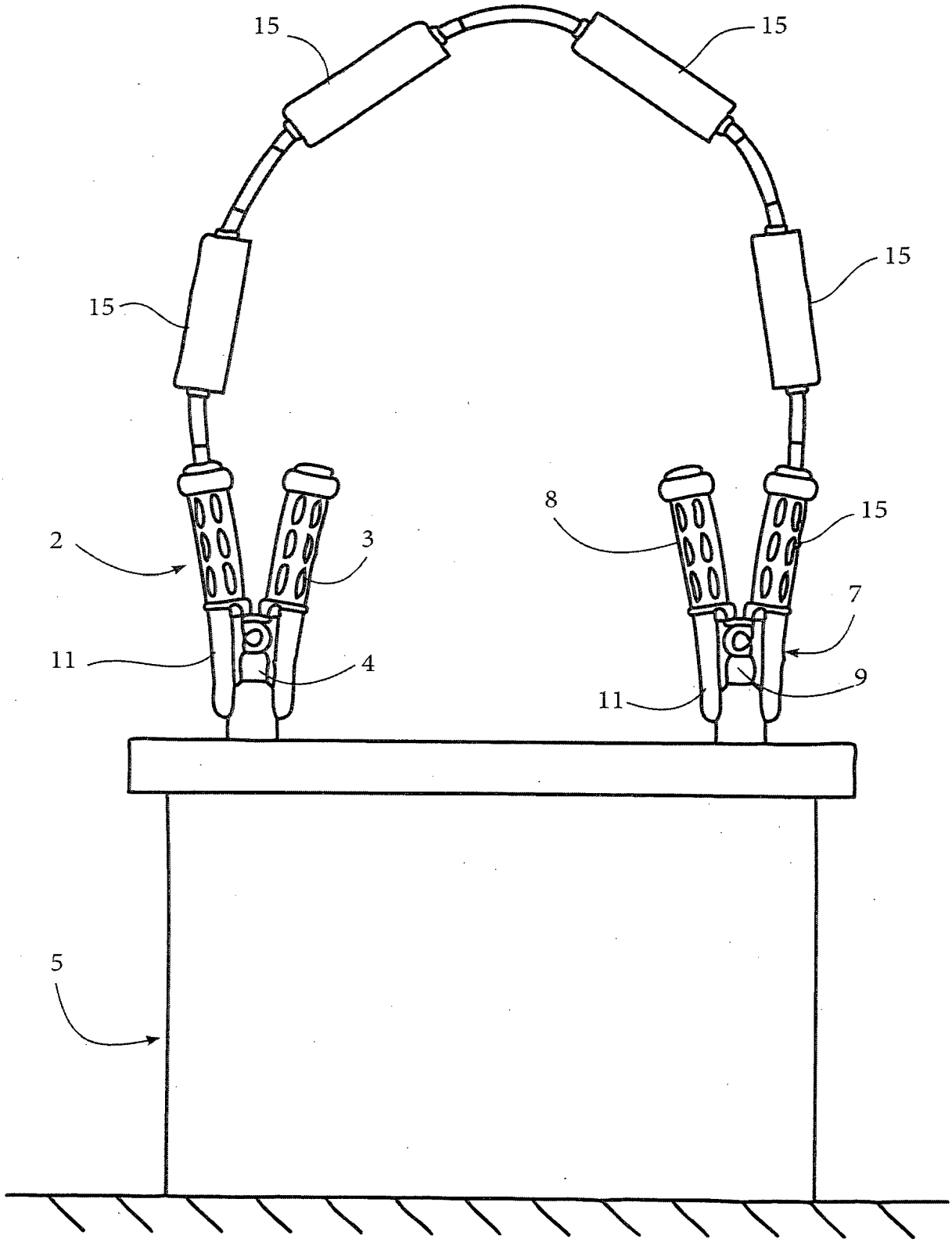


Fig.2

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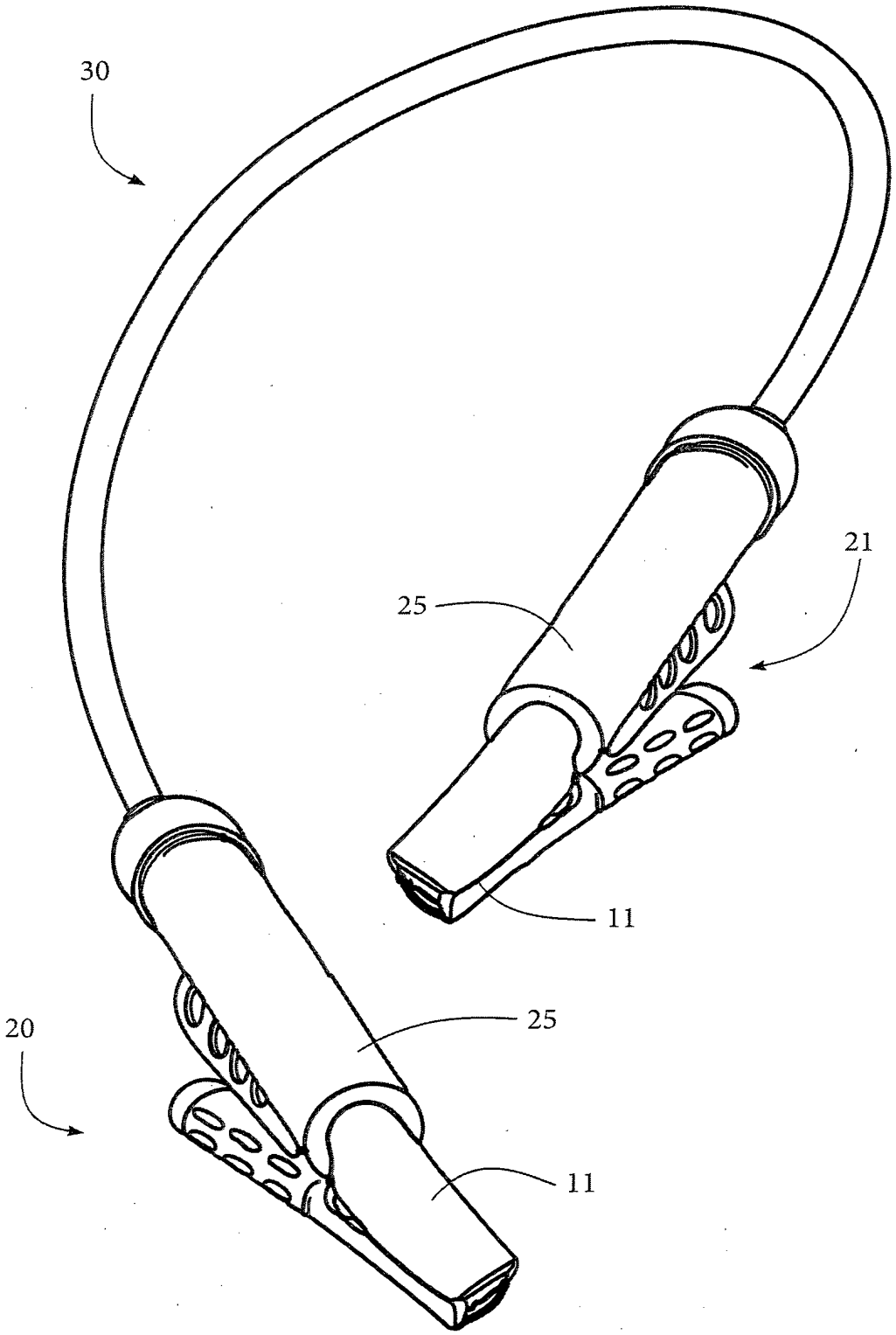


Fig.3

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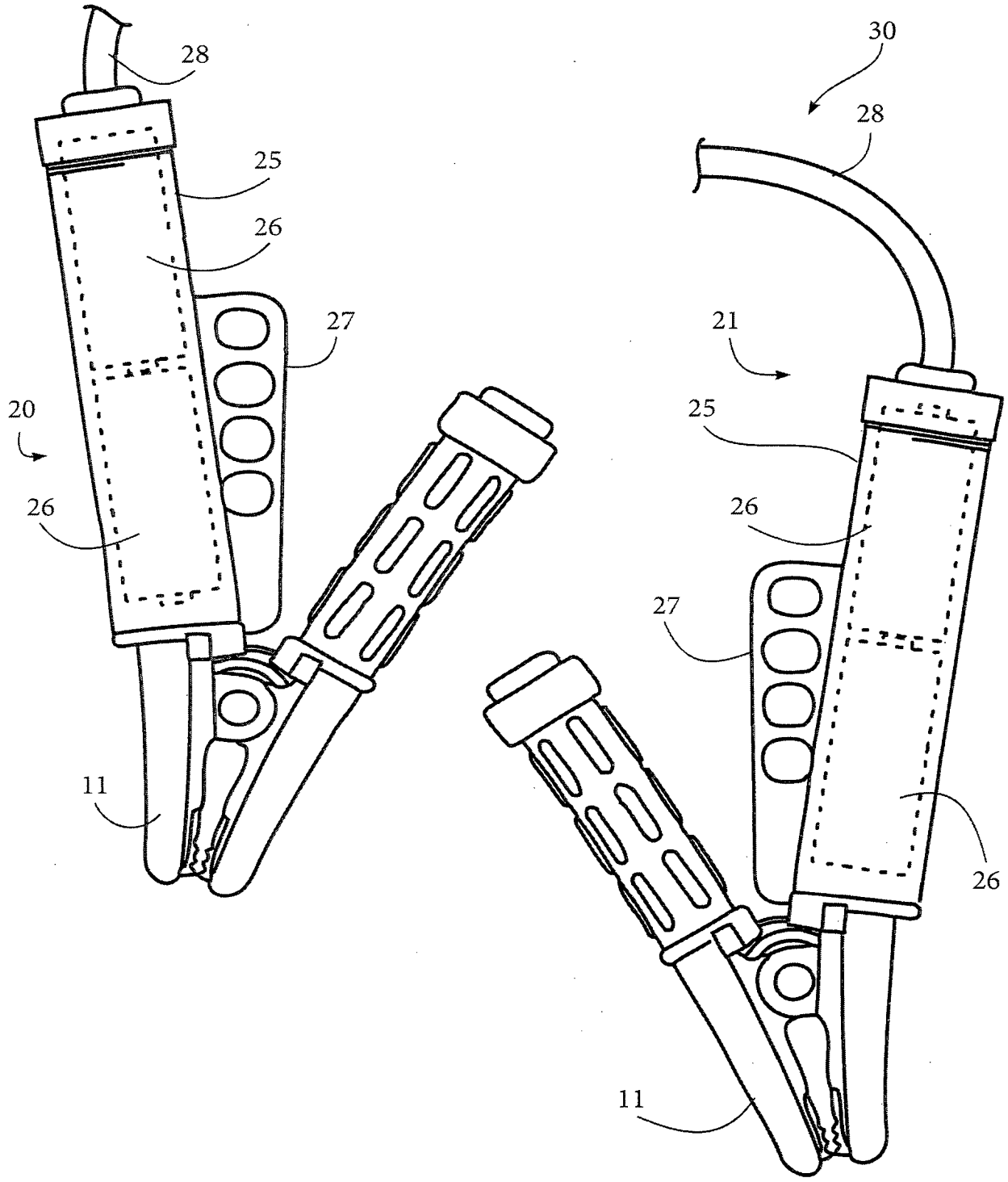


Fig.4

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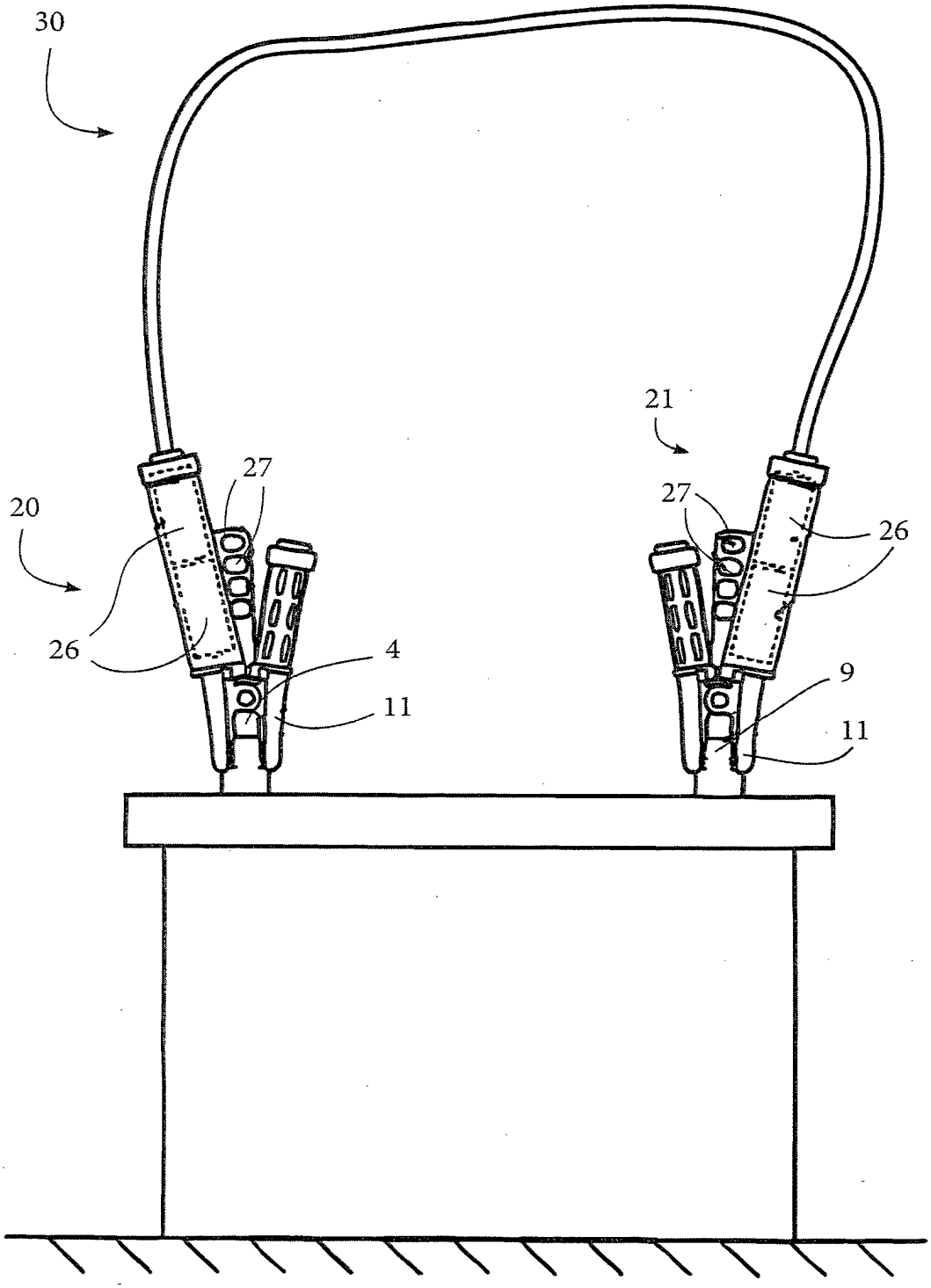


Fig.5

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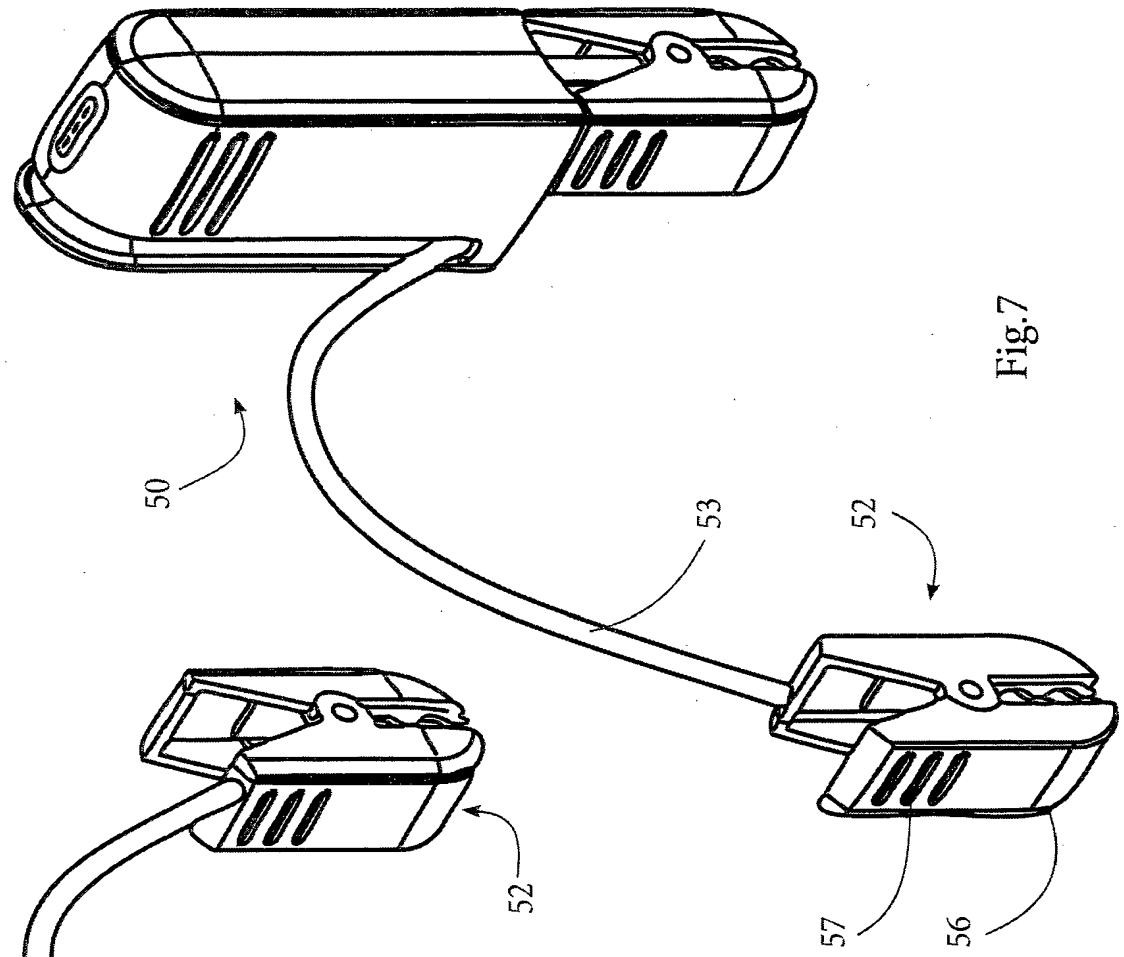


Fig.7

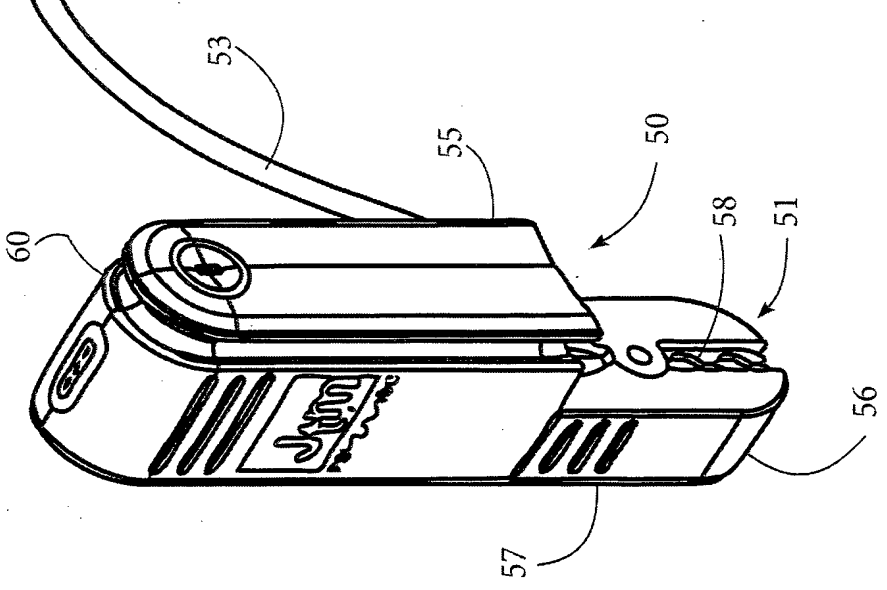


Fig.6

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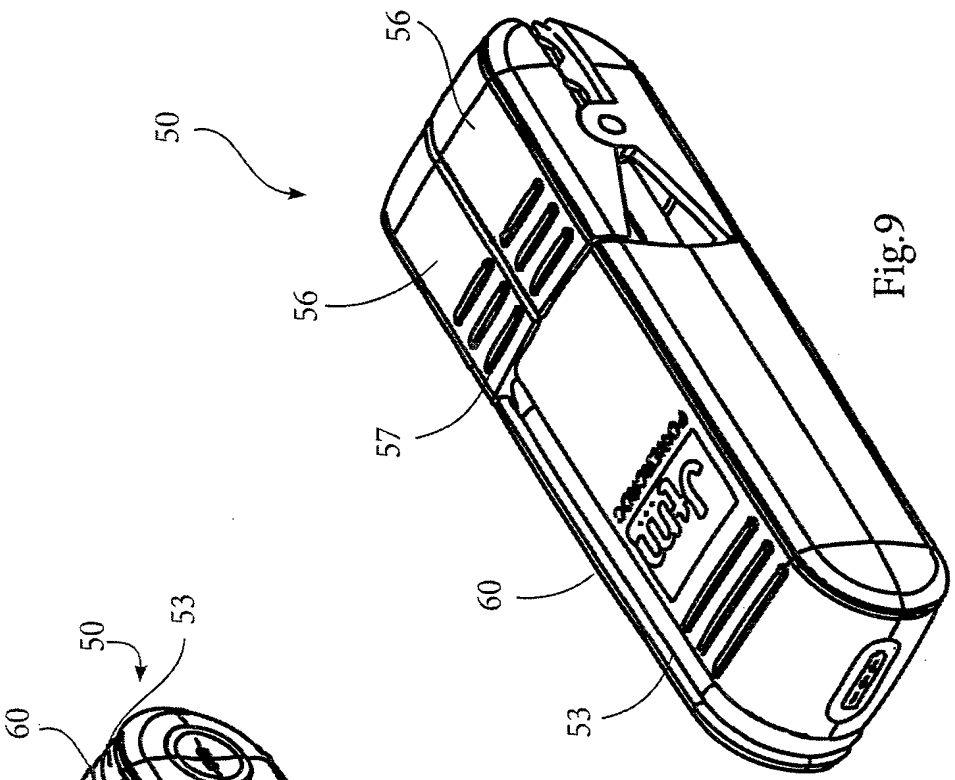


Fig.9

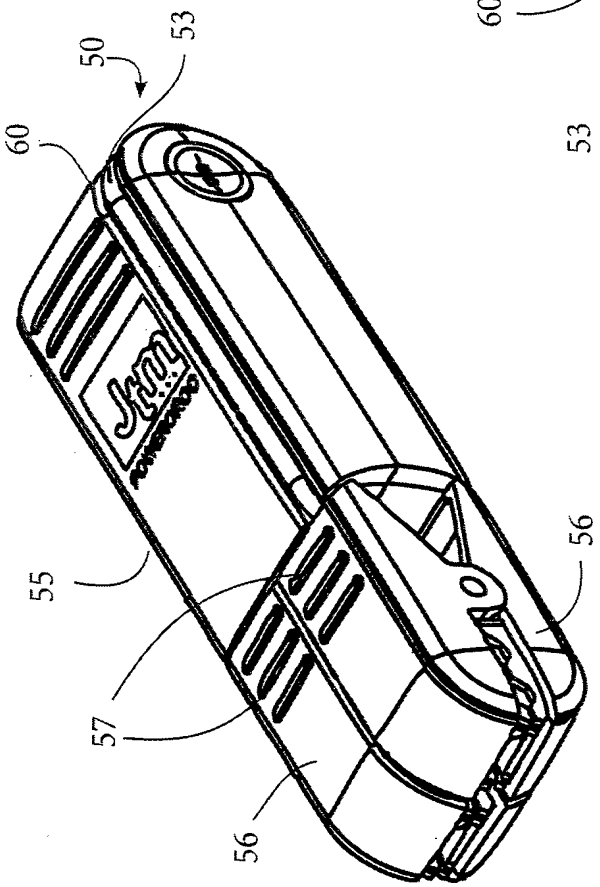


Fig.8

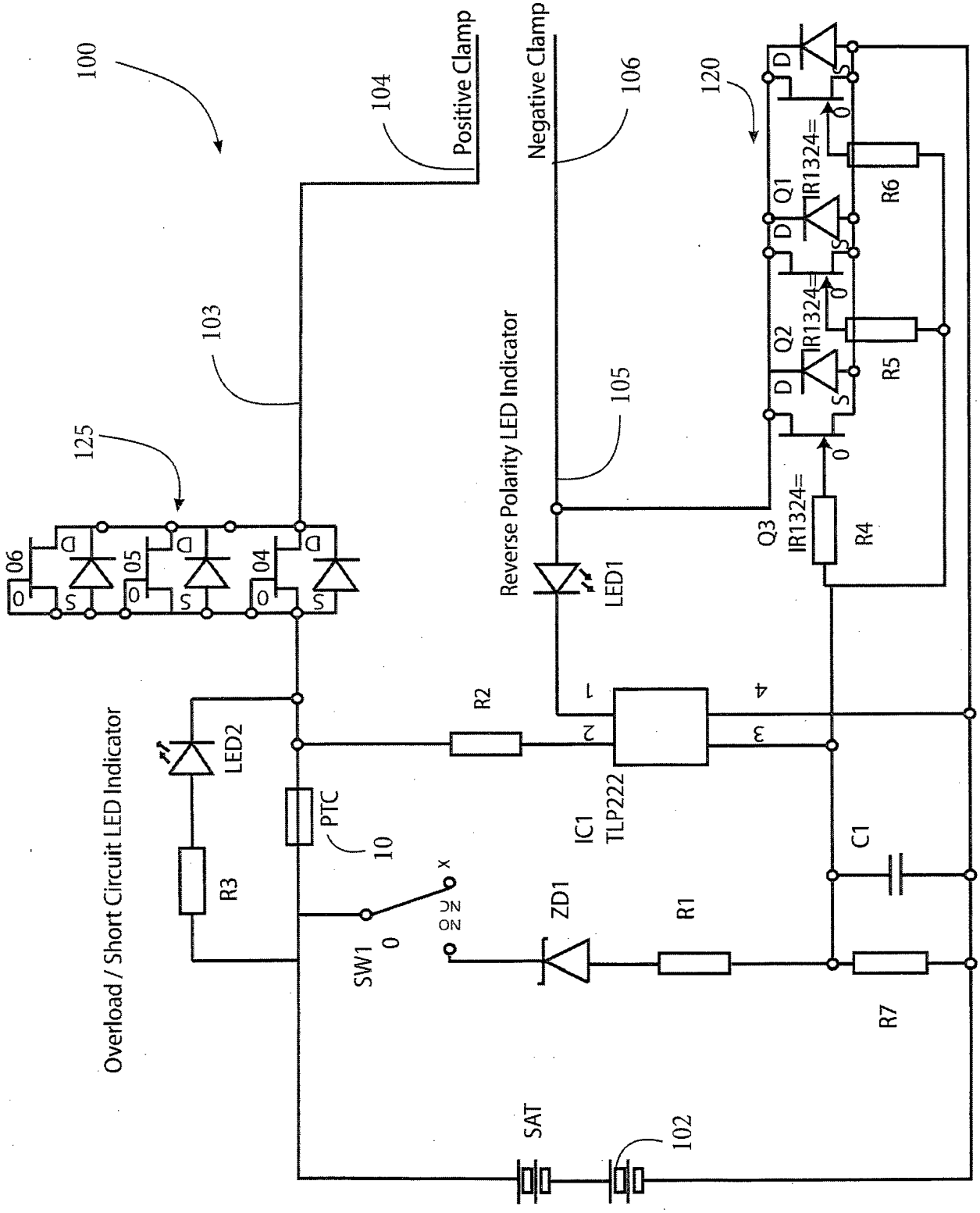


Fig.10

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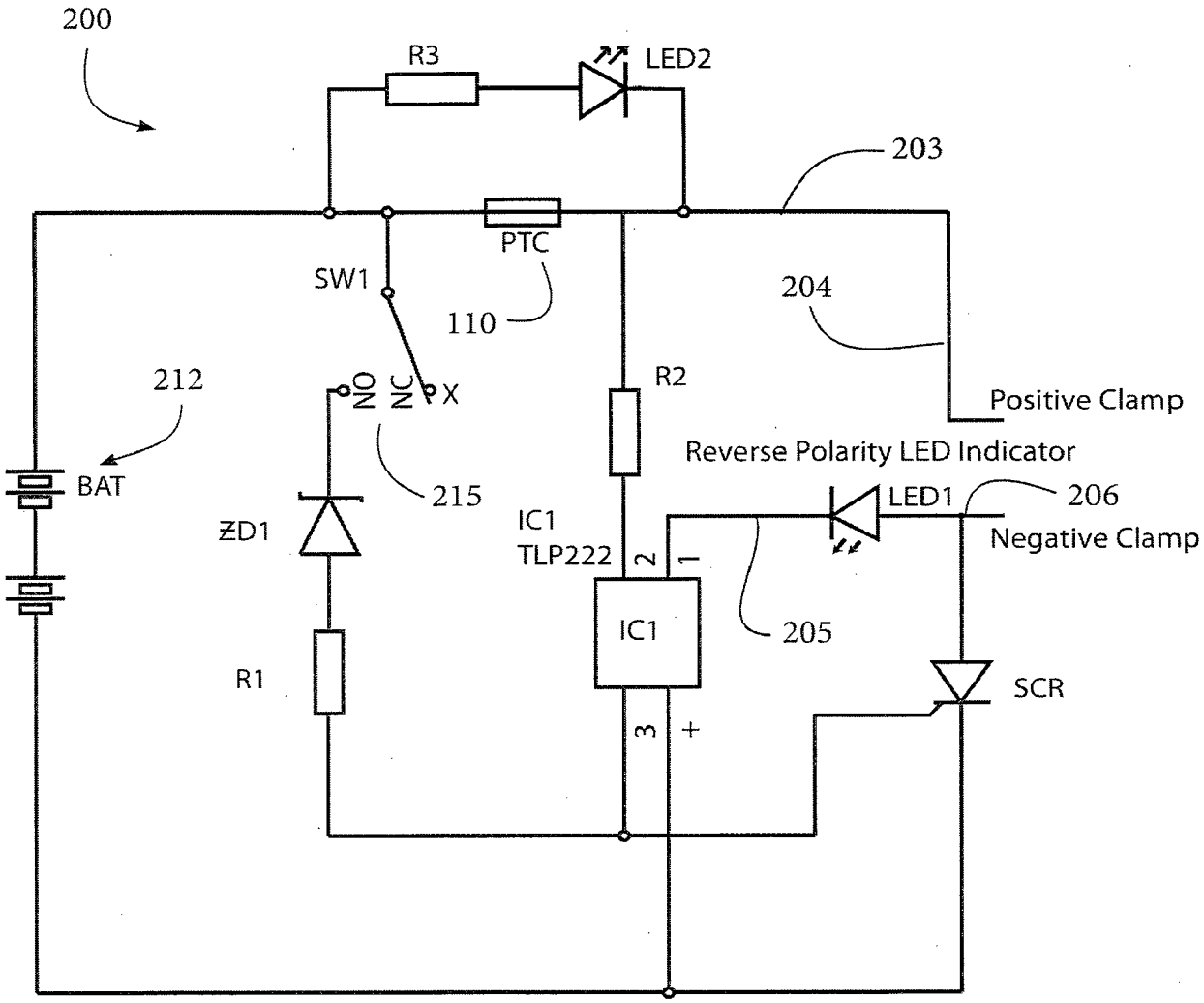

200
R3
LED2
203
PTC
SW1
110
204
212
NO
NC
X
R2
Positive Clamp
Reverse Polarity LED Indicator
BAT
215
LED1
206
ZD1
IC1
TLP222
Negative Clamp
2
1
IC1
205
R1
SCR
3
+

Fig.11

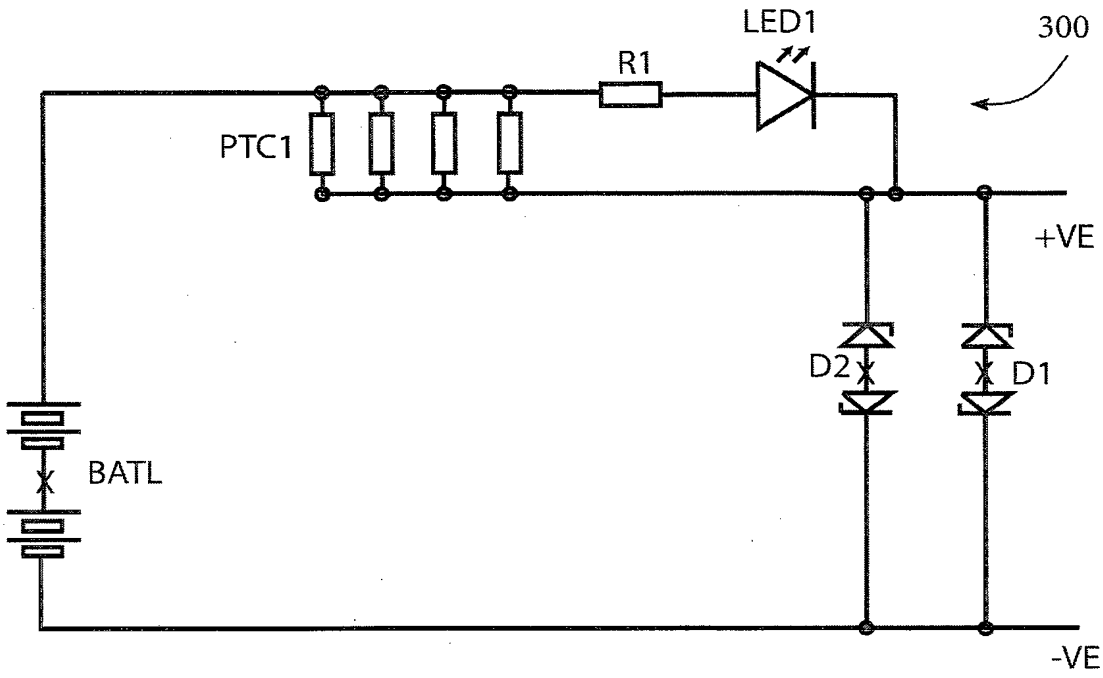


Fig.12

INTERNATIONAL SEARCH REPORT

International application No
PCT/IE2011/000066

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01M2/20 H01M10/44 H01M10/46 H01M10/052 H01R11/24
H01M4/58
ADD.
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)
H01R H01M

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 002 235 A (CLORE KEVIN L [US]) 14 December 1999 (1999-12-14) cited in the application	1-4, 10-26
A	abstract column 2, lines 23-59 figures 1-6	5-9

X	US 5 985 481 A (CHAMPAGNE RICHARD F [US] ET AL) 16 November 1999 (1999-11-16)	1-4, 10-26
A	column 2, line 39 - column 4, line 55 figures 1-10	5-9

A	US 5 083 076 A (SCOTT CLYDE A [US]) 21 January 1992 (1992-01-21) abstract figures 1-9 column 1, line 45 - column 2, line 29	1-26

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[X] Further documents are listed in the continuation of Box C.

[X] 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

"E" earlier document 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

"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

"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	Date of mailing of the international search report
21 February 2012	29/02/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Kelly, Michael

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IE2011/000066

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 840 583 A (MOORE DONALD M [US]) 20 June 1989 (1989-06-20) figures 1-4 abstract column 2, line 6 - column 3, line 44	1-26
A	US 4 163 134 A (BUDROSE CHARLES R [US]) 31 July 1979 (1979-07-31) abstract figures 1-9 column 1, line 43 - column 2, line 29	1-26
A	EP 2 209 153 A1 (HENGDIAN GROUP DMEGC MAGNETIC [CN] HENGDIAN GROUP DMEGC MAGNETIC LTD C) 21 July 2010 (2010-07-21) page 2, paragraph 0001-0005	1-26
A	US 6 254 426 B1 (IACOVELLI MARC [US] ET AL) 3 July 2001 (2001-07-03) column 1, line 48 - column 3, line 14 figures 1-2	1-26

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IE2011/000066

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6002235 A	14-12-1999	NONE	
US 5985481 A	16-11-1999	NONE	
US 5083076 A	21-01-1992	NONE	
US 4840583 A	20-06-1989	NONE	
US 4163134 A	31-07-1979	NONE	
EP 2209153 A1	21-07-2010	AT 543227 T	15-02-2012
		EP 2209153 A1	21-07-2010
		US 2010167127 A1	01-07-2010
US 6254426 B1	03-07-2001	CN 1264191 A	23-08-2000
		DE 19957873 A1	03-08-2000
		GB 2347562 A	06-09-2000
		US 6254426 B1	03-07-2001

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Espacenet

JP2001069673A POWER SUPPLY FOR VEHICLE

Applicants: HITACHI LTD

Inventors: SAITO HIROYUKI

Classifications:
IPC ***B60R16/02; B60R16/04; F02D45/00; F02N11/08; H02G3/16; H02J7/00;*** (IPC1-7): B60R16/02; F02D45/00; F02N11/08; H02G3/16; H02J7/00;

Priorities: JP24475299A 1999-08-31

Application: JP2001069673A·1999-08-31

Publication: JP2001069673A·2001-03-16

Published as: JP2001069673A

POWER SUPPLY FOR VEHICLE

Abstract

PROBLEM TO BE SOLVED: To omit a harness for connection between a fuse relay box and a battery by placing an electric circuit unit at the upper part of a battery fixing means and connecting only the positive-pole terminal of the battery to the electric circuit unit. SOLUTION: To secure a battery 123 on a vehicle body, a frame 118 is put over the top of the battery 123, and the battery is installed on the vehicle body with stays 121 and 122 and tightened with nuts 119 and 120. A fuse relay box 103 of an electric circuit units fastened to and secured on the upper part of the frame 118 as a battery fixing means by a means such as an adhesive. A booster cable is connected only to the positive-pole terminal of the battery 123, and an insulating protective cover 107 is secured detachably on the fuse relay box 103 so as to cover the positive-pole terminal.

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(19)日本国特許庁（ＪＰ）　(12) **公開特許公報**（Ａ）　(11)特許出願公開番号
特開2001－69673
（P2001－69673A）
(43)公開日　平成13年３月16日(2001.3.16)

(51)Int.Cl.[7]	識別記号	ＦＩ		ﾃｰﾏｺｰﾄﾞ(参考)
Ｈ０２Ｊ　7/00		Ｈ０２Ｊ　7/00	Ｐ	
	３０１		３０１Ｂ	
Ｂ６０Ｒ　16/02	６１０	Ｂ６０Ｒ　16/02	６１０Ｚ	
16/04		16/04	Ｃ	
Ｆ０２Ｄ　45/00	３９５	Ｆ０２Ｄ　45/00	３９５Ａ	

審査請求　未請求　請求項の数２　ＯＬ　（全　５　頁）　最終頁に続く

(21)出願番号　特願平11－244752

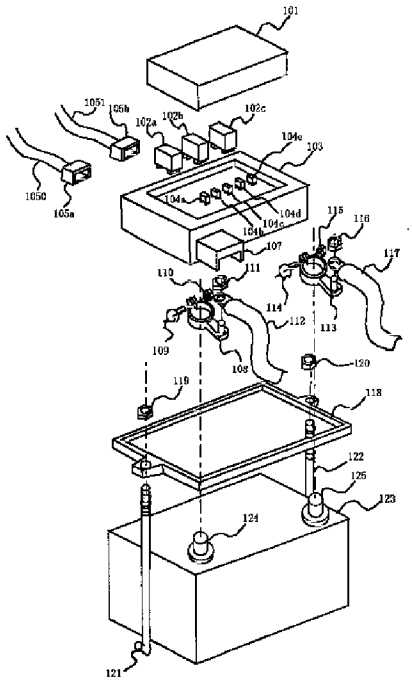
(22)出願日　平成11年８月31日(1999.8.31)

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弁理士　作田　康夫

(54)【発明の名称】　車両用電源装置

(57)【要約】
【課題】車両用バッテリに積み重ねて搭載されるヒューズ・リレーボックスに関し、バッテリの大きさに依存せず、ジャンパスタートが可能なヒューズ・リレーボックスを構成することが可能な車両用電源装置の構造を提供する。
【解決手段】バッテリを固定するフレームにヒューズ・リレーボックスを取り付け、バッテリの大きさ毎にフレームを用意して、ヒューズ・リレーボックスは標準化されたものを組み合わせることにより、バッテリの大きさに依存しないヒューズ・リレーボックスを構成する。ヒューズ・リレーボックスに、バッテリ（＋）端子保護カバーを設けておき、ジャンパスタート時には、カバーを取り外すことにより、バッテリ（＋）ターミナルにブースターケーブルを接続して、ジャンプスタートが可能となる。

図　1



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【特許請求の範囲】
【請求項１】　自動車の電気負荷に電源を供給する電源供給装置において、バッテリを車体に固定するバッテリ固定手段と、ヒューズおよび電源供給用リレーを備えた電気回路ユニットとを、分離可能なまま一体化して構成し、前記バッテリ固定手段の上部に前記電気回路ユニットを配置して、バッテリの正極端子のみ前記電気回路ユニットに接続することを特徴とする、車両用電源装置。
【請求項２】　請求項１に記載の車両用電源装置において、バッテリ正極端子に接続用端子を取り付け、該接続用端子にスタータモータ電源供給用電源線と前記電気回路ユニットへ電源を供給するための導電部材とを締結し、該接続用端子を含んだ正電位を有する部分の車体短絡保護用絶縁手段を設け、該車体短絡保護用絶縁手段を脱着可能な構成とし、ジャンパスタート時には該車体短絡保護用絶縁手段を取り外してジャンパスタートを実行する構成としたことを特徴とする、車両用電源装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、自動車の電気負荷に電源を供給する電源供給装置の構造に係わり、特にバッテリに積み重ねて取り付けられるヒューズ・リレーボックスの構造に関する。
【０００２】
【従来の技術】自動車電装負荷（例えばヘッドランプやスタータモータ等）は、自動車のバッテリないしオルタネータからの電源供給をうけ、負荷への給電や電源遮断はリレーや半導体スイッチング素子によって制御されている。また、上記電装負荷の短絡故障または車両配線の短絡事故などによる電線過熱を防止するため、バッテリと負荷との間にヒューズが通常設けられている。リレーおよびヒューズは、ヒューズ・リレーボックスに一括して搭載され、ヒューズ・リレーボックスは通常バッテリの近傍に設置されている。
【０００３】本ヒューズ・リレーボックスを小型化するために、特開平１０－２６４７４０号では、バッテリを取り囲む筐体とヒューズ・リレーボックスとを一体化して構成し、ヒューズ・リレーボックスを小型化する構成方法を提案している。さらに、バッテリ逆接時の電子機器の破壊を防止するためのバッテリの逆接防止構造も併せて提案している。
【０００４】
【発明が解決しようとする課題】上記発明では、バッテリとヒューズ・リレーボックスが一体化して構成されるため、電気負荷のオフし忘れなどによるバッテリ放電時に車両外部から電力を給電してエンジンを始動させるためのジャンパスタートに対する配慮が欠けており、ジャンパスタートが不可能な構成となっている。
【０００５】また、同一車種においても、寒冷地仕様や仕向地（日本および米国等）の違いなどでバッテリサイズが異なることがあるが、この点についても配慮が欠けており、バッテリの大きさ毎にヒューズ・リレーボックスを設定しなければならない煩わしさがあった。
【０００６】しかるに、本発明の目的は、車両用バッテリに積み重ねて搭載されるヒューズ・リレーボックスに関し、ジャンパスタートが可能かつバッテリの大きさに依らずに該ヒューズ・リレーボックスを構成することが可能な車両用電源装置を提供することにある。
【０００７】
【課題を解決するための手段】バッテリを車体に取り付けるためのステーは、バッテリ上部に組み付けられるフレームにねじ留めされ、該フレームにヒューズ・リレーボックスが固定される構造とする。バッテリの大きさ毎にフレームを用意し、ヒューズ・リレーボックスは標準化されたものを組み合わせることにより、バッテリの大きさに依存しないヒューズ・リレーボックスが構成できる。
【０００８】バッテリとヒューズ・リレーボックスとの電気的な接続は、以下のような構成とする。バッテリ（＋）ターミナルにボルト・ナット式端子を予め固定しておき、本ボルト・ナット式端子の反対部分にスタッドボルトを備え、該スタッドボルトにヒューズ・リレーボックスのバスバーとスタータモータ電源供給用電源線のタブを共締めする。バッテリ（－）ターミナルにボルト・ナット式端子を予め固定しておき、本ボルト・ナット式端子の反対部分にスタッドボルトを備え、該スタッドボルトにグランド線のタブを共締めする。バッテリ（＋）ターミナルは、ヒューズ・リレーボックス筐体に固定される絶縁保護カバーによってボディとの絶縁が保たれている。
【０００９】ジャンパスタート時は、該保護バッテリ（＋）ターミナル部材を取り外すことにより、バッテリ（＋）ターミナルにブースターケーブルを接続することが可能となる。
【００１０】
【発明の実施の形態】本発明の一実施例を、図面を用いて説明する。図１に、本発明の車両用電源装置の構造俯瞰図を示す。バッテリ１２３は、（＋）端子１２４および（－）端子１２５を備えている。バッテリ１２３を車体（図示せず）に固定するため、フレーム１１８をバッテリ１２３の上部からかぶせて、ステー１２１および１２２で車体に取り付け、ナット１１９および１２０で締め付ける。バッテリ１２３には、（＋）端子側に端子１０８が、（－）端子側に端子１１３が、それぞれ固定されている。端子１０８は、ボルト１０９およびナット１１０を締めて固定され、端子１１３は、ボルト１１４およびナット１１５を締めて固定される。端子１０８は、スタータモータへの電源供給線１１２およびヒューズ・リレーボックス内部のバスバー（図２にて説明する）を固定するためのスタッドボルトを備えており、前記電源

供給線およびバスバーをスタッドボルトに通した後で、ナット１１１によって締結・固定される。端子１２２は、グランド線１１７を固定するためのスタッドボルトを備えており、前記グランド線をスタッドボルトに通した後で、ナット１１６によって締結・固定される。

【００１１】ヒューズ・リレーボックス１０３は、フレーム１１８に固定されるが、その固定方法として、スナップフィットや接着剤による固定が可能であるが、他の固定方法でも良い。ヒューズ・リレーボックス１０３に脱着可能で固定される絶縁保護カバー１０７は、バッテリ（＋）ターミナルとボディ（車体）との絶縁を保つために設けられている。ジャンパスタート時は、前記カバーをはずして、バッテリ（＋）端子にブースターケーブルを接続する。本実施例では、ヒューズ・リレーボックス１０３には、ヒューズ１０４ａ、１０４ｂ、１０４ｃ、１０４ｄ、１０４ｅおよびリレー１０２ａ、１０２ｂ、１０２ｃが搭載されている。ヒューズ・リレーボックス１０３に接続される車両ハーネス１０５０および１０５１は、それぞれコネクタ１０５ａおよび１０５ｂを介して接続される。本実施例では、バッテリターミナルの反対側にコネクタが設定されているが、コネクタの場所は特に問わない。リレーおよびヒューズを物理的に保護するためのカバー１０１が、ヒューズ・リレーボックス１０３に取り付けられる。

【００１２】図２に、前記ヒューズ・リレーボックス１０３の断面図を示す。本図により、前記ヒューズ・リレーボックス１０３の詳細構造を説明する。

【００１３】カバー２０１は、ヒューズ２０４およびリレー２０２、２０３を保護するために設けられている。ヒューズ・リレーボックス１０３は、上下二分割の構造となっており、アッパーケース２０５およびロワーケース２０６から構成される。ロワーケース２０６は、車両ハーネス側のコネクタのハウジングも兼ねており、コネクタ端子２１６および２１８が突き出ている。リレー２０２、２０３およびヒューズ２０４の端子は、それぞれメスーメス端子２０７１、２０８１、２０９、２１０、２１１、２１２でもって、メタルフレット２１４に接続されている。前記コネクタ端子２１６および２１８は、ヒューズ・リレーボックス内でメタルフレットを形成しており、本実施例では、絶縁部材２１３、２１５、２１７をはさんだ三層構造となっている。メタルフレットの一方は、給電用メタルフレット２２０としてバッテリ（＋）端子２２８に接続されている。各層のメタルフレットの接続は、該ヒューズ・リレーボックスの内部回路（図３で説明）に従う。なお、本構成はメタルフレットを用いたジャンクションボックスに共通な構成である。

【００１４】バッテリ２２９の（＋）端子２２８に固定される端子２３０に、前記給電用メタルフレット２２０とスタータ電源供給線２２５とを締結・固定する。端子２３０のスタッドボルトに、スタータ電源供給線２２５をナット２２３で固定し、さらに給電用メタルフレット２２０をナット２２１およびワッシャ２２２で固定する。

【００１５】バッテリ２２９を車体に固定するフレーム２２７に、ヒューズ・リレーボックスロワケース２０６が固定される。カバー２１９は、ジャンパスタート時に脱着可能な構造となっている。

【００１６】図３に、本実施例のヒューズ・リレーボックスの内部回路構成例を示す。ヒューズ・リレーボックス３０１には、車両ハーネス用コネクタ３０２および３０３が設けられている。コネクタ３０２は、リレー３０９および３１０のスイッチ側（すなわち負荷接続側）ラインが接続される。リレーの各系統毎にそれぞれヒューズ３０４、３０５が設けられ、負荷短絡および電線地絡時のハーネス保護を実現している。このようなリレーの用途として、イグニッションリレー、スタータリレー、アクセサリリレーなどがある。また、リレー３０９よい３１０のコイル制御信号も同様にコネクタ３０２に接続される。コネクタ３０３は、リレー３１１のスイッチ側（すなわち負荷接続側）ラインと、ヒューズ３０７および３０８を介して常時給電されるライン（非スイッチ電源供給ライン）が接続される。リレー３１１の下流にヒューズ３０６が設けられ、負荷短絡および電線地絡時のハーネス保護を実現している。上記非スイッチ電源供給ラインの用途として、例えばコントロールユニットのメモリバックアップ電源やラジオの選局データ等がある。また、リレー３１１のコイル制御信号も同様にコネクタ３０３に接続される。　リレーの給電側ラインおよび非スイッチ電源供給ラインは、まとめてバッテリ３１２の（＋）端子３１３に接続され、一括して電源が供給される。上記とは別に、バッテリ３１２の（＋）端子３１３にはスタータ電源供給線３１５が、バッテリ３１２の（－）端子３１４にはグランド線３１６が、それぞれ独立に接続される。これは、スタータの突入電流および定常電流が他の電気負荷に比べ過大であり、適当な過電流遮断素子が存在しないためである。

【００１７】以上のように、本発明によればヒューズ・リレーボックスとバッテリ間をつなぐハーネスが省略でき、リレーボックスもバッテリの上に設置することができるので、小型化・省スペースな設計が可能となる。

【００１８】

【発明の効果】以上説明したように、本発明によれば、ヒューズ・リレーボックスとバッテリ間をつなぐハーネスが省略でき、リレーボックス設置スペースも省略できる。さらに、ジャンパスタートが可能かつバッテリの大きさに依らないヒューズ・リレーボックスが実現できる効果も期待できる。

【図面の簡単な説明】

【図１】本発明における車両用電源装置の構造俯瞰図。

【図２】本発明におけるヒューズ・リレーボックスの断

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面図。

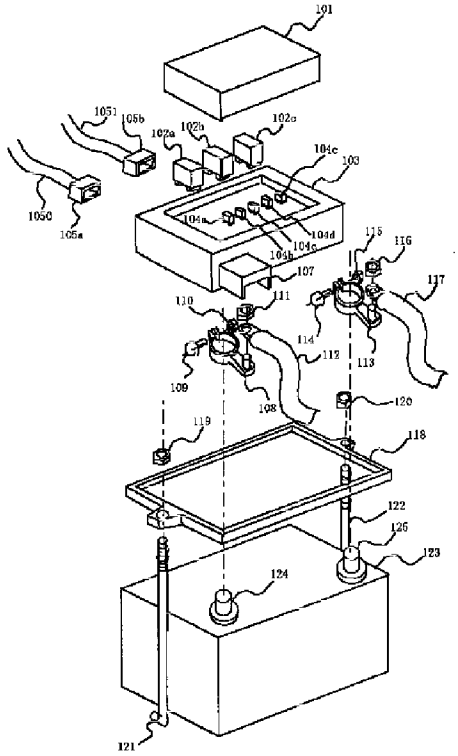
【図３】本発明におけるヒューズ・リレーボックスの内部回路構成図。

【符号の説明】

１０１…カバー、１０２ａ…リレー、１０３…ヒューズ・リレーボックス、１０４ａ…ヒューズ、１０５ａ…コネクタ、１０７…絶縁保護カバー、１０８…端子、１０９…ボルト、１１０…ナット、１１１…ナット、１１２…電源供給線、１１８…フレーム、１１９…ナット、１２１…ステー、１２３…バッテリ、１２４…バッテリ端子。

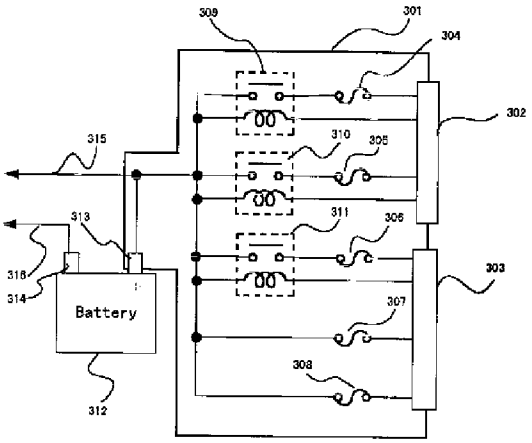
【図１】

図 1

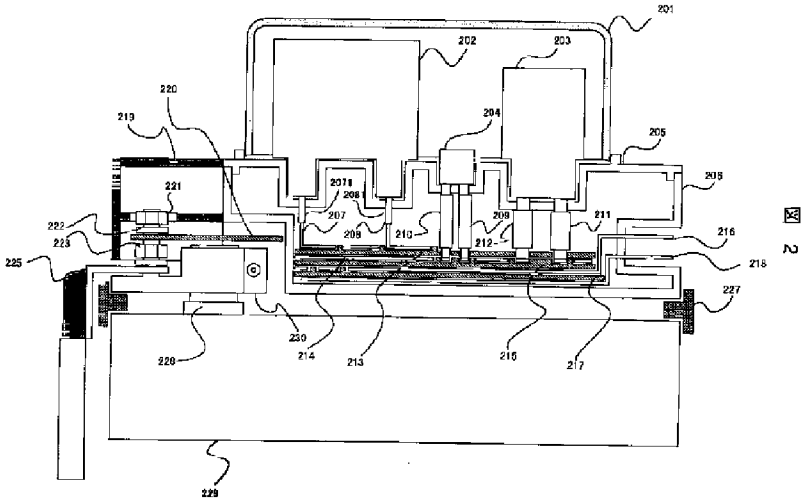


【図３】

図 3



【図２】



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(54) **Title**: COMPACT MULTIFUNCTIONAL BATTERY BOOSTER

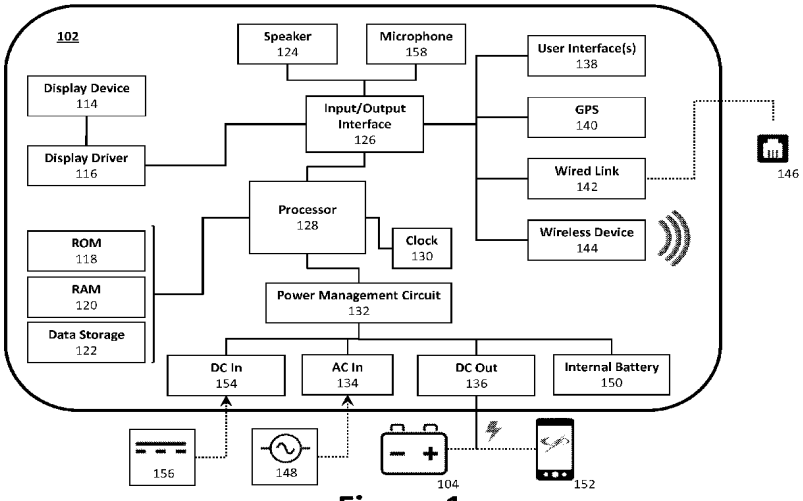


Figure 1

(57) **Abstract**: A compact battery charger for charging a battery comprising: a microprocessor; a set of terminals operatively coupled to said microprocessor and configured to electrically couple with an automotive battery; and an internal lithium ion battery, wherein the internal lithium ion battery is a lithium ion battery, wherein a single-ended primary-inductor converter may be configured to receive an input voltage of 5VDC to 20VDC and output a predetermined DC charge voltage to said internal lithium ion battery.

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COMPACT MULTIFUNCTIONAL BATTERY BOOSTER

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Patent Application No. 62/037,379 by Brian F. Butler et al., filed on August 14, 2014 and entitled "Compact Multifunctional Battery Booster." U.S. Provisional Patent Application No. 62/037,379 is hereby incorporated by reference in its entirety.

TECHNICAL FIELD

[0002] The present invention relates to a portable battery booster system and apparatus. More specifically, the present invention relates to systems, methods, and apparatuses for providing a compact multifunctional battery booster and charger.

BACKGROUND

[0003] It is well known that motorists from time to time find themselves with a battery of insufficient charge to start their vehicle. This is generally an occasion of extreme inconvenience and distress, particularly where one finds himself in this situation in an area where there are other vehicles and drivers, but no means for connecting the battery of the disabled vehicle to the battery of one of the other available vehicles. To remedy this, battery boosters were developed to jump start stranded cars. For example, U.S. Patent No. 4,079,304 discloses a battery booster system for jump starting an engine of a vehicle with a defective (or depleted) battery and interconnecting the same with a vehicle having a charged battery. Similarly, U.S. Patent Publication No. 2014/0159509 discloses a portable battery boost and jump starter apparatus for charging a vehicle battery. Typically, such battery booster systems rely on an internal lead acid battery, which is typically large, heavy, and cumbersome. Despite the advancements thus far, a need exists for an improved compact multifunctional battery booster, and, more particularly, to an improved lithium ion battery booster.

SUMMARY OF THE INVENTION

[0004] The present disclosure is directed to an improved compact multifunctional battery booster and charger, and, more particularly, to an improved lithium ion battery booster and charger.

[0005] According to a first aspect of the present invention, a compact battery booster comprises: a processor; a display device operatively coupled to the processor, wherein the display device displays a status of the compact battery booster; a storage capacitor and an internal lithium ion

battery, each of said storage capacitor and said internal lithium ion battery configured to provide a boosting energy to a vehicle coupled to an external battery; a direct current (DC) output terminal configured to electrically couple with the external battery; a single-ended primary-inductor converter configured to receive a variable input voltage between 5 volts DC and 20 volts DC and to output a predetermined output voltage to said storage capacitor and said internal lithium ion battery; and a power management circuit operatively coupled to the processor, the power management circuit configured to electrically couple the DC output terminal with said storage capacitor or said internal lithium ion battery, thereby providing the boosting energy from said storage capacitor or said internal lithium ion battery to said vehicle.

[0006] According to a second aspect of the present invention, a compact battery charger comprises: a processor; a display device operatively coupled to the processor, wherein the display device displays a status of the compact battery charger; an internal lithium ion battery, said internal lithium ion battery configured to provide a predetermined output energy; a direct current (DC) output terminal, wherein the DC output terminal is configured to couple with an external battery; a single-ended primary-inductor converter configured to receive an input voltage within predetermined input voltage range and to output a predetermined charge voltage to said internal lithium ion battery; and a power management circuit operatively coupled to the processor, the power management circuit configured to electrically couple the DC output terminal with said internal lithium ion battery, thereby providing the predetermined output energy from said internal lithium ion battery to said external battery.

[0007] According to a third aspect of the present invention, a compact battery charger comprises: an internal lithium ion battery, said internal lithium ion battery configured to provide a predetermined output energy; a direct current (DC) output terminal, wherein the DC output terminal is configured to couple with an external battery; an internal induction coil, wherein the internal induction coil receives energy from an electromagnetic field created by an external induction coil and converts the electromagnetic field to produce an input voltage; a DC to DC converter that receives the input voltage and outputs a predetermined output voltage to said internal lithium ion battery; and a power management circuit operatively coupled to the processor, the power management circuit configured to electrically couple the DC output terminal with said internal lithium ion battery, thereby providing the predetermined output energy from said internal lithium ion battery to said external battery.

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[0008] In certain aspects, the storage capacitor is a supercapacitor.

[0009] In certain aspects, the storage capacitor draws a charging current from the external battery.

[0010] In certain aspects, the device further comprises a supercapacitor, wherein the single-ended primary-inductor converter charges the supercapacitor.

[0011] In certain aspects, the device further comprises a supercapacitor, wherein the supercapacitor draws current from the external battery to charge the supercapacitor.

[0012] In certain aspects, the predetermined input voltage range is 5 volts to 20 volts.

[0013] In certain aspects, the predetermined charge voltage is greater than the input voltage.

[0014] In certain aspects, the predetermined output energy is a boosting energy for starting an engine coupled to the external battery.

[0015] In certain aspects, the predetermined output energy is a charging energy for charging the external battery.

[0016] In certain aspects, the device further comprises (1) a reverse polarity sensor configured to detect a polarity of the external battery; (2) a temperature sensor configured to detect a temperature of said internal lithium ion battery and to provide a temperature signal to said processor; and (3) a voltage sensor configured to detect a voltage of said internal lithium ion battery.

[0017] In certain aspects, the device further comprises a removable internal data storage device.

[0018] In certain aspects, the device further comprises an internal induction coil, wherein the internal induction coil receives energy from an electromagnetic field created by an external induction coil and converts the electromagnetic field to produce the input voltage.

[0019] In certain aspects, the device further comprises a second DC output terminal, wherein the DC output terminal provides a boosting energy for starting an engine coupled to the external battery, and wherein the second DC output terminal provides a charging energy to a portable electronic device.

[0020] In certain aspects, the second DC output terminal is a Universal Serial Bus (USB) port.

[0021] In certain aspects, the display device enters into a sleep mode after a predetermined time period of inactivity.

[0022] In certain aspects, the DC output terminal runs a predetermined current through the external battery to preheat the external battery.

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[0023] In certain aspects, the device further comprises a DC to alternating current (AC) converter coupled between the internal lithium ion battery and an AC output terminal.

[0024] In certain aspects, the device further comprises an internal data storage device, wherein the internal data storage device backs up digital content stored to a portable electronic device via a USB port.

DESCRIPTION OF THE DRAWINGS

[0025] These and other advantages of the present invention will be readily understood with reference to the following specifications and attached drawings wherein:

[0026] Figure 1 illustrates an exemplary compact battery charger block diagram configured for use with a battery charging system.

[0027] Figure 2 illustrates a flow diagram of an example method for providing the jump start function using a compact battery charger.

[0028] Figure 3 illustrates an example schematic diagram of a charger having a single-ended primary-inductor converter circuit and a supercapacitor.

DETAILED DESCRIPTION

[0029] Preferred embodiments of the present invention will be described hereinbelow with reference to the accompanying drawings. In the following description, well-known functions or constructions are not described in detail because they may obscure the invention in unnecessary detail. The present invention relates to a compact battery charger system, method, and apparatus. For this disclosure, the following terms and definitions shall apply:

[0030] As used herein, the word "exemplary" means "serving as an example, instance, or illustration." The embodiments described herein are not limiting, but rather are exemplary only. It should be understood that the described embodiments are not necessarily to be construed as preferred or advantageous over other embodiments. Moreover, the terms "embodiments of the invention," "embodiments," or "invention" do not require that all embodiments of the invention include the discussed feature, advantage, or mode of operation.

[0031] The terms "communicate" and "communicating" as used herein, include both conveying data from a source to a destination and delivering data to a communications medium, system, channel, network, device, wire, cable, fiber, circuit, and/or link to be conveyed to a destination. The term "communication" as used herein means data so conveyed or delivered. The

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term "communications" as used herein includes one or more of a communications medium, system, channel, network, device, wire, cable, fiber, circuit, and/or link.

[0032] The terms "coupled," "coupled to," and "coupled with" as used herein, each mean a relationship between or among two or more devices, apparatuses, files, circuits, elements, functions, operations, processes, programs, media, components, networks, systems, subsystems, and/or means, constituting any one or more of: (i) a connection, whether direct or through one or more other devices, apparatuses, files, circuits, elements, functions, operations, processes, programs, media, components, networks, systems, subsystems, or means; (ii) a communications relationship, whether direct or through one or more other devices, apparatuses, files, circuits, elements, functions, operations, processes, programs, media, components, networks, systems, subsystems, or means; and/or (iii) a functional relationship in which the operation of any one or more devices, apparatuses, files, circuits, elements, functions, operations, processes, programs, media, components, networks, systems, subsystems, or means depends, in whole or in part, on the operation of any one or more others thereof.

[0033] The term "data" as used herein means any indicia, signals, marks, symbols, domains, symbol sets, representations, and any other physical form or forms representing information, whether permanent or temporary, whether visible, audible, acoustic, electric, magnetic, electromagnetic, or otherwise manifested. The term "data" is used to represent predetermined information in one physical form, encompassing any and all representations of corresponding information in a different physical form or forms.

[0034] The term "database" as used herein means an organized body of related data, regardless of the manner in which the data or the organized body thereof is represented. For example, the organized body of related data may be in the form of one or more of a table, map, grid, packet, datagram, frame, file, email, message, document, report, list, or any other form.

[0035] The term "network" as used herein includes both networks and inter-networks of all kinds, including the Internet, and is not limited to any particular network or inter-network.

[0036] The term "processor" as used herein means processing devices, apparatuses, programs, circuits, components, systems, and subsystems, whether implemented in hardware, tangibly embodied software, or both, and whether or not it is programmable. The term "processor" as used herein includes, but is not limited to, one or more computing devices, hardwired circuits, signal-modifying devices and systems, devices and machines for controlling systems, central processing units,

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programmable devices and systems, field-programmable gate arrays, application-specific integrated circuits, systems on a chip, systems comprising discrete elements and/or circuits, state machines, virtual machines, data processors, processing facilities, and combinations of any of the foregoing.

[0037] A compact battery charger 102, as disclosed herein, may be used to start (a/k/a "boost", "jump", or "jump start") an engine coupled to an external battery 104 (*e.g.*, a 6V/12V nominal voltage vehicular battery, which may be fully or partially depleted). In certain aspects, the compact battery charger 102 may be further configured to charge the external battery 104, and/or other electronic devices operatively coupled with the compact battery charger 102. Example vehicular batteries include, without limitation, lead-acid batteries (*e.g.*, wet/flooded batteries, calcium-calcium batteries, Valve-Regulated, Lead Acid (VRLA) batteries, gel cell, and Absorbed Glass Mat (AGM)) and other rechargeable batteries (*e.g.*, lithium ion, lithium ion polymer, Nickel-Metal Hydride (NiMH), Nickel Cadmium (NiCd)). Other electronic devices that may be operatively coupled with the compact battery charger 102 include, for example, portable electronic devices 152 (*e.g.*, phones, tablet computers, portable computers, etc.), toys, etc.

[0038] Figure 1 illustrates a block diagram of an example compact battery charger 102. Specifically, Figure 1 illustrates a compact battery charger 102 having a processor 128 (*e.g.*, a central processing unit (CPU)) that is operatively coupled to a Read-Only Memory (ROM) 118 for receiving one or more instruction sets, to a Random Access Memory (RAM) 120 having a plurality of buffers for temporarily storing and retrieving information, and to an internal data storage device 122 (*e.g.*, a hard drive, such a solid state drive, or other non-volatile data storage device, such as flash memory). A clock 130 is also coupled to the processor 128 for providing clock or timing signals or pulses thereto. Those skilled in the art will understand that the compact battery charger 102 includes one or more bus structures for interconnecting its various components. Further, to increase ease of use in mobile applications, the various components of a compact battery charger 102 may be housed in a single housing. In certain aspects, multiple processors 128 may be provided to facilitate operation of the compact battery charger 102, whether or not embodied within the compact battery charger 102 itself. Accordingly, serial communication may be employed to communicate information and data between multiple processors that may be used.

[0039] The internal battery 150 may be a rechargeable lithium ion battery for outputting a direct current (DC) voltage, such as lithium iron phosphate and lithium ion polymer batteries. The internal battery 150 should be sufficiently rated to boost (jump start) a vehicle coupled to an external

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battery 104. For example, the internal battery 150 may be rated from about 3,000 mah to 20,000 mah, or higher. A compact battery charger 102 having a 12,000 mah internal battery 150, for instance, may output 200 cranking amps / 400 peak amps during the jump start function, which is sufficient to start a vehicle, but higher power internal batteries are contemplated for larger vehicles and trucks. In certain embodiments, the internal battery 150 may comprise a plurality of electrically coupled batteries (*e.g.*, connected in parallel, or when multiple lower voltage batteries are to be summed, in series). For example, lithium ion batteries containing LiFePO, $LiFePO_4$, $LiFeMgPO_4$, and $LiFeYPO_4$ have a nominal cell voltage of about 3.2V to 3.3V each. Thus, internal battery 150 need not be limited to a single battery or single battery cell. Accordingly, four lithium ion cells may be connected in series to achieve a nominal voltage of 12.8V to 13.2V. To the extent that a higher nominal voltage is desired, additional lithium ion cells may be connected in series to achieve higher voltages.

[0040] The compact battery charger 102 may receive external power via a direct current (DC) input terminal 154 coupled to a DC power supply 156 and/or an alternating current (AC) input terminal 134 coupled to an AC power supply 148. AC power supply 148 may be wall current (*e.g.*, 110VAC), while the DC power supply 156 may be, for example, an automotive cigarette lighter (*e.g.*, 12VDC) or a USB port (*i.e.,* 5VDC). The compact battery charger 102 may provide a plurality of DC outputs 136 to facilitate charging energy (*e.g.*, to external battery 104 or one or more portable electronic devices 152) or boosting energy (*e.g.*, to a vehicle/external battery 104). In certain aspects, such as when a USB Port or 12V port is used, a DC connector may be used for both DC input terminal 154 and DC output terminal 136. That is, the compact battery charger 102 may draw power from a device coupled to the DC connector (functioning as a DC input terminal 154), or supply power to the device coupled to the DC connector (functioning as a DC output terminal 136). To convert the AC power supply 148, an AC to DC transformer may be provided, which may be integral with, or external to, the compact battery charger 102. An AC to DC transformer may removably coupled to wall current and removably coupled to the compact battery charger 102. In certain aspects, a power inverter and AC output terminal may be provided to output an AC voltage (*e.g.*, a 110VAC output). In such an embodiment, power from the DC power supply 156 or the internal battery 150 may be processed (*e.g.*, using a DC to AC inverter) and used to supply the AC voltage to the AC output terminal.

[0041] In operation, when the AC power supply 148 or DC power supply 156 is unavailable (*e.g.*, disconnected, out of service, when a circuit breaker is blown, the compact battery charger 102 is

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otherwise disconnected, etc.), the compact battery charger 102 may draw the power needed to operate the compact battery charger 102's components from the external battery 104 and/or internal battery 150, thereby enabling the user to determine the status of the compact battery charger 102 (and state of charge, or other parameters, of the external battery 104) when the AC power supply 148 and the DC power supply 156. To that end, the compact battery charger 102 may report a power supply failure (*e.g.*, as an alert) to one or more portable electronic devices 152 (*e.g.*, phones, tablet computers, portable computers, or other handheld terminals) within a battery monitoring system via a communication network. A suitable example battery monitoring system is disclosed by commonly owned U.S. Patent Serial No. 14/826,805 by Brian F. Butler et al, filed August 14, 2015 and titled "Battery Charger Status Control System And Method."

[0042] The battery charging method or technique can be any of a variety of charging techniques including conventional, fast charging, and the like. The compact battery charger 102 may be further configured to determine, automatically, different battery chemistry (*e.g.*, AGM, gel, lithium ion, etc.) and the battery's nominal voltage. The charging characteristics of a battery charger may be configured to match the battery chemistry of the battery to be charged. For example, lead acid batteries may be charged with constant power, constant current, constant voltage, or combination thereof. Such batteries are known to be charged with both linear as well as switched-mode battery chargers. U.S. Patent No. 7,808,211, assigned to the same assignee as the assignee of the present invention, discloses an example of a switched-mode battery charger for automotive and marine battery applications. Further, commonly owned U.S. Patent No. 8,947,054 discloses a battery charger and method utilizing alternating DC charging current, while commonly owned U.S. Patent No. 8,575,899 discloses a battery charger with automatic voltage detection.

[0043] The identified battery chemistry and voltage may be displayed on display device 114. The compact battery charger 102 may indicate to the user (*e.g.*, via display device 114) the number of ampere hours put into battery, and/or an indication of the state of health of the external battery 104. For example, if customer inputs a battery size/model number, the compact battery charger 102 can use the battery capacity to provide the state of health. The compact battery charger 102 may indicate to the user the state of charge or health of the internal battery 150 (*e.g.*, the number of coulombs) via display device 114.

[0044] The compact battery charger 102 may further include an input/output interface 126 that interfaces the processor 128 with one or more peripheral and/or communicative devices, such as

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a user interface 138, a Global Positioning System (GPS) transmitter 140, a wired link 142, a wireless device 144, a microphone 158, and a speaker 124, which may be used to signal an alert (*e.g.*, charge complete, error, etc.) or other status information.

[0045] As illustrated, the processor 128 may be operatively coupled to a display device 114 via a display driver 116. The display device 114 may comprise, or otherwise employ, one or more light emitting diodes (LEDs) and/or a liquid crystal display (LCD) screen. The LCD screen may be an alphanumeric segmented LCD display, or a matrix LCD display, such as those used on portable electronic devices. In certain embodiments, the LCD screen may further provide touch screen functionality to facilitate user input device via a thin layer of sensing circuitry present either beneath the visible portion of display device 114's surface, or as part of a thin, clear membrane overlying the display device 114 that is sensitive to the position of a pen or finger on its surface. In operation, the display driver 116 may receive display data from the processor 128 via input/output interface 126 and display that display data via the display device 114. For example, interactive display device 114 may be provided on the housing to provide the user with status information and/or input capability (*e.g.*, via a touch screen or voice commands using, for example, wave files). Reminders, or other information (*e.g.*, status information), may be displayed to the user, via the display device 114, as a scrolling message or menu structure (*e.g.*, a graphical user interface (GUI)).

[0046] With regard to the internal data storage device 122, example flash memory devices include, for example, memory cards, such as RS-MMC, miniSD, microSD, etc. The internal data storage device 122 can function as an external hard drive or flash drive, thereby enabling the user to store digital files to the compact battery charger 102. In instances where the internal data storage device 122 is removable, as is the case with memory cards, the user can interchange, upgrade, or remove the memory card (*e.g.*, if the compact battery charger 102 becomes defective) to avoid data loss. The display device 114 may be used to display, for example, the contents of the internal data storage device 122, the remaining storage capacity (*e.g.*, as a percentage or in terms of available bytes), and, in certain aspects, the digital files themselves (*e.g.*, photos may be displayed, files accessed, etc.). In certain aspects, in addition to (or in lieu of) charging a portable electronic device (*e.g.*, a smart phone), the compact battery charger 102 may back up digital content stored to the portable electronic device 152 when the portable electronic device 152 is coupled to the compact battery charger 102 via, for example, the USB port.

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[0047] When an external battery 104 is connected to DC output terminal 136 (*e.g.*, via clamps), the display device 114 may display the external battery 104's voltage. The display device 114 may also indicate the state of charge in terms of percent of charge of the jump starter's internal battery 150. During user inactivity, such as when charging the external battery 104 or the internal battery 150, the display device 114 may enter a sleep mode and will not display any messages until activity is detected (*e.g.*, when devices are connected/disconnected from the compact battery charger 102 or the user interface 138 is actuated). As discussed below, if the external battery 104's voltage is too low to detect, the display device 114 may remain blank and the voltage will not display, but a manual start procedure may be selected to enable the jump start function. The jump start function may be used to start a vehicle having an external battery 104 (*e.g.*, a depleted automotive battery). The jump start function causes the compact battery charger 102 to output about 400-600 peak amperes (270-405 cranking amperes) via clamps coupled to the DC output terminal 136. One of skill in the art, however, would recognize that the internal battery 150 may be replaced with a higher capacity battery to facilitate higher output currents.

[0048] In one example, once an AC power supply 148 is connected, a first LED may be illuminated to indicate that the compact battery charger 102's internal battery 150 is charging. When the compact battery charger 102 is fully charged, a second LED on the unit may be illuminated. Finally, when the DC output terminal 136 is successfully coupled (*e.g.*, clamped or otherwise electrically coupled) to external battery 104, a third LED may be illuminated. Rather than employing separate LEDs, an LCD display or a single multi-color LED may be employed that changes color depending on the status of the compact battery charger 102. The compact battery charger 102 may be further equipped with a light, which functions as a map light, flash light, emergency light, etc. The light may be activated and deactivated via user interface 138. The light may be an LED that outputs, for example, about 1 Watt/90 Lm.

[0049] When an LCD display is employed, the display device 114 may be configured to display, in addition to, or in lieu of, the LEDs, a number of messages to indicate the current status, or operation of the compact battery charger 102 to the user. In selecting the message(s) to display, the compact battery charger 102 measures one or more parameters of the internal battery 150, external battery 104, or of the compact battery charger 102. Parameters include, for example, voltage, power capacity, temperature, connection status, etc. Example messages include those illustrated in Table A, where "[XX]" represents a measured or calculated value.

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Message	Status/Condition
Charging [XX]%	Coupled to AC power supply 148 or DC power supply 156 and internal battery 150 is charging.
Fully Charged	Coupled to AC power supply 148 and internal battery 150 is fully charged.
Battery Too Hot To Charge	Disconnect from AC power supply 148 or DC power supply 156 and allow internal battery 150 to cool down before charging.
Battery Too Cold To Charge	The temperature of the internal battery 150 is too low.
Charging - USB On	The USB port is in use while the internal battery 150 is charging.
Charging – 12V On	The 12V port is in use while the internal battery 150 is charging.
Fully Charged - USB On	The internal battery 150 is fully charged and the USB port is in use.
Fully Charged - 12V On	The internal battery 150 is fully charged and the 12V port is in use.
Unplug Charger	Attempting to use the jump starter function while the internal battery 150 is charging.
Charge Aborted	Charging cannot be completed normally.
Battery [XX]% - USB On	The USB port is in use. The percentage shows the internal battery 150's charge.
Battery [XX]% - 12V On	The 12V port is in use.
12V/USB Overload	The 12V/USB port is overloaded.
Battery Low - Recharge	While using the 12V/USB port, the internal battery 150's voltage has dropped. The 12V/USB power will shut off after

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	10 minutes.
Battery [XX]% - Clamps Disconnected	The compact battery charger 102 is turned on, but does not detect external battery 104.
Warning - Reverse Polarity	The DC output terminal 136 is connected backwards to an external battery 104 (*i.e.*, reverse polarity).
Battery Low-Recharge	The jump start function button has been selected, but the internal battery 150 has discharged below a predetermined level.
Turn Off 12V/USB	The jump start function button has been selected, but 12V/USB function is activated.
Off	The jump start button has been pressed twice.
Battery Too Hot	The internal temperature of the internal battery 150 is too warm. Allow internal battery 150 to cool down before attempting another jump start.
Jump Start Ready - Battery Cold : Reduced Performance	The temperature of the internal battery 150 is too low, which reduces cranking performance.
Jump Start Ready	The jump start button has been pressed, compact battery charger 102 is correctly connected to a vehicle battery, and the compact battery charger 102 is ready for jump start function.
Battery Cool Down - [XX] Seconds Remaining	Shows waiting time needed before attempting another engine start.

Table A

[0050] The user interface 138 may be used to enable the user to switch the output charge amperage (*e.g.*, 1A, 10A, 50A, 100A, etc.) or another setting (*e.g.*, charge, boost, other). Example user interface 138 devices may include, for example, physical buttons, physical switches, a digitizer (whether a touch pad, or transparent layer overlaying the display device 114), voice command (*e.g.* via the microphone 158 and speaker 124), and other input devices. For instance, using the digitizer, a

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user may control or interact with the compact battery charger 102 by writing or tapping on the display device 114 using, a pen, stylus, or finger.

[0051] The GPS transmitter 140 may be used to track and/or monitor the location of the compact battery charger 102 and to relay the location information in the form of positional data (*e.g.*, geographic coordinate system data or Internet Protocol (IP) address) to a booster management server or another device in battery charging system or via a communication network. For example, a computer may be configured to track the activities, location, and/or charge history of a particular compact battery charger 102 in a battery charging system. The positional data may also be locally stored to the compact battery charger 102 (*e.g.*, to internal data storage device 122).

[0052] The wireless device 144 may be configured to manage communication and/or transmission of signals or data between the processor 128 and another device (*e.g.*, a remote interface device via a communication network or directly with a remote interface device) by way of a wireless transceiver. The wireless device 144 may be a wireless transceiver configured to communicate via one or more wireless standards such as Bluetooth (*e.g.*, short-wavelength, Ultra-High Frequency (UHF) radio waves in the Industrial, Scientific, and Medical (ISM) band from 2.4 to 2.485 GHz), near-field communication (NFC), Wi-Fi (*e.g.*, Institute of Electrical and Electronics Engineers' (IEEE) 802.11 standards), etc. For example, wireless connectivity (*e.g.*, RF 900MHz or Wi-Fi) may be integrated with the compact battery charger 102 to provide remote monitoring and control of the compact battery charger 102 via one or more portable electronic devices 152. Using a wireless device 144, a user may be able to start and/or stop the compact battery charger 102's charge cycle or otherwise change the settings.

[0053] That is, via a communication network and a booster management server, a user may monitor live charging status updates, charging conditions, historic data, remotely update software and firmware, and stay connected with the compact battery charger 102 manufacturer's news and updates. In certain aspects, an internal cellular modem may be implemented that utilizes standards-based wireless technologies, such as 2G, 3G, 4G, Code Division Multiple Access (CDMA), and Global System for Mobile Communications (GSM), to provide wireless data communication over worldwide cellular networks. An advantage of an internal cellular modem is that there is no reliance on a user's local network (*e.g.*, wireless router, modem, etc.), thereby enabling communication between the compact battery charger 102 and communication network, even in the event of a total power failure in a user's location.

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[0054] In certain aspects, a wired link 142 may be provided to manage communication and/or transmission of signals or data between the processor 128 and another device via, for example, a data port 146 (*e.g.*, RS-232, USB, and/or Ethernet ports) capable of being wiredly coupled with another data port 146 positioned outside the compact battery charger 102 housing. As noted above, a USB port or 12V supply may be provided as DC output terminals 136 on the charger to facilitate the charging of accessories, such as portable electronic devices 152. Thus, the compact battery charger's 102 internal battery 150 may also be used as a power source for one or more DC accessories. Charging while operating the accessories can extend run time of the compact battery charger 102, but will also extend recharge time. If the load exceeds the charging input amperage (*e.g.*, 1A), however, the accessory being charged may discharge the internal battery 150.

[0055] The USB port may provide, for example, up to 3.0A at 5VDC. To activate the USB port, a USB power button (or other user selectable element) may be provided via user interface 138. The USB port may be activated by pressing the USB power button, and disabled by, for example, pressing the USB power button a second time, two or more times in quick succession, or held for a predetermined period of time. The 12VDC power output may provide, for example, up to 6.0A a 12VDC.

[0056] The compact battery charger 102 may further comprise a plurality of sensors to provide measurement data descriptive of the surrounding environment. In certain aspects, the USB output may automatically shut off when no load is detected (*e.g.*, after 5-10 minutes of a no load state). The 12VDC power supply, however, may remain active until the compact battery charger 102 reaches a low battery state (*e.g.*, the internal battery 150's charge level is less than a predetermined threshold, *e.g.*, number of coulombs). The 12VDC power supply may be used to supply power to an integrated or remotely situated air compressor (*e.g.*, for tire inflation) and may further function as a memory saver. The 12VDC power supply may be limited to 6.0A with over current protection. In certain aspects, a user may wish to check the internal battery 150's charge level. To do so, a button (or other user selectable element) may be provided via user interface 138 that causes the charge level to be displayed on the display device 114. To ensure accuracy of the measurement, the user may be instructed (*e.g.*, via display device 114) to turn off the compact battery charger 102 before actuating the button (or displaying the charge level). In one aspect, the display device 114 can show the internal battery 150's percent of charge, or a battery icon indicating the same. For example, the display device 114 may display "100%" (or a solid battery icon) when the internal battery 150 is fully charged.

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[0057] The compact battery charger 102 may include a temperature or humidity sensor, or configured to monitor other appliances or devices, either directly (*e.g.*, using a sensor) or wirelessly (*e.g.*, using Wi-Fi). For example, the compact battery charger 102 may be configured to charge and monitor, in addition to automotive batteries, one or more portable electronic devices 152 being charged by said compact battery charger 102. Another temperature sensor may be provided to measure the temperature of a battery being charged (*e.g.*, a lithium-ion battery). If the measured temperature deviates from an operating range (*i.e.*, a range in which the measured value is acceptable), the charging or boosting operating may be prohibited.

[0058] A power management circuit 132 may be used to manage power needed to operate the compact battery charger 102 (and components thereof), start an engine, and to charge the external battery 104 or other device. That is, AC power may be drawn from an AC power supply 148, converted to DC power, and used to charge external battery 104 and/or internal battery 150. For instance, the compact battery charger 102 may be removably coupled with an AC power supply 148 located outside the housing (*e.g.*, a wall outlet) via an AC input terminal 134 and an AC to DC converter. In such an example, an AC wall charger may receive 120VAC from an electrical wall outlet and output, via an inverter, 12VDC to the compact battery charger 102's input socket. When charging, an LED (*e.g.*, a green LED) may light, and/or the display device 114 may display a message such as "Charging - [XX]%." When the charging has completed, the LED may pulse, and/or the display device 114 may display a message such as "Fully Charged."

[0059] In certain aspects, a Single-Ended Primary-Inductor Converter (SEPIC) circuit 302, in conjunction with an AC to DC converter 314, may be used to charge the internal battery 150. Generally speaking, a SEPIC circuit 302 is a type of DC to DC converter that allows the electrical potential (voltage) at its output to be greater than, less than, or equal to that at its input. The output of a SEPIC circuit 302 is controlled by the duty cycle of the control transistor. A SEPIC circuit 302 exchanges energy between capacitors and inductors in order to convert a variable input voltage to a predetermined output voltage. The amount of energy exchanged is controlled by a switch, which may be a transistor such as a Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET). As a result, a SEPIC circuit 302 enables a wide variation in input voltage both substantially higher and lower than nominal battery voltage. For example, to charge a 12 volt battery (nominal voltage) to 14.4V, the variable input voltage can be a voltage from a predetermined range, such as between 5VDC to 20VDC, thereby enabling internal battery 150 recharging functionality via a USB port, which is

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5VDC. That is, the input voltage may not be always known, but the predetermined range may be known. In certain aspects, the SEPIC circuit 302 may be shut off (*e.g.*, bypassed) to facilitate a higher efficiency charge. For example, if a 20V power supply is used, the compact battery charger 102 may bypass the SEPIC circuit 302, whereas, if 12VDC power supply (*e.g.*, a vehicle charger accessory) is used, the SEPIC circuit 302 may be employed.

[0060] Accordingly, as illustrated in Figure 3, a supercapacitor 308, or another storage capacitor, may be used in conjunction with the SEPIC circuit 302 to supply a large amount of power that is sufficient time to jump start a vehicle. Supercapacitors 308 are useful in that, unlike batteries, they do not necessarily suffer from ageing and temperature problems. Because the amount of energy in the capacitor is finite, however, supercapacitors 308 are primarily used for engine starting. Yet, when a supercapacitor is simply coupled to a depleted battery, the finite energy reserve is drained into the battery, often lowering the supercapacitor's 308 voltage to a level that cannot start an engine. A jump starter battery, on the otherhand, can start an engine as it has sufficient current to override the discharging effects of a depleted vehicle battery. In cold weather, however, the peak current that a battery can supply may be limited due to the temperature effecting the chemical reaction inside the jump starter battery. This limit in peak current may be such that the engine may not turn over. Thus, an improved system for starting the vehicle may be jump starter having both an internal battery 150 and a supercapacitor 308, where the battery can supplies sufficient current to overcome the effects of the depleted external battery 104, while the supercapacitor 308 may supply the peak current.

[0061] In general, a supercapacitor 308 can hold a very high charge that can be released relatively quickly, thereby making it suitable for jump starting a vehicle, since the vehicle cranking operation lasts for a very short period of time during which high cranking power is required. Moreover, supercapacitors 308 are relatively small in size and can be employed in the compact battery charger 102 to provide sufficient cranking power to jump-start a vehicle. In operation, the SEPIC circuit 302 would draw current from the depleted external battery 104, which would be used to charge the supercapacitor 308. A small lithium battery may be used in combination with the supercapacitor to prevent the supercapacitor 308 from discharging the current back to the depleted external battery 104 until the compact battery charger 102 determines that the user trying to start the vehicle. Existing supercapacitor jump starter systems are deficient because they would require the removal of one of the external battery 104 connections to prevent the capacitor from discharging back into the dead battery. The disclose arrangement, however, obviates the need to disconnect one of the

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external battery's 104 terminals. Thus, in one aspect of the present invention, a compact battery charger 102 is provided that employs a SEPIC circuit 302 in conjunction with a supercapacitor 308.

[0062] An example schematic diagram 300 of a charger having a SEPIC circuit 302 in conjunction with a supercapacitor 308 is illustrated in Figure 3. As illustrated, DC input power is received from a DC power supply 156 via DC input terminal 154, or either AC power supply 148 via an AC to DC converter 314. The DC input power is received by SEPIC circuit 302 and output to the internal battery 150 and the supercapacitor 308, in parallel, via an internal battery controller circuit 304 and a supercapacitor controller circuit 306, respectively. The internal battery controller circuit 304 and a supercapacitor controller circuit 306 may be used to monitor the parameters of the internal battery 150 and the supercapacitor 308, such as the charge level. Further, internal battery controller circuit 304 may monitor the temperature of the internal battery 150. The parameters may be communicated to the processor 128, which controlled, *inter alia*, the battery control relay 310, and supercapacitor controller 312.

[0063] The supercapacitor 308 and internal battery 150 may receive charging current from the DC input power. When DC input power is unavailable, for instance, the supercapacitor 308 may receive charging current from external battery 104 via the supercapacitor controller 312. For example, if an external battery 104 having a nominal voltage of 12VDC has depleted to 6VDC, the external battery 104 may be unable to start a vehicle, but the remaining power may be drawn from the depleted external battery 104 to the supercapacitor 308, which could then be used to boost the vehicle. As noted above, existing supercapacitor-only battery boosters were required to disconnect one of the external battery's 104 terminals so as to avoid premature discharge of the supercapacitor into the depleted battery. The lithium ion battery, however, may be used to output a current to the external battery 104, which may be monitored by the processor 128. If a drop in current is detected at the DC output terminal 136, the processor 128 may determines that the user is attempting to start the vehicle and the supercapacitor controller 312 may be instructed to electrically couple the supercapacitor 308 to the external battery 104 (via DC output terminal 136), thereby causing the supercapacitor 308 to quickly discharge into the external battery 104, thereby enabling the vehicle to start. The processor 128 may be similarly configured to control the battery control relay 310, which enables the internal battery 150 to discharge into the external battery 104.

[0064] Thus, the internal battery 150 and a supercapacitor 308 can each be recharged by a SEPIC circuit 302, which may any input voltage between, for example, 5VDC to 20VDC. The

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internal battery controller circuit 304 recharges the battery inside the compact battery charger 102 properly, while a separate supercapacitor controller circuit 306 charges the supercapacitor 308. The supercapacitor 308 may also be recharged from the internal battery 150, thereby providing multiple peak current starts. The jump starting function is controlled by one or more processors 108 (e.g., a microprocessor(s)) once the jump starter cables are attached to an external battery 104 and the jump start function is engaged (either manually or automatically) the internal jump starter battery is connected by a circuit or relay to the vehicle's battery. The internal battery 150 transfers energy into the external battery 104 and when the vehicle ignition is actuated (e.g., the key is turned, or the start button is pressed), current drawn from the starter motor will cause a voltage drop across the jump starter connection leads. This voltage drop will be detected by the one or more processors 108, at which point the one or more processors 108 will electrically couple the supercapacitor in parallel with its internal battery 150 to supply the peak current required to start the engine. If the engine starts, the jump starter function is done and the compact battery charger 102 can recharge itself (*e.g.,* the internal battery 150 and/or the supercapacitor 308) from an electrical connection to the vehicle's electrical system, which may continue until the internal battery 150 and/or the supercapacitor 308 are fully charged. Afterwhich the compact battery charger 102 may shut off its charging function, or the clamps are removed. If the vehicle does not start, once the starter is disengaged the voltage on the external battery 104 will stabilize and the supercapacitor 308 will recharge from the internal battery 150 (or any available power from the external battery 104), and prepare for the next attempt to start the engine, whereby the process is repeated.

[0065] There are a number of ways in which the internal battery 150 may be charged. The user may also charge the internal battery 150 while driving via the DC input terminal 154 using a 12VDC car charger that couples to the cigarette lighter. Accordingly, a 12VDC input socket may be used to recharge the compact battery charger 102 to a point where the compact battery charger 102 is charged. The compact battery charger 102 may then be used to jump start a vehicle having an external battery 104. In certain aspects, the compact battery charger 102 may be charged through the clamps, which may be retractable and/or configured to be housed in a recess of the compact battery charger 102's housing. For example, charging may be accomplished by leaving the relay closed, thereby allowing the alternator in the vehicle, which can provide up to 70A, to rapidly charge the internal battery 150. Thus, the compact battery charger 102 may be configured to sense the current in a bidirectional manner through the clamps (*e.g.*, (1) to measure current going from the compact battery

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charger 102 into the external battery 104, and (2) from the external battery 104 into the compact battery charger 102). To prevent overheating when current is passing into the compact battery charger 102, a temperature sensor may be coupled to the compact battery charger 102, whereby the relay is shut off if the compact battery charger 102, or the internal battery 150, reaches a predetermined shut-off temperature threshold. Indeed, a benefit of maximizing the amount of current going back into the compact battery charger 102 is that it yields a faster charge.

[0066] In lieu of clamps, the compact battery charger 102's charger cables may be fixedly coupled to the external battery 104 (*e.g.*, via a bolt and ring terminals) and configured to quick connect to compact battery charger 102 (*e.g.*, using quick connects/disconnect connectors). In certain instances, the quick connect connectors may not be compatible with different devices. For example, a battery maintainer (a/k/a trickle charger) may use a first type of connector, while a compact battery charger 102 may use a second type of connector. Such issues are common between different manufacturers. Due to the inconvenience of disconnecting and reconnecting the fixedly coupled connections, it may be advantageous to use a charger cable that fixedly couples to the external battery 104 at one end, but provides a plurality of different connectors at the second end. For example, the first end may be fixedly coupled to a battery terminal through the ring terminals, while the second end may be provided with two connecters, namely (1) an EC5 (male) connector configured to couple with an EC5 (female) connector of the compact battery charger 102 and (2) a second (male) connector configured to couple with a second (female) connector of a battery charger/maintainer. One or more end caps may be further provided to protect the unused connector from dirt and debris. Such a charger cable would be of particular use for vehicles that are not often used and typically require jump starting. While two connectors are described, such a charger cable need not be limited to two connectors, nor should it be limited to the example connector types described.

[0067] In another alterative, the entire compact battery charger 102 may be permanently coupled to an external battery 104 or a vehicle's electrical system (*e.g.*, installed under the hood or inside the vehicle). For example, the compact battery charger 102 may be fixedly coupled to the vehicle and remotely actuated using a physical button or controller (*e.g.*, one positioned under the hood, on the dashboard, in the glove box, etc.), or wirelessly. When integrated with the vehicle, the compact battery charger's 102 housing may be fabricated to mitigate damage from engine temperature or engine fluids. Wireless control may be accomplished using, for example, a portable electronic device 152 that is communicatively coupled to the compact battery charger 102 via a

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communication network. For instance, a smart phone may wirelessly send a signal to the compact battery charger 102, either directly or through the vehicle's control system, which causes the compact battery charger 102 to output boosting energy or charging energy to the external battery 104 of the vehicle. The wireless communication may employ one or more wireless standards such as Bluetooth (*e.g.*, short-wavelength, UHF radio waves in the ISM band from 2.4 to 2.485 GHz), NFC, Wi-Fi (*e.g.*, IEEE 802.11 standards), etc. When permanently coupled to the external battery 104 or vehicle's electrical system, the compact battery charger 102 may charge the internal battery 150 when the vehicle is running via the vehicle's electrical system (*e.g.*, 12VDC supply).

[0068] In certain aspects, the supercapacitor 308 may be integrated with the vehicle's electrical system and configured to receive any residual power from the vehicle's accessories for use in jump starting the vehicles. For example, vehicles often have sufficient power to power the vehicle's entertainment system, but insufficient power to turn over the engine. In this example, the power may be diverted from the entertainment system (or other accessory or auxiliary system) at the press of a button and used to charge an integrated supercapacitor, which may be used to jump start the vehicle.

[0069] In certain aspects, the compact battery charger 102 may employ inductive charging to facilitate wireless charging of the internal battery 150. For example, the compact battery charger 102 may be placed on a corresponding charging inductor pad to charge the compact battery charger 102's internal battery 150. In one aspect, the charging inductor pad may comprise an induction coil that creates an alternating electromagnetic field from within a charging inductor pad and a second induction coil in the compact battery charger 102 that receives power from the electromagnetic field and converts the received power into electric current to charge the internal battery 150. The two induction coils in proximity combine to form an electrical transformer. Greater distances between transmitter and receiver coils can be achieved when the inductive charging system uses resonant inductive coupling. The coils may be fabricated using a number of materials, such as silver plated copper (or aluminum) to minimize weight and decrease resistance resulting from the skin effect. The charging inductor pad and the compact battery charger 102 may operate in compliance with one or more wireless power transfer standards, such as the Power Matters Alliance (PMA) under the IEEE Standards Association (IEEE-SA) Industry Connections, Rezence, and Qi. The PMA interface standard describes analog power transfer (inductive and resonant), digital transceiver communication, cloud based power management, and environmental sustainability.

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[0070] Rezence is an interface standard developed by the Alliance for Wireless Power (A4WP) for wireless electrical power transfer based on the principles of magnetic resonance. The Rezence system comprises a single power transmitter unit (PTU) and one or more power receiver units (PRUs). The interface standard supports power transfer up to 50 Watts, at distances up to 5 centimeters. The power transmission frequency is about 6.78 MHz, and a plurality of devices can be powered from a single PTU depending on transmitter and receiver geometry and power levels. To use the Rezence system, the compact battery charger 102 (*i.e.*, PRU) is placed on top of the charging inductor pad (*i.e.*, PTU), which charges the compact battery charger 102's internal battery 150 via resonant inductive coupling. In addition to power transfer, the Rezence system may be used to transfer data from the compact battery charger 102 (*e.g.*, from the internal data storage device 122) to another device via the charging inductor pad. There exists, however, overlap between the PMA and Rezence specifications. For instance, PMA adopted the Rezence specification as the PMA magnetic resonance charging specification for both transmitters and receivers in both single and multi-mode configurations, while Rezence adopted the PMA inductive specification as a supported option for multi-mode inductive, magnetic resonance implementations. Akin to Rezence, Qi is an interface standard developed by the Wireless Power Consortium for inductive electrical power transfer over distances of up to 4 centimeters. The Qi system comprises a PTU and a PRU. To use the Qi system, the compact battery charger 102 (*i.e.*, PRU) is placed on top of the charging inductor pad (*i.e.*, PTU), which charges the compact battery charger 102's internal battery 150 via resonant inductive coupling.

[0071] Inductive charging offers advantages to the compact battery charger 102, beyond convenience of use. First, the connections on both the compact battery charger 102 and charging inductor pad are enclosed; therefore corrosion is avoided (or mitigated) because any electronic components are protected from water and oxygen in the atmosphere. Moreover, to mitigate water damage, the compact battery charger 102's housing may be waterproof and buoyant to facilitate, for example, marine applications. Second, inductive charging also lends durability to the compact battery charger 102 because the need to plug and unplug the device is obviated, resulting in significantly less wear and tear on the socket of the device and the attaching cable.

[0072] In certain aspects, the compact battery charger 102 may employ solar cells to facilitate a charging of the internal battery 150 and/or supercapacitor 308. The solar cell may be provided as a separate solar cell panel, or integrated with the compact battery charger 102. For example, solar cells may be positioned on an exterior surface of the compact battery charger's 102 housing or, when

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integrated with a vehicle, the solar cell may be positioned on the vehicle, such as the roof, hood, trunk, windows, etc.

[0073] The compact battery charger 102's housing may further comprise a metal (*e.g.*, aluminum) plate on a back side to facilitate exterior warming of the interior battery 150 via the user's hand. Conversely, a button may be provided on the user interface 138 that causes power to be diverted from the interior battery 150 to a heating apparatus, such as a flexible heater. Flexible heaters can conform to a surface, such as a the compact battery charger 102. Example flexible heaters include silicone rubber heaters, polyimide film heaters, heating tapes, etc. Suitable flexible heaters include, for example, polyimide film insulated flexible heaters, such as those available from OMEGA Engineering Inc, and Kapton heaters (a form of ultra-thin, ultra-flexible, semitransparent, lightweight heaters), such as those available from Bucan Electric Heating Devices Inc.

[0074] The DC power may be output to the external battery 104 or other devices by way of a DC output terminal 136 (*e.g.*, battery terminal cables/clamps). Thus, power management circuit 132 and processor 128 may control the charging operation of the external battery 104 to provide charging, maintaining, and, in certain embodiments, the jump start function. Further, power management circuit 132 and processor 128 may facilitate reverse hook-up protection, as well as automatic nominal battery voltage detection. While the power management circuit 132 and processor 128 are illustrated as separate components, one of skill in the art would appreciate that power management functionality (*e.g.*, battery charging, battery maintaining, etc.) may be provided as a single component that combines the functionality of the power management circuit 132 and processor 128.

[0075] The output power may be controlled by software (*e.g.*, via a relay, MOSFET, and/or a silicon-controlled rectifier). The output power may be controlled using one or more parameters, such as maximum current over time, maximum temperature of battery, maximum time alone and/or minimum voltage (with or without time). Thus, when a parameter value is exceeded (or a requirement isn't met), the output voltage may be shut off. The compact battery charger 102 may include the ability to sense, or otherwise detect, that a battery (or other load/power supply) is coupled to the clamps. When a battery is not detected, the power may be shut off; however, the user may be provided with a manual override option (*e.g.*, by holding a button for a predetermined amount of time, such as 2 to 10 seconds, or about 5 seconds). In certain aspects, the compact battery charger 102 may not charge an external battery 104 when the external battery 104 is too hot or cold, thereby avoiding potential hazards and maintaining efficiency.

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[0076] The compact battery charger 102 may further include the ability to sense the occurrence of a manual override, and, if voltage is still 0 after engine start, the user may be instructed to check and replace the vehicle battery. Further, an automatic shut-off function may be provided if a battery/load/power supply is not attached to the clamps within a predetermined amount of time (*e.g.*, about 1 to 60 minutes, more preferably about 5 to 30 minutes, most preferably about 15 minutes). The compact battery charger 102 may further preheat a cold battery by, for example, running amperes though the battery, or an internal heater. The compact battery charger 102 may further employ alternate power sources, such as a solar panel to enable battery maintaining and charging, as well as data monitoring through solar panels (*e.g.*, one or more 12-14 Watt panels). For example, solar cells may be used to charge or maintain fleet vehicles, such as vehicle dealership fleets, rental vehicles fleets, etc.

[0077] To use the jump start function, the DC output terminal 136 may be coupled to the external battery 104 (*i.e.*, the battery to be charged/jumped, whether directly or indirectly) and the user interface 138 may be used to activate the boost feature. If the compact battery charger 102 is being charged when the jump start function is selected, the display device 114 may indicate that the jump start function cannot be performed while the compact battery charger 102 is charging. If the clamps are improperly connected (*e.g.*, reverse polarity or disconnected), an aural alarm may sound, and the display device 114 may display a warning message, such as "Warning – Reverse Polarity" or "Warning - Battery Disconnected." Conversely, if the clamps are properly connected and the compact battery charger 102 is ready for use, the display device 114 may display a standby message, such as "Jump Start Ready."

[0078] If the compact battery charger 102's jump start function is attempted twice within a predetermined time period (*e.g.*, a minute), the jump start function may be prohibited until the compact battery charger 102 has cooled down. During the cool down period, the display device 114 may display a cool down message, which may also indicate the remaining time for the cool down period.

[0079] If the external battery 104's voltage is too low for the compact battery charger 102 to detect that the clamps are connected, a manual start procedure (*e.g.*, the manual override) may be selected to enable the jump start function. To use the manual start procedure, the DC output terminal 136 may be coupled to the external battery 104 and the user interface 138 may be used to activate the boost feature. For example, the same button may be used to trigger the jump start function, but

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instead of a momentary press, the button may be pressed and held for a predetermined period of time (*e.g.*, about 2 to 10 seconds, more preferably about 5 seconds) until the display device 114 displays the standby message. In certain aspects, the manual start procedure may override safety features to ensure that power is delivered regardless of connection status. Accordingly, the compact battery charger 102 may energize the clamps and cause sparking if they are touched together (*i.e.*, shorted).

[0080] Figure 2 illustrates a flow diagram 200 of an example method for providing the jump start function using a compact battery charger 102. The process starts at step 202, which may be initiated by the user actuating a jump start function button on the user interface 138. At step 204, the compact battery charger 102's processor 128 determines, using one or more sensors, whether the temperature of the internal battery 150 is within an operating range. For example, if the temperature of the internal battery 150 exceeds a first predetermined shut-off temperature threshold, a warning is provided at step 220 indicating that the internal battery 150 is too hot. Similarly, if the temperature of the internal battery 150 does not meet a first predetermined shut-off temperature threshold, a warning is provided at step 220 indicating that the internal battery 150 is too cold. Otherwise, the process proceeds to the next step.

[0081] At step 206, the compact battery charger 102's processor 128 determines whether the state of charge for the internal battery 150 is within an operating range. For example, if the internal battery 150's state of charge does not meet a predetermined charge level threshold, a warning is provided at step 220 indicating that the internal battery 150 is not adequately charged. Otherwise, the process proceeds to the next step.

[0082] At step 208, the compact battery charger 102's processor 128 determines whether the internal battery 150 is being charged. If the internal battery 150's is being charged, a warning is provided at step 220 indicating that the internal battery 150 is being charged and cannot be used to provide the jump start function. Otherwise, the process proceeds to the next step.

[0083] At step 210, the compact battery charger 102's processor 128 determines whether an external battery 104 is coupled to the compact battery charger 102 (*e.g.*, via clamps coupled to the DC output terminal 136). If no external battery 104 is detected (*e.g.*, by measuring a voltage or resistance across the battery terminals), a warning is provided at step 220 indicating that the external battery 104 is not detected. Otherwise, the process proceeds to the next step.

[0084] At step 212, the compact battery charger 102's processor 128 determines whether an accessory is currently coupled to, or otherwise using, the compact battery charger 102 (*e.g.*, via DC

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output terminal 136 or an AC output terminal). If an accessory is detected (*e.g.*, by detecting a load or other current draw at an output terminal), a warning is provided at step 220 indicating that the internal battery 150 is in use and cannot be used to provide the jump start function. Otherwise, the process proceeds to the next step.

[0085] At step 214, the compact battery charger 102's processor 128 determines whether an external battery 104 is properly coupled to the compact battery charger 102. If a reverse polarity condition is detected for the external battery 104, a warning is provided at step 220 indicating that the external battery 104 is improperly connected. Otherwise, the process proceeds to the next step.

[0086] At step 216, the compact battery charger 102's processor 128 determines whether the compact battery charger 102 is in a cool down period. For example, as noted above, if the compact battery charger 102's jump start function is attempted twice within a predetermined time period (*e.g.*, a minute), the jump start function may be prohibited until the compact battery charger 102 has cooled down (*i.e.*, the predetermine time period has elapsed). Accordingly, if the jump start function has been performed within a predetermined period of time, a warning is provided at step 220 indicating a cool down message, which may also indicate the remaining time for the cool down period. After the predetermined time period has elapsed at step 222 (*e.g.*, using a timer), the process may proceed to the next step.

[0087] At step 218, the compact battery charger 102 is ready to perform the jump start function, whereby boosting energy may be output to the external battery 104 upon actuating the jump start function button on the user interface 138, or automatically. The boosting energy may be provided for a predetermined period of time, before shutting off. For example, the boosting energy may be provided for 1 to 60 seconds, more preferably 5 to 30 seconds.

[0088] A warning may be provided at step 220 via one or more of a display device 114, a speaker 124, or to another device (*e.g.*, a portable electronic device 152) via a communication network. The message may indicate to the user one or more statuses/conditions of the internal battery 150, external battery 104, and/or of the compact battery charger 102, such as those illustrated in Table A.

[0089] At step 224, the process may be reset such that the process is repeated. The reset feature may be manually triggered (*e.g.*, via a button) or automatically once a predetermined condition is met. For example, if the temperature of the internal battery 150 is outside of the operating

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range, the system may be automatically reset once the temperature of the internal battery 150 returns to the operating range. If a reset is not selected at step 224, the processed exits at step 226.

[0090] In certain aspects, a manual override option may be selected (*e.g.*, at any time) that causes the compact battery charger 102 to proceed to step 218, the compact battery charger 102 is ready to perform the jump start function, regardless of the status of the internal battery 150, external battery 104, or of the compact battery charger 102. Further, the compact battery charger 102's processor 128 determines whether the voltage of the internal battery 150 or the external battery 104 exceeds a predetermined threshold, in which case charging and/or boosting is prohibited to prevent overcharging.

[0091] The above-cited patents and patent publications are hereby incorporated by reference in their entirety. Although various embodiments have been described with reference to a particular arrangement of parts, features, and the like, these are not intended to exhaust all possible arrangements or features, and indeed many other embodiments, modifications, and variations will be ascertainable to those of skill in the art. Thus, it is to be understood that the invention may therefore be practiced otherwise than as specifically described above.

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What is claimed is:

Claim 1. A compact battery booster comprising:

a processor;

a display device operatively coupled to the processor, wherein the display device displays a status of the compact battery booster;

a storage capacitor and an internal lithium ion battery, each of said storage capacitor and said internal lithium ion battery configured to provide a boosting energy to a vehicle coupled to an external battery;

a direct current (DC) output terminal configured to electrically couple with the external battery;

a single-ended primary-inductor converter configured to receive a variable input voltage between 5 volts DC and 20 volts DC and to output a predetermined output voltage to said storage capacitor and said internal lithium ion battery; and

a power management circuit operatively coupled to the processor, the power management circuit configured to electrically couple the DC output terminal with said storage capacitor or said internal lithium ion battery, thereby providing the boosting energy from said storage capacitor or said internal lithium ion battery to said vehicle.

Claim 2. The compact battery charger of claim 1, wherein the storage capacitor is a supercapacitor.

Claim 3. The compact battery charger of claim 1, wherein the storage capacitor draws a charging current from the external battery.

Claim 4. A compact battery charger comprising:

a processor;

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a display device operatively coupled to the processor, wherein the display device displays a status of the compact battery charger;

an internal lithium ion battery, said internal lithium ion battery configured to provide a predetermined output energy;

a direct current (DC) output terminal, wherein the DC output terminal is configured to couple with an external battery;

a single-ended primary-inductor converter configured to receive an input voltage within predetermined input voltage range and to output a predetermined charge voltage to said internal lithium ion battery; and

a power management circuit operatively coupled to the processor, the power management circuit configured to electrically couple the DC output terminal with said internal lithium ion battery, thereby providing the predetermined output energy from said internal lithium ion battery to said external battery.

Claim 5. The compact battery charger of claim 4, further comprising a supercapacitor, wherein the single-ended primary-inductor converter charges the supercapacitor.

Claim 6. The compact battery charger of claim 4, further comprising a supercapacitor, wherein the supercapacitor draws current from the external battery to charge the supercapacitor.

Claim 7. The compact battery charger of claim 4, wherein the predetermined input voltage range is 5 volts to 20 volts.

Claim 8. The compact battery charger of claim 4, wherein the predetermined charge voltage is greater than the input voltage.

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Claim 9. The compact battery charger of claim 4, wherein the predetermined output energy is a boosting energy for starting an engine coupled to the external battery.

Claim 10. The compact battery charger of claim 4, wherein the predetermined output energy is a charging energy for charging the external battery.

Claim 11. The compact battery charger of claim 4, further comprising (1) a reverse polarity sensor configured to detect a polarity of the external battery; (2) a temperature sensor configured to detect a temperature of said internal lithium ion battery and to provide a temperature signal to said processor; and (3) a voltage sensor configured to detect a voltage of said internal lithium ion battery.

Claim 12. The compact battery charger of claim 4, further comprising a removable internal data storage device.

Claim 13. The compact battery charger of claim 4, further comprising an internal induction coil, wherein the internal induction coil receives energy from an electromagnetic field created by an external induction coil and converts the electromagnetic field to produce the input voltage.

Claim 14. The compact battery charger of claim 4, further comprising a second DC output terminal, wherein the DC output terminal provides a boosting energy for starting an engine coupled to the external battery, and wherein the second DC output terminal provides a charging energy to a portable electronic device.

Claim 15. The compact battery charger of claim 14, wherein said second DC output terminal is a Universal Serial Bus (USB) port.

Claim 16. The compact battery charger of claim 4, wherein the display device enters into a sleep mode after a predetermined time period of inactivity.

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Claim 17. The compact battery charger of claim 4, wherein the DC output terminal runs a predetermined current through the external battery to preheat the external battery.

Claim 18. The compact battery charger of claim 4, further comprising a DC to alternating current (AC) converter coupled between the internal lithium ion battery and an AC output terminal.

Claim 19. The compact battery charger of claim 4, further comprising an internal data storage device, wherein the internal data storage device backs up digital content stored to a portable electronic device via a USB port.

Claim 20. A compact battery charger comprising:

an internal lithium ion battery, said internal lithium ion battery configured to provide a predetermined output energy;

a direct current (DC) output terminal, wherein the DC output terminal is configured to couple with an external battery;

an internal induction coil, wherein the internal induction coil receives energy from an electromagnetic field created by an external induction coil and converts the electromagnetic field to produce an input voltage;

a DC to DC converter that receives the input voltage and outputs a predetermined output voltage to said internal lithium ion battery; and

a power management circuit operatively coupled to the processor, the power management circuit configured to electrically couple the DC output terminal with said internal lithium ion battery, thereby providing the predetermined output energy from said internal lithium ion battery to said external battery.

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Claim 21. The compact battery charger of claim 19, further comprising a removable data storage device.

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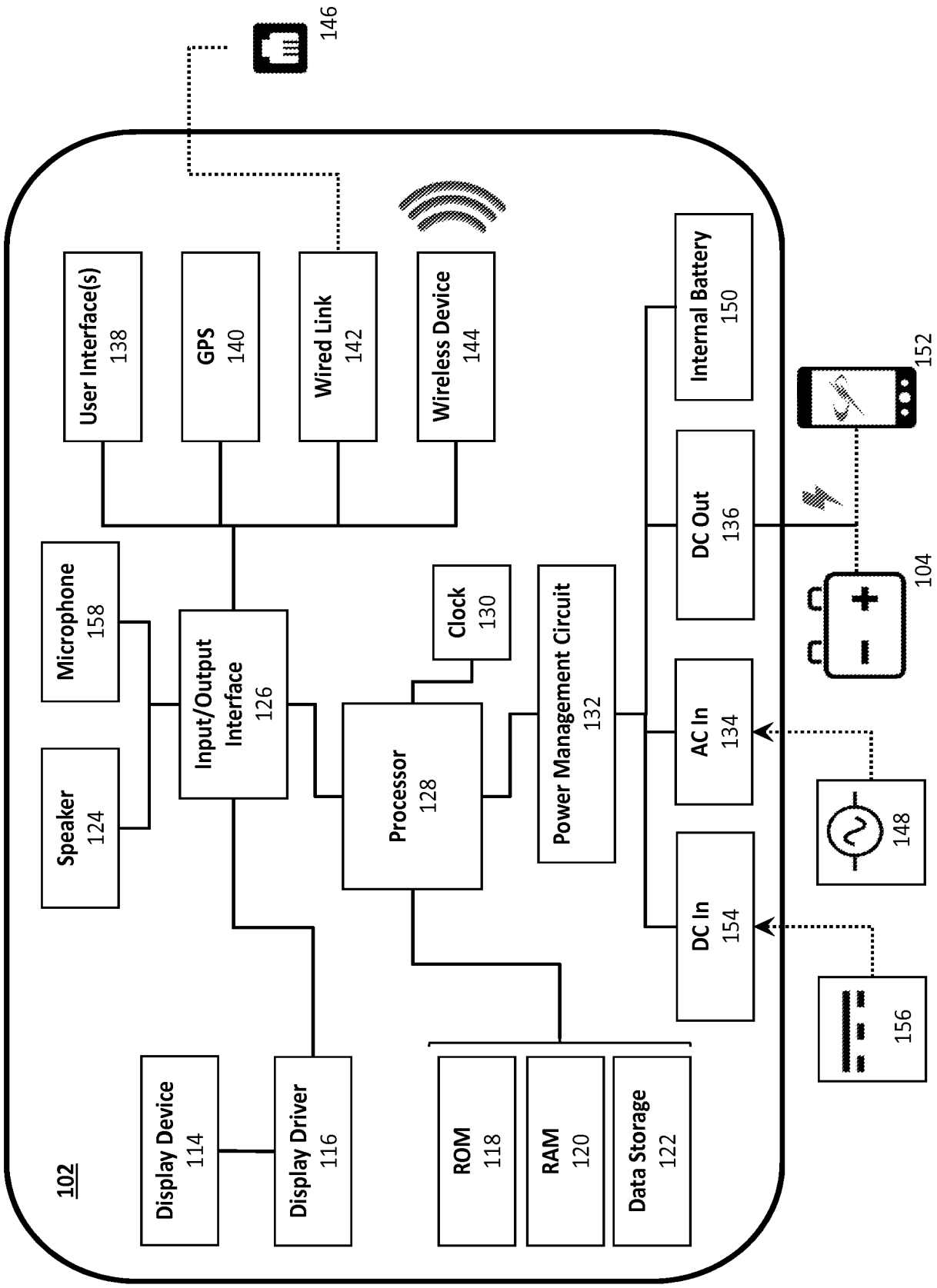


Figure 1

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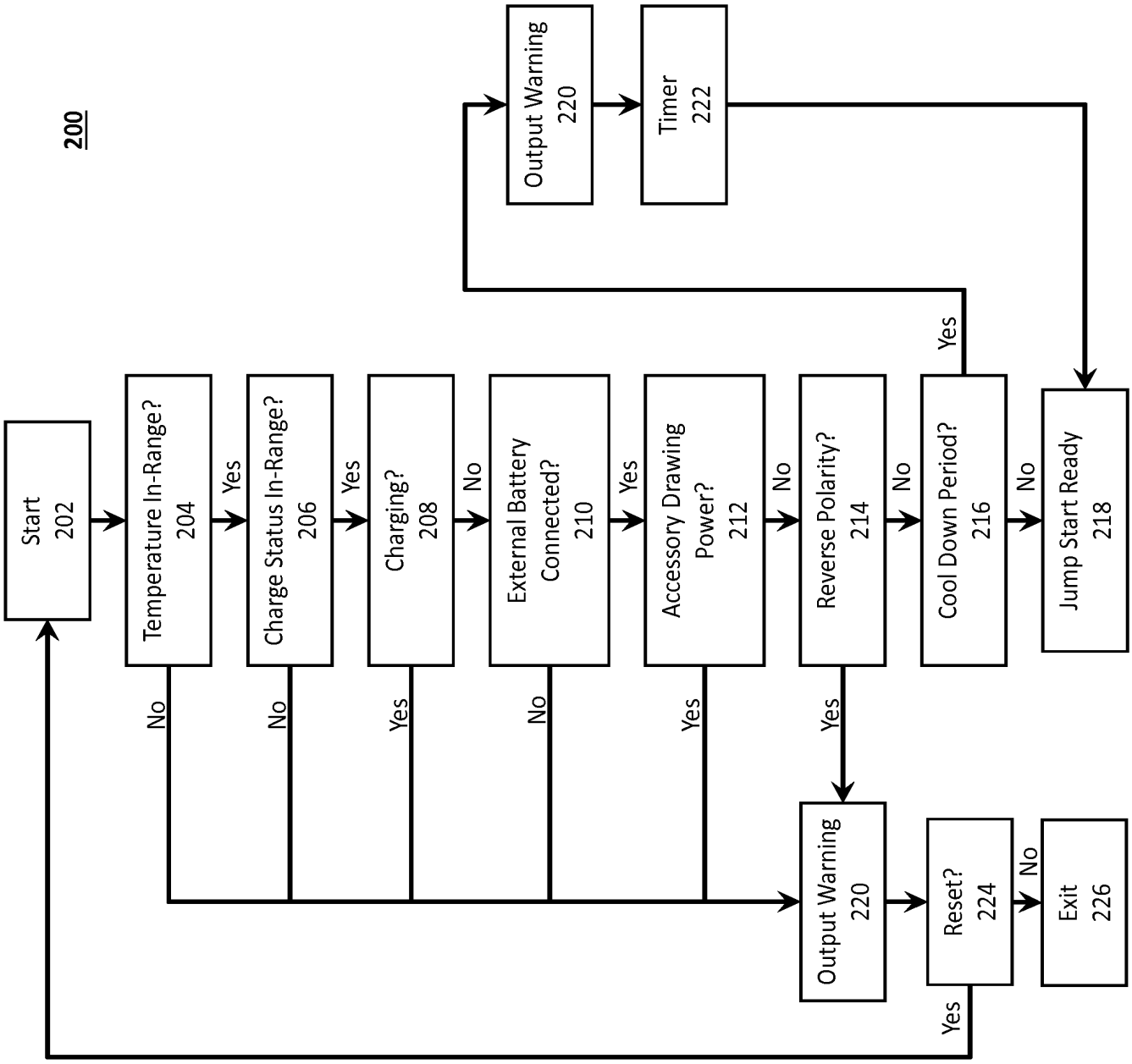


Figure 2

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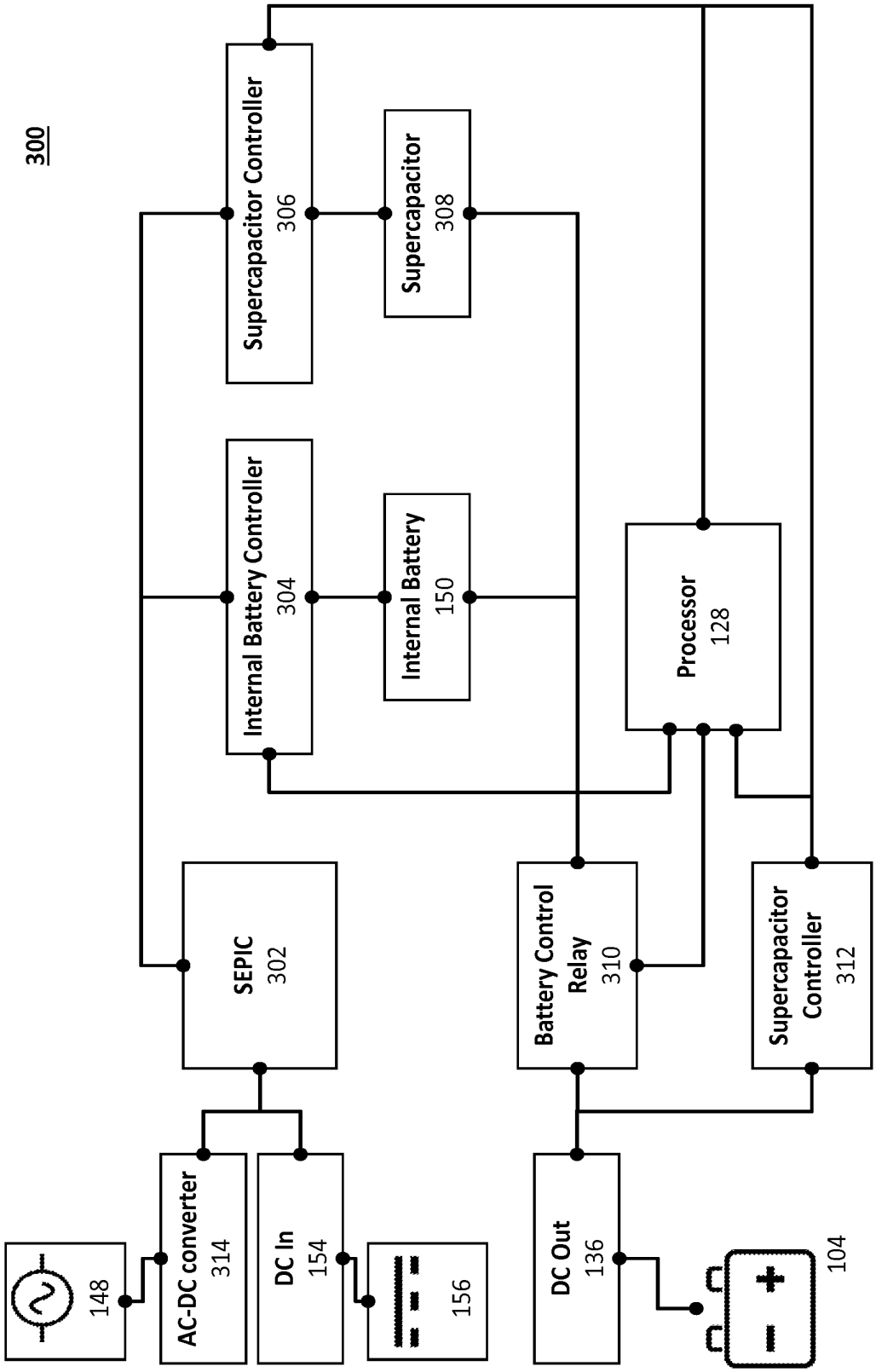


Figure 3

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/045335

A. CLASSIFICATION OF SUBJECT MATTER
IPC (2015.01) H02M 3/18, H02J 7/02

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 (2015.01) H02M 3/18, H02J 7/02

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)
Databases consulted: THOMSON INNOVATION, Esp@cenet, Google Patents, Google Scholar, FamPat database
Search terms used: battery, booster, starter, crank, auxiliary power unit (APU), ground power unit (GPU), Supercapacitor (SC), electric double-layer capacitor (EDLC), ultracapacitor, Pseudocapacitance, Processor, display, user interface (UI), DC/DC converter

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012068662 A1 DURANDO RONALD A [US]; ALLEN FRED?[US]; SIMON STEVE [US]; ERGUL NECDET [US]; MPHASE TECHNOLOGIES INC 22 Mar 2012 (2012/03/22) Entire document	1-21
A	US 2013264875 A1 MAXWELL TECHNOLOGIES INC [US] 10 Oct 2013 (2013/10/10) Figs 11-15	1-21
A	US 2011100735 A1 ISE CORP [US] 05 May 2011 (2011/05/05) Figs 1-7	1-21
A	US 2010315046 A1 TPL INC [US] 16 Dec 2010 (2010/12/16) Fig 3	1-21
A	US 2008246443 A1 DOLJACK FRANK ANTHONY, COOPER TECHNOLOGIES COMPANY 09 Oct 2008 (2008/10/09) Figs 1B, 5-6	1-21

☐ 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
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"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
"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
"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	Date of mailing of the international search report
10 Nov 2015	23 Nov 2015
Name and mailing address of the ISA: Israel Patent Office Technology Park, Bldg.5, Malcha, Jerusalem, 9695101, Israel Facsimile No. 972-2-5651616	Authorized officer COHAY Mattan Telephone No. 972-2-5651611

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/US2015/045335

Patent document cited search report	Publication date	Patent family member(s)	Publication Date
US 2012068662 A1	22 Mar 2012	US 2012068662 A1	22 Mar 2012
US 2013264875 A1	10 Oct 2013	US 2013264875 A1	10 Oct 2013
		CN 104285336 A	14 Jan 2015
		EP 2826095 A2	21 Jan 2015
		JP 2015518233 A	25 Jun 2015
		KR 20140130232 A	07 Nov 2014
		US 2013266824 A1	10 Oct 2013
		US 2013266825 A1	10 Oct 2013
		US 2013266826 A1	10 Oct 2013
		WO 2013138380 A2	19 Sep 2013
		WO 2013138380 A3	13 Mar 2014
US 2011100735 A1	05 May 2011	US 2011100735 A1	05 May 2011
		US 2010133025 A1	03 Jun 2010
		US 8245801 B2	21 Aug 2012
		WO 2011056998 A2	12 May 2011
		WO 2011056998 A3	13 Oct 2011
		WO 2011056999 A2	12 May 2011
		WO 2011056999 A3	25 Aug 2011
US 2010315046 A1	16 Dec 2010	US 2010315046 A1	16 Dec 2010
		US 7982439 B2	19 Jul 2011
		EP 1994623 A2	26 Nov 2008
		TW 200814489 A	16 Mar 2008
		TW I338990 B	11 Mar 2011
		US 2007182362 A1	09 Aug 2007
		US 7692411 B2	06 Apr 2010
		US 2010060231 A1	11 Mar 2010
		US 2012068669 A1	22 Mar 2012
		WO 2007082168 A2	19 Jul 2007

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Patent document cited search report	Publication date	Patent family member(s)	Publication Date
		WO 2007082168 A3	22 Nov 2007
US 2008246443 A1	09 Oct 2008	US 2008246443 A1	09 Oct 2008
		US 8179103 B2	15 May 2012
		CN 101641760 A	03 Feb 2010
		EP 2143124 A1	13 Jan 2010
		TW 200847580 A	01 Dec 2008
		WO 2008124510 A1	16 Oct 2008

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Espacenet

CN103066662A Emergency power supply

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Emergency power supply

Abstract

The invention relates to an emergency power supply which comprises a shell body. A battery pack used for storing electric energy is arranged in the shell body, and an input end of the battery pack is connected with output ends of a charging circuit used for charging the battery pack and a solar panel input circuit. An output of the battery pack is connected with a large current output circuit used for outputting large currents when an automobile is started, and an externally connected battery intelligent detecting system is connected between the battery pack and the large current output circuit. The emergency power supply is convenient to charge, capable of outputting large currents for starting an automobile, and capable of accurately controlling current output.

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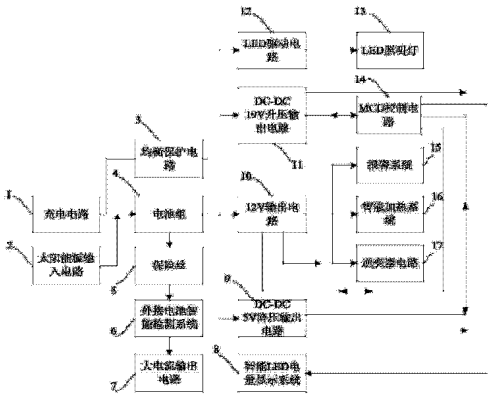
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(54)发明名称

应急电源

(57)摘要

本发明涉及一种应急电源，包括壳体，所述壳体的内部设置有用于储存电能的电池组，所述电池组的输入端与用于给所述电池组充电的充电电路、太阳能板输入电路的输出端连接，所述电池组的输出端连接有用于汽车启动时输出大电流的大电流输出电路，所述电池组与所述大电流输出电路之间连接有外接电池智能检测系统。该应急电源自身充电方便、可大电流输出用于汽车启动，并能准确控制大电流输出。



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1. 一种应急电源，包括壳体，所述壳体的内部设置有用于储存电能的电池组（4），其特征在于：所述电池组（4）的输入端与用于给所述电池组（4）充电的充电电路（1）、太阳能板输入电路（2）的输出端连接，所述电池组（4）的输出端连接有用于汽车启动时输出大电流的大电流输出电路（7），所述电池组（4）与所述大电流输出电路（7）之间连接有外接电池智能检测系统（6）。

2. 根据权利要求 1 所述的一种应急电源，其特征在于：所述电池组（4）由以磷酸铁锂、钴酸锂、镍钴锰三元锂或锰酸锂为正极，以人造或天然石墨为负极的锂离子电芯串联或并联组成，其输出端还连接有多路 DC-DC 调压电路以及 LED 驱动电路（12），每路所述 DC-DC 调压电路均与 MCU 控制电路（14）连接，所述 MCU 控制电路（14）还连接有用于显示该应急电源的电量的智能 LED 电量显示系统（8），所述 LED 驱动电路（12）的输出端连接有 LED 照明灯（13），所述电池组（4）的两端并联有用于保护所述电池组（4）的均衡保护电路（3）。

3. 根据权利要求 1 所述的一种应急电源，其特征在于：所述外接电池智能检测系统（6）包括用于连接外接电池的红黑电瓶夹、根据检测信号控制电路导通或断开的继电器、用于识别外接铅酸电瓶或锂离子启动电池的电压的电压识别系统、及识别通过外接启动电路的电流的电流识别系统，所述继电器的线圈的两端连接所述电压识别系统，所述继电器的输入端连接电压识别系统，所述继电器的输出端连接所述大电流输出电路（7），所述红黑电瓶夹通过可插拔防反接插头连接或通过焊接于所述电池组（4）正负极两端的导线连接，所述可插拔防反接插头与所述电池组（4）的正负极连接，所述电压识别系统与所述红黑电瓶夹连接，所述继电器为 12V 或 24V 继电器，电流规格为 20A ～ 300A，脚位为 4 ～ 6 个，所述外接电池智能检测系统（6）设置于所述应急电源的外部，通过可插拔防反接插头与所述应急电源连接，或者设置于所述应急电源的内部、而红黑电瓶夹设置于所述应急电源的外部。

4. 根据权利要求 3 所述的一种应急电源，其特征在于：所述红黑电瓶夹分别与外部电池的正负极极柱连接时，若为接对状态，所述电压识别系统显示的反馈电压为正，否则反馈电压为负，其中，所述正的反馈电压为 a ～ b 的范围，所述 a 为 6 ～ 24V，b 为 9 ～ 30V，取值时，a 小于 b；当反馈电压为 a ～ b，且为正值时，所述继电器的线圈得到电信号，触点闭合，输出端与所述大电流输出电路（7）导通，该应急电源开始对外接的设备进行大电流供电，此时，所述电流识别系统检测经过所述大电流输出电路（7）的电流，若该电流小于 c 时，c 为 0.1 ～ 10A，所述继电器的线圈两端的电信号消失，触点断开，输出端断开与所述大电流输出电路（7）的连接，停止对外接的设备大电流放电，所述大电流输出电路（7）的输出电压为 DC12V 或 DC24V，瞬间电流为 100A ～ 600A。

5. 根据权利要求 2 所述的一种应急电源，其特征在于：所述 DC-DC 调压电路包括输出电压为 19V 的 DC-DC19V 升压输出电路（11）、输出电压为 12V 的 DC-DC12V 输出电路（10）以及输出电压为 5V 的 DC-DC5V 降压输出电路（9）。

6. 根据权利要求 5 所述的一种应急电源，其特征在于：所述 DC-DC12V 输出电路（10）的输出端连接有用于发出警报信号的报警系统（15）、用于将所述电池组（4）输出的直流电转换为交流电的逆变器电路（17）以及用于给所述电池组（4）加热的智能加热系统（16）。

7. 根据权利要求 6 所述的一种应急电源，其特征在于：所述逆变器电路（17）输出的交流电的电压为 110V ～ 220V，所述逆变器电路（17）内置于所述壳体的内部或者外接于所述壳体。

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8. 根据权利要求 6 所述的一种应急电源，其特征在于：所述智能加热系统（16）包括缠绕于所述电池组（4）的外侧的加热丝或者加热膜，贴附于所述电池组（4）的外表面并与加热丝或加热膜连接的热敏电阻，及启动智能加热系统（16）的加热启动开关；所述的加热丝或加热膜的电阻值的范围为 0.1Ω ～ 10Ω；预先设定所述电池组（4）表面的升温上限温度为 t，t 的范围为 0 ～ 70℃，此时，打开加热启动开关，若通过所述热敏电阻反馈到所述 MCU 控制电路（14）的所述电池组（4）的表面温度小于 t，则加热启动开关打开，加热丝或加热膜的两端导通电流，开始对所述电池组（4）进行加热，预先设定加热的时间为一固定值 d，d 的范围为 10 ～ 300s，当所述电池组（4）的表面温度达到上限温度 t 时，加热启动开关自动断开，或者当加热的时间达到 d 时，智能加热系统的加热电路自动断开。

9. 根据权利要求 1 所述的一种应急电源，其特征在于：所述壳体为塑胶材质、铝合金材质或混合材质的外壳，所述太阳能板输入电路（2）设置于所述壳体的外侧，所述太阳能板输入电路（2）的功率为 0.5W ～ 50W，输入电压为 5V ～ 25V。

10. 根据权利要求 1 所述的一种应急电源，其特征在于：所述电池组（4）的输出端与所述外接电池智能检测系统（6）之间还连接有一次性或者可恢复的保险丝（5），所述保险丝（5）的电流为 50A ～ 500A。

11. 根据权利要求 3 所述的一种应急电源，其特征在于，所述电流识别系统的电路（62）包括：高精度运算放大器 U3，型号是 SGM8591，电阻 R12、R13、R14、R15、R16、R17、R18、R20、R21、RS，电容 C9、C12，开关二极管 D4，型号是 IN4148，U3 的管脚 1 悬空，U3 的管脚 2 与 R16 的一端、R15 的一端、R21 的一端连接在一起，U3 的管脚 3 与 C12 的一端、RS 的一端、BT2 的负极连接在一起，U3 的管脚 4 与 BT1 的负极、RS 的另一端一起接地，U3 的管脚 5 悬空，U3 的管脚 6 与 R20 的一端、R21 的另一端、D4 的正极连接在一起，R20 的另一端与 C12 的另一端连接，U3 的管脚 7 与 VCC 端、C9 的一端连接在一起，C9 的另一端接地，U3 的管脚 8 悬空，D4 的负极接 R17 的一端，R17 的另一端与 R18 的一端、IN2 端连接在一起，R18 的另一端接地，R15 的另一端与 R12 的一端、R13 的一端、R14 的一端连接在一起。

12. 根据权利要求 11 所述的一种应急电源，其特征在于：所述电压识别系统的电路（61）包括：双运算放大器 U2，型号是 LM358，三端稳压电路 U1，型号是 7805，电阻 R1、R2、R4、R5、R6、R7、R8、R9、R10、R11，电容 C1、C2、C3、C4、C5、C6、C7、C8，肖特基二极管 D1、D2，型号是 SS14，三端可调分流基准源 U4，型号为 TL431，U2 的管脚 1 与 R5 的一端、C5 的一端、C4 的一端连接在一起，R5 的另一端与 R6 的一端、IN1 端连接在一起，R6 的另一端接地，U2 的管脚 2 与 U2 的管脚 5、R11 的一端、U4 的阴极、U4 的参考极、R16 的另一端连接在一起，R11 的另一端接 VCC 端，U2 的管脚 3 与 C5 的另一端、R1 的一端、R7 的一端、R8 的一端连接在一起，R1 的另一端接 C4 另一端，U2 的管脚 4 与 R7 的另一端、U4 的阳极、R9 的一端一起接地，R8 的另一端与 D2 的负极、R10 的一端连接在一起，D2 的正极接 BT2 的正极，U2 的管脚 6 与 R10 的另一端、R9 的另一端、C6 的一端、R2 的一端连接在一起，U2 的管脚 7 与 C6 的另一端、C7 的一端、R4 的一端连接在一起，R4 的另一端接 A 点，C7 的另一端接 R2 的另一端，U2 的管脚 8 与 C8 的一端、C2 的一端、C3 的一端、U1 的管脚 3、VCC 端连接在一起，C8 的另一端接地，C2 的另一端和 C3 的另一端一起接地，U1 的管脚 1 与 C1 的一端、D1 的负极连接在一起，U1 的管脚 2 与 C1 的另一端一起接地，D1 的正极接 BT1 的正极。

13. 根据权利要求 12 所述的一种应急电源，其特征在于：所述继电器的电路（63）包括：

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三端稳压芯片 U5，型号是 XC6219，电阻 R3、R19、R22，电容 C11、C13、C14，肖特基二极管 D5，型号是 SS14，MCU 控制芯片 J1，控制开关 Q1、Q2、Q3，型号是 SI2300，继电器，U5 的管脚 1 与 C13 的一端、U5 的管脚 3、VCC 端连接在一起，U5 的管脚 2 与 C13 的另一端、C14 的一端、J1 的管脚 2 一起接地，U5 的管脚 4 悬空，U5 的管脚 5 与 C14 的另一端、J1 的管脚 1 连接在一起，J1 的管脚 3 接 IN1 端，J1 的管脚 4 接 OUT1 端，J1 的管脚 5 接 IN2 端，J1 的管脚 6 接 OUT2 端，J1 的管脚 7 悬空，J1 的管脚 8 悬空，OUT1 端接 R3 的一端，R3 的另一端接 Q2 的栅极，Q2 的漏极与 Q3 的源极、R13 的另一端连接在一起，Q3 的漏极接 R12 的另一端，Q3 的栅极连接 A 点，Q2 的源极与 Q1 的源极、R14 的另一端连接在一起，Q1 的栅极接 R19 的一端，R19 的另一端接 OUT2 端，Q1 的漏极与 D5 的正极、继电器线圈的一端连接在一起，D5 的负极、继电器线圈的另一端、继电器的常开接点的一端、R22 的一端与 BT1 的正极连接在一起，R22 的另一端接 C11 的一端，C11 的另一端与继电器的常开接点的另一端、BT2 的正极连接在一起。

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应急电源

技术领域

[0001] 本发明属于直流电源领域，具体涉及一种可为多种设备提供电源的应急电源。

背景技术

[0002] 随着科技的日新月异，人们生活水平的日益提高，汽车、手机、电脑、数码相机等成为人们生活、出游以及旅行必备的物品，它们均采用电池供电，一旦失去电源，将完全丧失其具有的功能，给人们的生活带来诸多不便。因此，对应每种产品，厂家均提供有相应的充电器，能够将 220v 的市电转换成相应电压的直流电源对其进行充电，但是这种充电器无法满足户外充电的需求。尤其对于汽车而言，常常会遇到打不着火的问题，特别是在旅途中的汽车，因电瓶电量不足或者温度过低很难打着火，给使用者带来很多不便。

[0003] 现有中国专利文献 CN101685974A 公开了一种移动电源，包括电池组、充电电路、MCU 微控制电路、DC-DC 调压输出电路，所述充电电路设有可与外部电源连接的输入端，所述充电电路设有的输出端与电池组电连接，电池组同时与 MCU 微控制电路和 DC-DC 调压输出电路电连接，MCU 微控制电路电连接并控制充电电路和 DC-DC 调压输出电路，采用上述技术方案的有益效果是：线路简洁、体积较小、轻巧便于携带、易操控、智能化、功率损耗低和多功能，既可以利用市电充电，又可以通过更换不同的输出转换头给多种电子产品供电或充电，管理、携带和使用方便。该申请专利解决了多种电压等级的输出且具有自充电功能，但其不具备大电流输出能力，不能作为汽车启动电源，另外，该申请文件中的电流输出后均为直流电，而在现实中，也有很多外部设备是需要输入交流电，所以该申请专利也无法解决这类设备的临时供电问题。

发明内容

[0004] 本发明的目的在于提出一种自身充电方便、可大电流输出用于汽车启动，并能准确控制大电流输出的应急电源。

[0005] 为达到此目的，本发明采用以下技术方案：

[0006] 一种应急电源，包括壳体，所述壳体的内部设置有用于储存电能的电池组，所述电池组的输入端与用于给所述电池组充电的充电电路、太阳能板输入电路的输出端连接，所述电池组的输出端连接有用于汽车启动时输出大电流的大电流输出电路，所述电池组与所述大电流输出电路之间连接有外接电池智能检测系统。

[0007] 其中，所述电池组由以磷酸铁锂、钴酸锂、镍钴锰三元锂或锰酸锂为正极，以人造或天然石墨为负极的锂离子电芯串联或并联组成，其输出端还连接有多路 DC-DC 调压电路以及 LED 驱动电路，每路所述 DC-DC 调压电路均与 MCU 控制电路连接，所述 MCU 控制电路还连接有用于显示该应急电源的电量的智能 LED 电量显示系统，所述 LED 驱动电路的输出端连接有 LED 照明灯，所述电池组的两端并联有用于保护所述电池组的均衡保护电路。

[0008] 其中，所述外接电池智能检测系统包括用于连接外接电池的红黑电瓶夹、根据检测信号控制电路导通或断开的继电器、用于识别外接铅酸电瓶或锂离子启动电池的电压的

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电压识别系统、及识别通过外接启动电路的电流的电流识别系统，所述继电器的线圈的两端连接所述电压识别系统，所述继电器的输入端连接电压识别系统，所述继电器的输出端连接所述大电流输出电路，所述红黑电瓶夹通过可插拔防反接插头连接或通过焊接于所述电池组正负极两端的导线连接，所述可插拔防反接插头与所述电池组的正负极连接，所述电压识别系统与所述红黑电瓶夹连接，所述继电器为 12V 或 24V 继电器，电流规格为 20A ～ 300A，脚位为 4 ～ 6 个，所述外接电池智能检测系统设置于所述应急电源的外部，通过可插拔防反接插头与所述应急电源连接，或者设置于所述应急电源的内部、红黑电瓶夹设置于所述应急电源的外部。

[0009] 其中，所述红黑电瓶夹分别与外部电池的正负极极柱连接时，若为接对状态，所述电压识别系统显示的反馈电压为正，否则反馈电压为负，其中，所述正的反馈电压为 a ～ b 的范围，所述 a 为 6 ～ 24V，b 为 9 ～ 30V，取值时，a 小于 b；当反馈电压为 a ～ b，且为正值时，所述继电器的线圈得到电信号，触点闭合，输出端与所述大电流输出电路的输入端导通，该应急电源开始对外接的设备进行大电流供电，此时，所述电流识别系统检测经过所述大电流输出电路的电流，若该电流小于 c 时，c 为 0.1 ～ 10A，所述继电器的线圈两端的电信号消失，触点断开，输出端断开与所述大电流输出电路的连接，停止对外接的设备大电流放电，所述大电流输出电路的输出电压为 DC12V 或 DC24V，瞬间电流为 100A ～ 600A。

[0010] 其中，所述 DC-DC 调压电路包括输出电压为 19V 的 DC-DC19V 升压输出电路、输出电压为 12V 的 DC-DC12V 输出电路以及输出电压为 5V 的 DC-DC5V 降压输出电路。

[0011] 其中，所述 DC-DC12V 输出电路的输出端连接有用于发出警报信号的报警系统、用于将所述电池组输出的直流电转换为交流电的逆变器电路以及用于给所述电池组加热的智能加热系统。

[0012] 其中，所述逆变器电路输出的交流电的电压为 110V ～ 220V，所述逆变器电路内置于所述壳体的内部或者外接于所述壳体。

[0013] 其中，所述智能加热系统包括缠绕于所述电池组的外侧的加热丝或者加热膜，贴附于所述电池组的外表面并与加热丝或加热膜连接的热敏电阻，及启动智能加热系统的加热启动开关；所述的加热丝或加热膜的电阻值的范围为 0.1Ω ～ 10Ω；预先设定所述电池组表面的升温上限温度为 t，t 的范围为 0 ～ 70℃，此时，打开加热启动开关，若通过所述热敏电阻反馈到所述 MCU 控制电路的所述电池组的表面温度小于 t，则加热启动开关打开，加热丝或加热膜的两端导通电流，开始对所述电池组进行加热，预先设定加热的时间为一固定值 d，d 的范围为 10 ～ 300s，当所述电池组的表面温度达到上限温度 t 时，加热启动开关自动断开，或者当加热的时间达到 d 时，智能加热系统的加热电路自动断开。

[0014] 其中，所述壳体为塑胶材质、铝合金材质或混合材质的外壳，所述太阳能板输入电路设置于所述壳体的外侧，所述太阳能板输入电路的功率为 0.5W ～ 50W，输入电压为 5V ～ 25V。

[0015] 其中，所述电池组的输出端与所述外接电池智能检测系统之间还连接有一次性或者可恢复的保险丝，所述保险丝的电流为 50A ～ 500A。

[0016] 其中，所述电流识别系统的电路包括：高精度运算放大器 U3，型号是 SGM8591，电阻 R12、R13、R14、R15、R16、R17、R18、R20、R21、RS，电容 C9、C12，开关二极管 D4，型号是 IN4148，U3 的管脚 1 悬空，U3 的管脚 2 与 R16 的一端、R15 的一端、R21 的一端连接在一起，

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U3 的管脚 3 与 C12 的一端、RS 的一端、BT2 的负极连接在一起，U3 的管脚 4 与 BT1 的负极、RS 的另一端一起接地，U3 的管脚 5 悬空，U3 的管脚 6 与 R20 的一端、R21 的另一端、D4 的正极连接在一起，R20 的另一端与 C12 的另一端连接，U3 的管脚 7 与 VCC 端、C9 的一端连接在一起，C9 的另一端接地，U3 的管脚 8 悬空，D4 的负极接 R17 的一端，R17 的另一端与 R18 的一端、IN2 端连接在一起，R18 的另一端接地，R15 的另一端与 R12 的一端、R13 的一端、R14 的一端连接在一起。

[0017] 其中，所述电压识别系统的电路包括：双运算放大器 U2，型号是 LM358，三端稳压电路 U1，型号是 7805，电阻 R1、R2、R4、R5、R6、R7、R8、R9、R10、R11，电容 C1、C2、C3、C4、C5、C6、C7、C8，肖特基二极管 D1、D2，型号是 SS14，三端可调分流基准源 U4，型号为 TL431，U2 的管脚 1 与 R5 的一端、C5 的一端、C4 的一端连接在一起，R5 的另一端与 R6 的一端、IN1 端连接在一起，R6 的另一端接地，U2 的管脚 2 与 U2 的管脚 5、R11 的一端、U4 的阴极、U4 的参考极、R16 的另一端连接在一起，R11 的另一端接 VCC 端，U2 的管脚 3 与 C5 的另一端、R1 的一端、R7 的一端、R8 的一端连接在一起，R1 的另一端接 C4 另一端，U2 的管脚 4 与 R7 的另一端、U4 的阳极、R9 的一端一起接地，R8 的另一端与 D2 的负极、R10 的一端连接在一起，D2 的正极接 BT2 的正极，U2 的管脚 6 与 R10 的另一端、R9 的另一端、C6 的一端、R2 的一端连接在一起，U2 的管脚 7 与 C6 的另一端、C7 的一端、R4 的一端连接在一起，R4 的另一端接 A 点，C7 的另一端接 R2 的另一端，U2 的管脚 8 与 C8 的一端、C2 的一端、C3 的一端、U1 的管脚 3、VCC 端连接在一起，C8 的另一端接地，C2 的另一端和 C3 的另一端一起接地，U1 的管脚 1 与 C1 的一端、D1 的负极连接在一起，U1 的管脚 2 与 C1 的另一端一起接地，D1 的正极接 BT1 的正极。

[0018] 其中，所述继电器的电路包括：三端稳压芯片 U5，型号是 XC6219，电阻 R3、R19、R22，电容 C11、C13、C14，肖特基二极管 D5，型号是 SS14，MCU 控制芯片 J1，控制开关 Q1、Q2、Q3，型号是 SI2300，继电器，U5 的管脚 1 与 C13 的一端、U5 的管脚 3、VCC 端连接在一起，U5 的管脚 2 与 C13 的另一端、C14 的一端、J1 的管脚 2 一起接地，U5 的管脚 4 悬空，U5 的管脚 5 与 C14 的另一端、J1 的管脚 1 连接在一起，J1 的管脚 3 接 IN1 端，J1 的管脚 4 接 OUT1 端，J1 的管脚 5 接 IN2 端，J1 的管脚 6 接 OUT2 端，J1 的管脚 7 悬空，J1 的管脚 8 悬空，OUT1 端接 R3 的一端，R3 的另一端接 Q2 的栅极，Q2 的漏极与 Q3 的源极、R13 的另一端连接在一起，Q3 的漏极接 R12 的另一端，Q3 的栅极连接 A 点，Q2 的源极与 Q1 的源极、R14 的另一端连接在一起，Q1 的栅极接 R19 的一端，R19 的另一端接 OUT2 端，Q1 的漏极与 D5 的正极、继电器线圈的一端连接在一起，D5 的负极、继电器线圈的另一端、继电器的常开接点的一端、R22 的一端与 BT1 的正极连接在一起，R22 的另一端接 C11 的一端，C11 的另一端与继电器的常开接点的另一端、BT2 的正极连接在一起。

[0019] 本发明的有益效果为：本发明的应急电源采用锂离子电池作为电池组，具有重量轻、体积小、耐用、瞬间放电电流大，能够反复充电的特点，可满足汽车启动的大电流需要，通过在大电流输出电路与电池组之间连接外接电池智能检测系统，可有效地控制对外接设备的大电流供电，准确可靠，有效利用电源的电能。该应急电源的电池组又连接有可输出多种电压等级的调压电路，通过将各路调压电路输出端与 MCU 控制电路连接，可以满足手机、电脑、数码相机、车载打气泵、车载冰箱、车载吸尘器等设备的户外供电需要；LED 灯可提供户外照明；该应急电源本身可通过外部电源充电，也可以通过太阳能对其进行充电，这使得

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该应急电源在户外时，可以自动补充电能。另外，该应急电源自身设置有报警系统，当用户迷路或者出现状况时自行按下报警系统，报警系统会通过指示灯的显示或者报警系统发出声音提示周围，以达到求救的目的；该应急电源还连接有逆变器电路和智能加热系统，其中，逆变器电路可以将电池组输出的直流电转换为交流电，以便户外时需要交流电的设备电力不足时供电，而智能加热系统通过加热丝或加热膜以及热敏电阻，可以在外部环境温度较低影响电源正常供电的情况下，对电源的电池组进行加热，保证电池组在低温环境下也可以正常工作，向外部提供电能。同时，该应急电源设置有红黑电瓶夹，可有效防止在于外部需要救援的电池时将正负极接反，为使用者提供便利。

附图说明

[0020] 图 1 是本发明应急电源的原理示意图；

[0021] 图 2 是本发明应急电源的外接电池智能检测系统的电路原理图一；

[0022] 图 3 是图 2 中的外接电池智能检测系统的电路原理图二。

[0023] 图中：1- 充电电路；2- 太阳能板输入电路；3- 均衡保护电路；4- 电池组；5- 保险丝；6- 外接电池智能检测系统；7- 大电流输出电路；8- 智能 LED 电量显示系统；9-DC-DC5V 降压输出电路；10-12V 输出电路；11-DC-DC19V 升压输出电路；12-LED 驱动电路；13-LED 照明灯；14-MCU 控制电路；15- 报警系统；16- 智能加热系统；17- 逆变器电路；61- 电压识别系统的电路；62- 电流识别系统的电路；63- 继电器的电路。

具体实施方式

[0024] 下面结合附图和具体实施例对本发明作进一步说明。

[0025] 如图 1 至图 3 所示，一种应急电源，包括壳体，壳体的内部设置有用于储存电能的电池组 4，电池组 4 的输入端与用于给电池组 4 充电的充电电路 1、太阳能板输入电路 2 的输出端连接，电池组 4 的输出端连接有用于汽车启动时输出大电流的大电流输出电路 7，电池组 4 与大电流输出电路 7 之间连接有外接电池智能检测系统 6。进一步地，电池组 4 由以磷酸铁锂、钴酸锂、镍钴锰三元锂或锰酸锂为正极，以人造或天然石墨为负极的锂离子电芯串联或并联组成，其输出端还连接有多路 DC-DC 调压电路以及 LED 驱动电路 12，每路 DC-DC 调压电路均与 MCU 控制电路 14 连接，MCU 控制电路 14 还连接有用于显示该应急电源的电量的智能 LED 电量显示系统 8，LED 驱动电路 12 的输出端连接有 LED 照明灯 13，电池组 4 的两端并联有用于保护所述电池组 4 的均衡保护电路 3。其中，DC-DC 调压电路包括输出电压为 19V 的 DC-DC19V 升压输出电路 11、输出电压为 12V 的 DC-DC12V 输出电路 10 以及输出电压为 5V 的 DC-DC5V 降压输出电路 9。另外，本发明中的壳体为塑胶材质、铝合金材质或混合材质的外壳，太阳能板输入电路 2 设置于壳体的外侧，太阳能板输入电路 2 的功率为 0.5W ～ 50W，输入电压为 5V ～ 25V。

[0026] 该应急电源采用锂离子电池组成的电池组，具有重量轻、体积小、耐用、瞬间放电电流大，能够反复充电的特点，可满足汽车启动的大电流需要。该应急电源又通过在大电流输出电路与电池组之间连接外接电池智能检测系统，可有效地控制对外接设备的大电流供电，准确可靠，有效利用电源的电能；其电池组又连接有可输出多种电压等级的调压电路，通过将各路调压电路输出端与 MCU 控制电路连接，可以满足手机、电脑、数码相机、车载打

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气泵、车载冰箱、车载吸尘器等设备的户外供电需要；LED 灯可提供户外照明；该应急电源本身可通过外部电源充电，在无外部电源的情况下，也可以通过太阳能对其进行充电，这使得该应急电源在户外时，可以自动补充电能。同时，通过智能 LED 电量显示系统 14，可以实时检测该应急电源的电池组 4 的电量使用状态。

[0027] DC-DC12V 输出电路 10 的输出端连接有用于发出警报信号的报警系统 15、用于将电池组 4 输出的直流电转换为交流电的逆变器电路 17 以及用于给电池组 4 加热的智能加热系统 16。该报警系统 15 可以在用户迷路或者出现状况时由用户自行按下，报警系统 15 会通过指示灯的显示或者报警系统 15 发出声音提示周围，以达到求救的目的。其中，逆变器电路 17 输出的交流电的电压为 110V ～ 220V，可以很方便地将该应急电源与需要交流电供电的外部设备连接，电压匹配，无需再次调压，便于这种设备在户外使用时，电力不足的情况下提供电能，保证设备的正常工作。该逆变器电路 17 可以内置于壳体的内部，也可以在该壳体上设置连接逆变器电路 17 的接口，当需要提供交流电时，直接将外部的逆变器与该接口连接，即可实现直流转换成交流的目的，操作方便。另外，智能加热系统 16 包括缠绕于电池组 4 的外侧的加热丝或者加热膜，贴附于电池组 4 的外表面并与加热丝或加热膜连接的热敏电阻，及启动智能加热系统的加热启动开关；加热丝或加热膜的电阻值的范围为 0.1Ω ～ 10Ω；使用时，预先设定电池组 4 表面的升温上限温度为 t，t 的范围为 0 ～ 70℃，当外部环境温度较低，且已经影响电源的正常供电时，打开加热启动开关，若通过热敏电阻反馈到 MCU 控制电路 14 的电池组 4 的表面温度小于 t，则控制加热丝或者加热膜的加热启动开关打开，加热丝或加热膜的两端导通电流，该智能加热系统 16 便开始对电池组 4 进行加热；加热前，预先设定加热的时间为一固定值 d，d 的范围为 10 ～ 300s；在加热的过程中，当电池组 4 的表面温度达到上限温度 t 时，控制加热丝或者加热膜的加热启动开关自动断开，阻断通过加热丝或加热膜两端的电流的通过，或者当加热的时间达到 d，则智能加热系统 16 的加热电路自动断开，完成对电池组 4 的加热。该智能加热系统 16 通过热敏电阻自身对热的敏感特性，准确地控制智能加热系统 16 的加热电路的导通与断开，有效提高加热效率，并降低加热消耗的电能。通过增加该智能加热系统 16，该应急电源可以在外部环境温度较低影响电源正常供电的情况下，仍然能保证电池组正常工作，向外部提供电能，提高了整个系统的可靠性。

[0028] 外接电池智能检测系统 6 包括用于连接外接电池的红黑电瓶夹、根据检测信号控制电路导通或断开的继电器、用于识别外接铅酸电瓶或锂离子启动电池的电压的电压识别系统、及识别通过外接启动电路的电流的电流识别系统，其中，继电器的线圈的两端连接电压识别系统，继电器的输入端连接电压识别系统，继电器的输出端连接大电流输出电路 7，红黑电瓶夹通过可插拔防反接插头连接或通过焊接于电池组 4 正负极两端的导线连接，若红黑电瓶夹与可插拔防反接插头连接时，该可插拔防反接插头与电池组 4 的正负极连接，电压识别系统与红黑电瓶夹连接。本发明中的继电器为 12V 或 24V 继电器，电流规格为 20A ～ 300A，脚位为 4 ～ 6 个，外接电池智能检测系统 6 设置于该应急电源的外部，通过可插拔防反接插头与该应急电源连接，或者设置于应急电源的内部、而红黑电瓶夹设置于应急电源的外部。优选的，在本发明中，外接电池智能检测系统 6 设置于应急电源的内部、而红黑电瓶夹设置于应急电源的外部。红黑电瓶夹与电池组 4 之间通过硅胶线或者其他导线连接，以供与外部设备连接，通过红黑电瓶夹与外部电池连接，也可以有效防止插反或者红

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黑电瓶夹碰撞造成的短路。

[0029] 当红黑电瓶夹分别与外部电池的正负极极柱连接时，若为接对状态，电压识别系统显示的反馈电压为正，否则反馈电压为负，其中，正的反馈电压为 a ～ b 的范围，a 为 6 ～ 24V，b 为 9 ～ 30V，取值时，应使 a 小于 b ；若为接反状态，继电器不工作，大电流输出电路 7 处于断开状态。若当外接电池智能检测系统 6 失效，为保证该应急电源的安全性，本发明的应急电源电路中，在电池组 4 与外接电池智能检测系统 6 之间串联连接有一次性或者可恢复的保险丝 5，该保险丝 5 的电流为 50A ～ 500A。为确保电池组 4 的充放电安全，电池组 4 的两端连接有均衡保护电路 3，对电池组 4 进行过流过载过充过放保护。

[0030] 在本发明中，当电压识别系统的反馈电压为 a ～ b，且为正值时，继电器的线圈接收到该电压信号，触点闭合，输出端与大电流输出电路 7 导通，该应急电源开始对外接的设备进行大电流供电，此时，电流识别系统检测经过大电流输出电路 7 的电流，若该电流小于 c 时，c 为 0. 1 ～ 10A，继电器的线圈两端的电压信号消失，触点断开，输出端断开与大电流输出电路 7 的连接，停止对外接的设备大电流放电。该大电流输出电路 7 的输出电压为 DC12V 或 DC24V，瞬间电流为 100A ～ 600A，可以作为应急状态下汽车的启动电源使用。通过在大电流输出电路 7 与电池组 4 之间连接外接电池智能检测系统 6，可有效地控制对外接设备的大电流供电，准确可靠，有效利用电源的电能。该外接电池智能检测系统 6 可以内置于壳体的内部，也可以外接于壳体。

[0031] 如图 2、图 3 所示为外接电池智能检测系统 6 的电路原理图，其中，BT1 为充电电池，即电池组 4，BT2 为被充电汽车电池。

[0032] 具体地，电流识别系统的电路 62 包括 ：高精度运算放大器 U3，型号是 SGM8591，电阻 R12、R13、R14、R15、R16、R17、R18、R20、R21、RS，电容 C9、C12，开关二极管 D4，型号是 IN4148，U3 的管脚 1 悬空，U3 的管脚 2 与 R16 的一端、R15 的一端、R21 的一端连接在一起，U3 的管脚 3 与 C12 的一端、RS 的一端、BT2 的负极连接在一起，U3 的管脚 4 与 BT1 的负极、RS 的另一端一起接地，U3 的管脚 5 悬空，U3 的管脚 6 与 R20 的一端、R21 的另一端、D4 的正极连接在一起，R20 的另一端与 C12 的另一端连接，U3 的管脚 7 与 VCC 端、C9 的一端连接在一起，C9 的另一端接地，U3 的管脚 8 悬空，D4 的负极接 R17 的一端，R17 的另一端与 R18 的一端、IN2 端连接在一起，R18 的另一端接地，R15 的另一端与 R12 的一端、R13 的一端、R14 的一端连接在一起。

[0033] 具体地，电压识别系统的电路 61 包括 ：双运算放大器 U2，型号是 LM358，三端稳压电路 U1，型号是 7805，电阻 R1、R2、R4、R5、R6、R7、R8、R9、R10、R11，电容 C1、C2、C3、C4、C5、C6、C7、C8，肖特基二极管 D1、D2，型号是 SS14，三端可调分流基准源 U4，型号为 TL431，U2 的管脚 1 与 R5 的一端、C5 的一端、C4 的一端连接在一起，R5 的另一端与 R6 的一端、IN1 端连接在一起，R6 的另一端接地，U2 的管脚 2 与 U2 的管脚 5、R11 的一端、U4 的阴极、U4 的参考极、R16 的另一端连接在一起，R11 的另一端接 VCC 端，U2 的管脚 3 与 C5 的另一端、R1 的一端、R7 的一端、R8 的一端连接在一起，R1 的另一端接 C4 另一端，U2 的管脚 4 与 R7 的另一端、U4 的阳极、R9 的一端一起接地，R8 的另一端与 D2 的负极、R10 的一端连接在一起，D2 的正极接 BT2 的正极，U2 的管脚 6 与 R10 的另一端、R9 的另一端、C6 的一端、R2 的一端连接在一起，U2 的管脚 7 与 C6 的另一端、C7 的一端、R4 的一端连接在一起，R4 的另一端接 A 点，C7 的另一端接 R2 的另一端，U2 的管脚 8 与 C8 的一端、C2 的一端、C3 的一端、U1 的管

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脚 3、VCC 端连接在一起，C8 的另一端接地，C2 的另一端和 C3 的另一端一起接地，U1 的管脚 1 与 C1 的一端、D1 的负极连接在一起，U1 的管脚 2 与 C1 的另一端一起接地，D1 的正极接 BT1 的正极。

[0034] 具体地，继电器的电路 63 包括：三端稳压芯片 U5，型号是 XC6219，电阻 R3、R19、R22，电容 C11、C13、C14，肖特基二极管 D5，型号是 SS14，MCU 控制芯片 J1，控制开关 Q1、Q2、Q3，型号是 SI2300，继电器，U5 的管脚 1 与 C13 的一端、U5 的管脚 3、VCC 端连接在一起，U5 的管脚 2 与 C13 的另一端、C14 的一端、J1 的管脚 2 一起接地，U5 的管脚 4 悬空，U5 的管脚 5 与 C14 的另一端、J1 的管脚 1 连接在一起，J1 的管脚 3 接 IN1 端，J1 的管脚 4 接 OUT1 端，J1 的管脚 5 接 IN2 端，J1 的管脚 6 接 OUT2 端，J1 的管脚 7 悬空，J1 的管脚 8 悬空，OUT1 端接 R3 的一端，R3 的另一端接 Q2 的栅极，Q2 的漏极与 Q3 的源极、R13 的另一端连接在一起，Q3 的漏极接 R12 的另一端，Q3 的栅极连接 A 点，Q2 的源极与 Q1 的源极、R14 的另一端连接在一起，Q1 的栅极接 R19 的一端，R19 的另一端接 OUT2 端，Q1 的漏极与 D5 的正极、继电器线圈的一端连接在一起，D5 的负极、继电器线圈的另一端、继电器的常开接点的一端、R22 的一端与 BT1 的正极连接在一起，R22 的另一端接 C11 的一端，C11 的另一端与继电器的常开接点的另一端、BT2 的正极连接在一起。

[0035] 当该应急电源与外部充电电池的连接断开，或电流小于设定的电流值时，电流识别系统的电路 62 中的 R15 和 R16 提供给 U3 检测信号，此时 U3 根据该检测信号发出一个输出信号给 MCU 控制芯片，以供 MCU 控制芯片判断电路的连接或断开的状态，以做出合适的指示；当输出电压低于预定值，在本发明中该电压的预定值为 8.1V 时，电压识别系统的电路 61 中的电阻 R7、R8 会提供检测信号给 U2，U2 根据该检测信号发出一个输出信号给 IN1 端，MCU 控制芯片根据 IN1 端的信号，进而控制继电器的电路 63 中的控制开关 Q2；而当输出电压高于预定值，在本发明中，该电压的预定值为 12.6V 时，电压识别系统的电路 61 中的电阻 R9、R10 会提供检测信号给 U2，U2 根据该检测信号发出一个信号控制继电器的电路 63 中的控制开关 Q3。在本发明中，通过电压识别系统的电路 61，电流识别系统的电路 62 的共同作用，给予 MCU 控制芯片信号，可通过 MCU 控制芯片的判断，最终实现控制继电器的电路 63 中的 Q1、Q2 和 Q3 的目的，进而达到充电和保护的效果。

[0036] 以上所述仅为本发明的优选实施例而已，并不用于限制本发明，对于本领域的技术人员来说，本发明可以有各种更改和变化。凡在本发明的精神和原则之内，所作的任何修改、等同替换、改进等，均应包含在本发明的保护范围之内。

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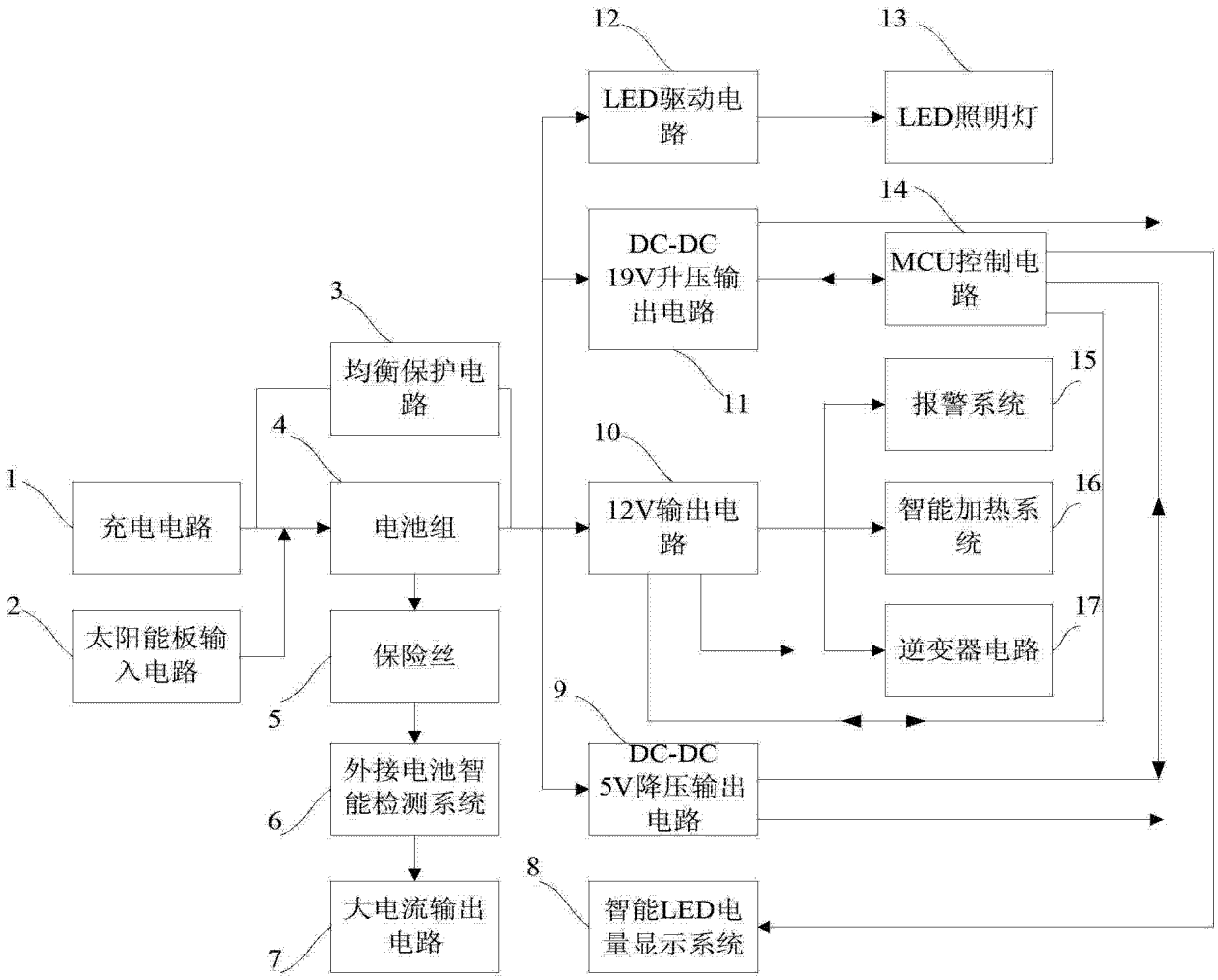


图 1

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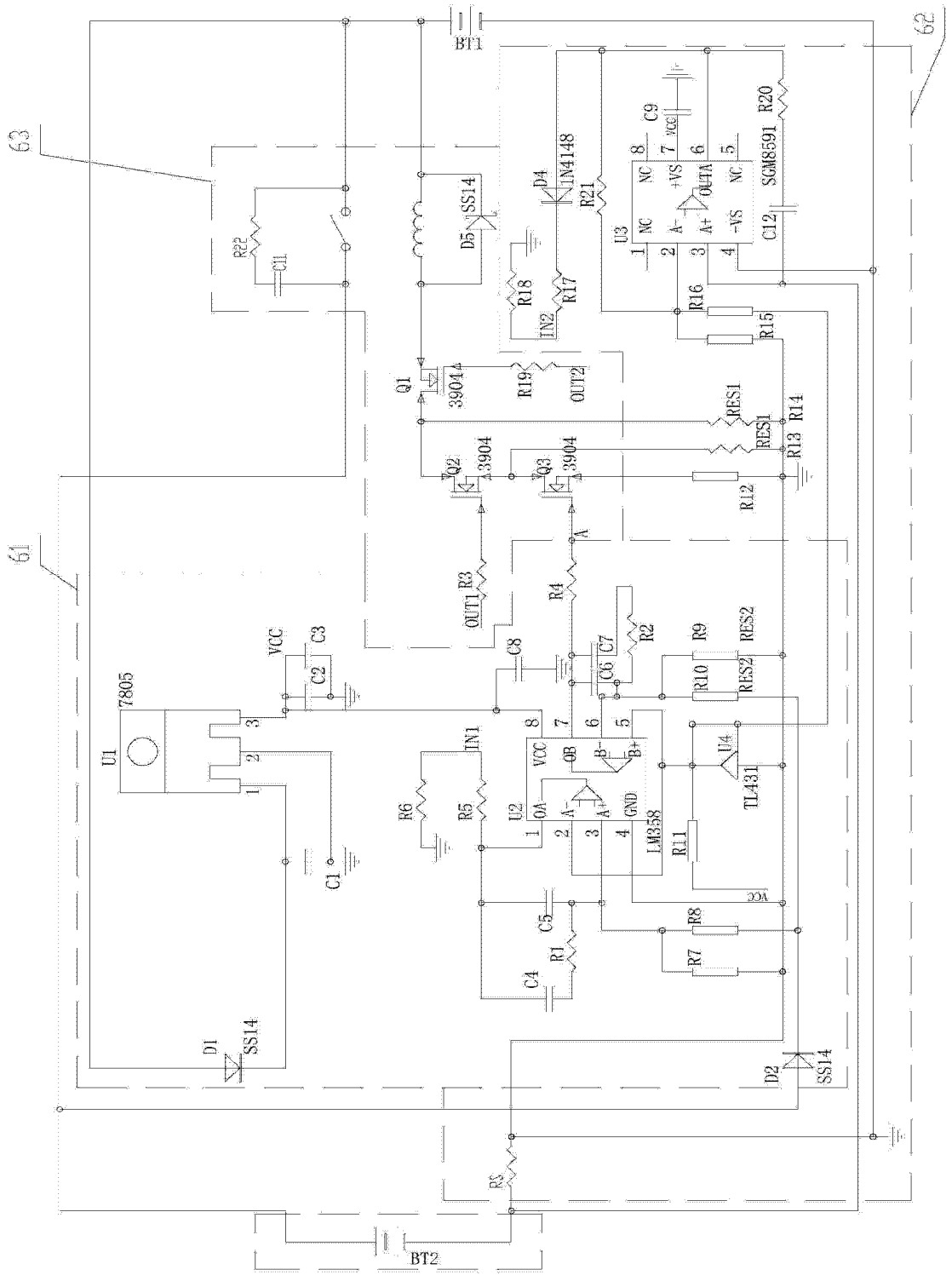


图 2

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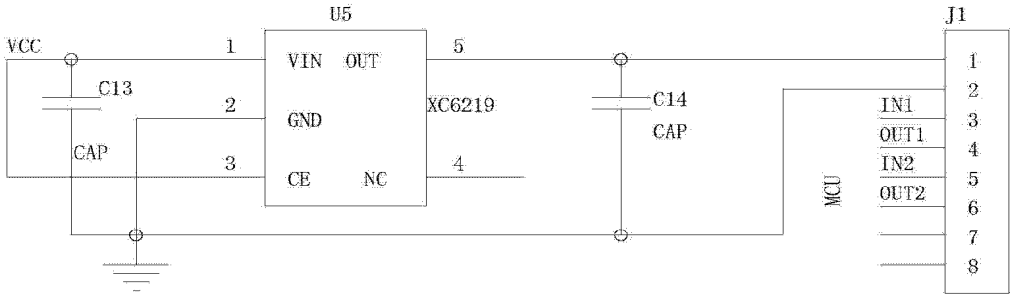


图 3

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(54) Portable electrical power supply.

(57) A portable power supply is shown generally at 10. The power supply comprises a sealed rechargeable lead acid battery 11 to which is connected a charging circuit 12 for charging the battery 11.

A switching unit 13 controls the switching of power from the battery 11 either to accessory sockets 14 or to power output leads represented by 15.

Between the switching unit 13 and the power output leads 15 are a reverse-polarity protection circuit 16, a vehicle-start test/timer unit 17 and a stand by/monitor circuit 18, the operation of all of which will be described below.

The power supply apparatus 10 is primarily for use in the supply of 12 V dc electrical power at locations remote from conventional electricity supplies. The battery 11, at the heart of the apparatus, can be recharged from either a domestic mains electricity supply, using an integral mains charger unit 19, or from a 12-18 V dc source, such as a vehicle cigar lighter socket, a photovoltaic solar cell array, a wind-driven generator etc. using an integral 12 V dc charger lead 20.

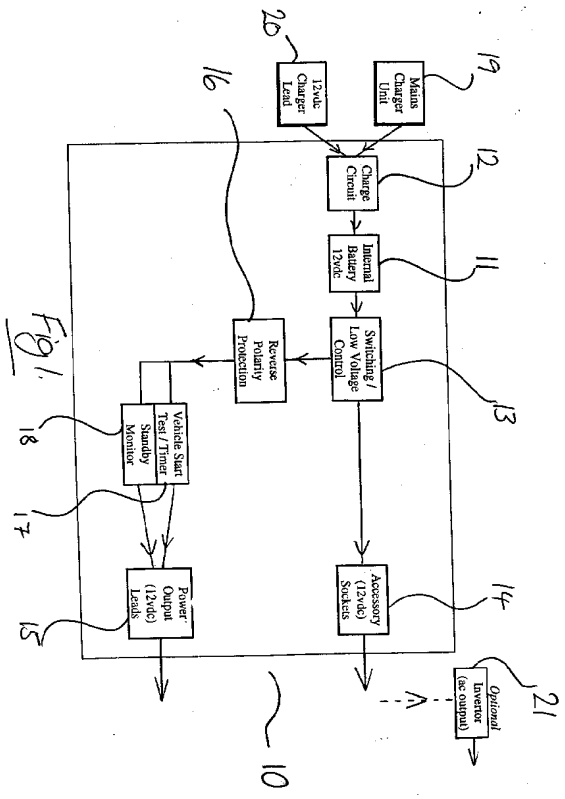


Fig 1.

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The present invention relates to a portable electrical power supply apparatus and to a method of supplying electrical power.

According to a first aspect of the present invention, there is provided portable apparatus for the supply of electrical power, the apparatus comprising rechargeable energy storage means arranged, in use, to store electrical energy, output means arranged, in use, to provide an output for electrical power from the storage means and charging means arranged, in use, to charge the storage means with electrical energy from an external source.

In a preferred arrangement the apparatus comprises a housing.

Preferably the storage means comprises at least one battery.

In a preferred arrangement, the charging means comprises an electrical charging circuit arranged, in use, to recharge the or each battery from an external source of electrical power.

The unit may be arranged to supply direct current electrical power. Alternatively or additionally, the apparatus may be arranged to supply alternating current electrical power.

The charging means may be arranged in use to recharge the or each battery from an external source of alternating current electrical power.

Preferably the charging means is arranged, in use, to recharge the or each battery from an external source of mains electrical power.

Alternatively or additionally, the charging means may be arranged in use to recharge the or each battery from an external source of direct current electrical power.

Preferably the charging means is arranged in use to recharge the or each battery from a direct current power source of a vehicle.

The apparatus preferably comprises a first monitor means arranged in use to monitor an external power supply. In a preferred arrangement, the apparatus is arranged in use to supply electrical power automatically to an external appliance according to the monitored condition of the external power supply.

The apparatus may be arranged in use to supply electrical power to an external appliance automatically, according to a condition of an external power supply to an external appliance, which condition is detected by the first monitor means.

The apparatus may comprise a second monitor means arranged, in use, to monitor a condition of an external appliance. Preferably, the apparatus is arranged in use to supply electrical power to an external appliance according to the monitored condition of the appliance, which condition is detected by the second monitoring means.

The first and second monitor means may comprise a common monitor means.

Preferably the apparatus comprises connection means for connection with an external battery. The connection means may comprise electrically conductive cables.

In a preferred arrangement, the apparatus comprises means to recharge a battery of a vehicle to which it is connected.

Alternatively or additionally, the apparatus may be arranged to supply electrical power to assist in the starting of a vehicle engine. Preferably, the apparatus is arranged in use to recharge to a predetermined extent a vehicle battery to which it is connected and to supply electrical power directly from its own battery for supplementing the vehicle battery during starting of the vehicle engine.

In a preferred arrangement the housing comprises a case. The case may comprise a closure member which is moveable between a first open position in which a user may gain access to one or more controls of the apparatus and a second closed position, in which the user may not so gain access.

The case may comprise a transparent window portion for enabling a user to see one or more controls of the apparatus.

In a preferred arrangement, the closure member comprises the transparent portion.

The case may be provided with at least one carrying handle.

Preferably the case comprises a bag.

According to a second aspect of the present invention, there is provided a method of starting an engine using a portable power supply apparatus, the method including electrically connecting the apparatus to terminals of a battery of the engine, supplying a charging current from a storage means of the apparatus to the battery of the engine to a predetermined extent, and subsequently switching on a starter motor of the engine whilst the apparatus is still electrically connected to the battery of the engine.

The method may comprise starting the engine using a portable power supply apparatus according to any statement herein.

According to a third aspect of the present invention, there is provided a method of supplying electrical power to an electrical appliance from portable supply apparatus, the method including supplying power from a rechargeable storage means to at least one output means, which output means is connected to the appliance.

Preferably the method includes recharging the storage means from either a mains electricity source or from a direct current power source.

The method may include supplying electrical power using apparatus according to any statement herein.

The invention may be carried into practice in various ways, but an embodiment will now be described by way of example with reference to the accompanying diagrammatic drawings in which:

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Figure 1 shows schematically a portable power supply apparatus according to one embodiment of the present invention, and

Figure 2 shows a carrying case for the apparatus of Figure 1.

Referring to Figure 1, a portable power supply is shown generally at 10. The power supply comprises a sealed rechargeable lead acid battery 11 to which is connected a charging circuit 12 for charging the battery 11.

A switching unit 13 controls the switching of power from the battery 11 either to accessory sockets 14 or to power output leads represented by 15.

Between the switching unit 13 and the power output leads 15 are a reverse-polarity protection circuit 16, a vehicle-start test/timer unit 17 and a stand by/monitor circuit 18, the operation of all of which will be described below.

The power supply apparatus 10 is primarily for use in the supply of 12 V dc electrical power at locations remote from conventional electricity supplies. The battery 11, at the heart of the apparatus, can be recharged from either a domestic mains electricity supply, using an integral mains charger unit 19, or from a 12-18 V dc source, such as a vehicle cigar lighter socket, a photovoltaic solar cell array, a wind-driven generator etc. using an integral 12 V dc charger lead 20.

For example, the mains charger unit 19 which is permanently attached to the apparatus on a short lead, permits full recharging of the battery 11 from a conventional mains electricity supply in around 15 hours. Alternatively, the 12 V dc lead permits recharging of the battery 11 from a vehicle's cigar lighter socket during a short journey.

The 12 V dc accessory sockets 14 comprise conventional vehicle cigar-lighter sockets which are protected by a 30 amp fuse (not shown). If it is required to operate a 12 V applicance in this way, the switch 13 is made to connect the sockets 14 to the battery 11 and the appliance is connected using a conventional cigar lighter plug, which fits into one of the sockets 14.

An optional inverter device 21 may be employed to provide a 240 V ac supply. This is achieved by connecting two cigar lighter plugs (not shown) of the device 21 into the two sockets 14.

In addition to supplying power to a range of 12 V appliances and a range of 240 V ac appliances the apparatus can also be used to assist the starting of a vehicle engine (not shown).

To do this, the switch unit 13 is made to connect the battery 11 to the leads 15. The leads 15 are then connected to terminals on the vehicle battery (not shown) and, for a predetermined time interval, the vehicle battery is charged from the internal battery 11 of the apparatus. Once the time interval has elapsed, the test/timer unit 17 provides a visual indication on the exterior of the apparatus to confirm this and the vehicle may be started. The leads 15 are left connected to the terminals of the vehicle battery so that the charge on the vehicle battery can be supplemented by the charge on the internal battery 11.

The reverse polarity protection circuit 16 is arranged to disconnect the internal battery 11 in the event that the leads 15 are connected to the wrong terminals on the battery, thereby avoiding damage to either the internal battery 11 or the vehicle battery (not shown).

The stand by/monitor 18 is used to monitor the charge on an external battery, for example, a caravan battery, which is being used to provide power for one or more appliances. In the event that the charge on the external battery falls below a predetermined level, the stand by/monitor unit detects this and begins to charge the external battery from the internal battery 11, thereby maintaining the operation of the appliances.

Additionally, the stand by/monitor unit can monitor a mains supply and, in the event of mains failure, can enable the internal battery 11 to provide a back up power supply for an appliance connected by the sockets 14.

In more detail, the switching unit 13 comprises a 3-way mechanical switch, the three positions of which correspond to: (1) output via the sockets 14, (2) off position, (3) output via the leads 15. In addition, the switching unit 13 comprises an energise switch, which electrically connects the sockets 14 to the internal battery 11 via a low voltage control circuit.

The accessory sockets are protected by a 30 amp fuse and are intended to deliver the 12 V output to a range of optional 12 V plug-in low current accessories. The low voltage control circuit operates via a small relay (not shown), which disconnects the output in order to prevent the output voltage from falling below a certain value, as power is drained by the accessory.

This prevents the internal battery 11 from going into deep-discharge from which it would be unlikely to recover.

The heavy duty power leads 15 are used in the engine's start facility and are capable of delivering up to around 200 amps. No fuse protection is provided for this output, but protection is obtained by use of a large relay (not shown), which disconnects the output leads 15 when the voltage falls to below a predetermined value (as it would if the leads 15 were accidentally shorted together).

When the apparatus is connected to an external 12 V battery (for example a caravan battery), the apparatus continuously monitors the voltage of that battery, and if it should fall below a predetermined level (for example 10.5 V), the apparatus automatically closes the contacts of a large relay so connecting the apparatus' internal battery 11 to the caravan battery.

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This results in the caravan battery being boosted for a short period of time until its voltage is recovered, at which time the apparatus disconnects the internal battery 11 from the load. This operation is repeated for as long as electrical charge remains in the apparatus' internal battery 11. The net result is that the caravan owner, for example, can arrange 12 V accessories in the caravan for longer than the caravan battery would permit.

The charge circuit 12 comprises a full-wave bridge rectifier (the input of which is 16.5 V ac from the mains charger unit 19), a smoothing and filtering circuit, a voltage regulator and an output protection diode (the output is 14.5 V dc) to charge the internal 12 V battery 11.

Referring to Figure 2, this shows a carrying case containing the apparatus of Figure 1. The case is in the form of a bag 22 having a zip-up flap 23 of transparent plastics material and a carrying strap 24 attached to each side of the bag 22 (only one attachment shown).

The transparent fold back flap 23 enables the user to see the controls without unzipping the flap 23. If, however, access to the controls is required, the flap 23 can be conveniently unzipped and folded back, for example to provide access to the accessory sockets 14 or to the three-position switch 25 of the switching unit 13 (see Figure 1).

The leads 15 (shown in Figure 1) are retained in internal compartments 26a and 26b, which are formed in cavities between an internal plastics box 28 in which the unit 10 is housed and the external canvas bag 22. Access to the leads 15 is obtained using a zipper 27, which extends around the side faces and bottom face of the bag 22.

The above-described invention provides a convenient fully portable and rechargeable power storage and supply unit. The canvas bag 22 is strong and weatherproof and is designed to be carried on the shoulder using the strap 24.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

Claims

1. Portable apparatus for the supply of electrical power characterised in that the apparatus comprises rechargeable energy storage means arranged, in use, to store electrical energy, output means arranged, in use, to provide an output for electrical power from the storage means and charging means arranged in use to charge the storage means with electrical energy from an external source.

2. Apparatus according to Claim 1, wherein the apparatus comprises a housing.

3. Apparatus according to Claim 1 or Claim 2, wherein the storage means comprises at least one battery.

4. Apparatus according to any of Claims 1 to 3, wherein the charging means comprises an electrical charging circuit arranged, in use, to recharge the or each battery from an external source of electrical power.

5. Apparatus according to any of Claims 1 to 4, wherein the unit is arranged to supply direct current electrical power.

6. Apparatus according to any of Claims 1 to 5, wherein the apparatus is arranged to supply alternating current electrical power.

7. Apparatus according to any of Claims 1 to 6, wherein the charging means is arranged in use to recharge the or each battery from an external source of alternating current electrical power.

8. Apparatus according to any of Claims 1 to 7, wherein the charging means is arranged, in use, to recharge the or each battery from an external source of mains electrical power.

9. Apparatus according to any of Claims 1 to 8, wherein the charging means is arranged in use to recharge the or each battery from an external

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source of direct current electrical power.

10. Apparatus according to any of Claims 1 to 9, wherein the charging means is arranged in use to recharge the or each battery from a direct current power source of a vehicle.

11. Apparatus according to any of Claims 1 to 10, wherein the apparatus comprises a first monitor means arranged in use to monitor an external power supply.

12. Apparatus according to Claim 11, wherein the apparatus is arranged in use to supply electrical power automatically to an external appliance according to the monitored condition of the external power supply.

13. Apparatus according to Claim 11 or Claim 12, wherein the apparatus is arranged in use to supply electrical power to an external appliance automatically, according to a condition of an external power supply to an external appliance, which condition is detected by the first monitor means.

14. Apparatus according to any of Claims 1 to 13, wherein the apparatus comprises a second monitor means arranged in use to monitor a condition of an external appliance.

15. Apparatus according to Claim 14, wherein the apparatus is arranged in use to supply electrical power to an external appliance according to the monitored condition of the appliance, which condition is detected by the second monitor means.

16. Apparatus according to Claim 11 and Claim 14, wherein the first and second monitor means comprise a common monitor means.

17. Apparatus according to Claim 2, wherein the housing comprises a case.

18. Apparatus according to Claim 17, wherein the case comprises a closure member which is moveable between a first open position in which a user may gain access to one or more controls of the apparatus and a second closed position in which the user may not so gain access.

19. Apparatus according to Claim 17 or 18 wherein the case comprises a transparent window portion for enabling a user to see one or more controls of the apparatus.

20. Apparatus according to Claim 19, wherein the closure member comprises the transparent portion.

21. Apparatus according to any of Claims 17 to 20, wherein the case comprises a bag.

22. A method of starting an engine using a portable power supply apparatus, the method including electrically connecting the apparatus to terminals of a battery of the engine, supplying a charging current from a storage means of the apparatus to the battery of the engine to a predetermined extent, and subsequently switching on a starter motor of the engine whilst the apparatus is still electrically connected to the battery of the engine.

23. A method of supplying electrical power to an electrical appliance from portable supply apparatus, the method including supplying power from a rechargable storage means to at least one output means, which output means is connected to the appliance.

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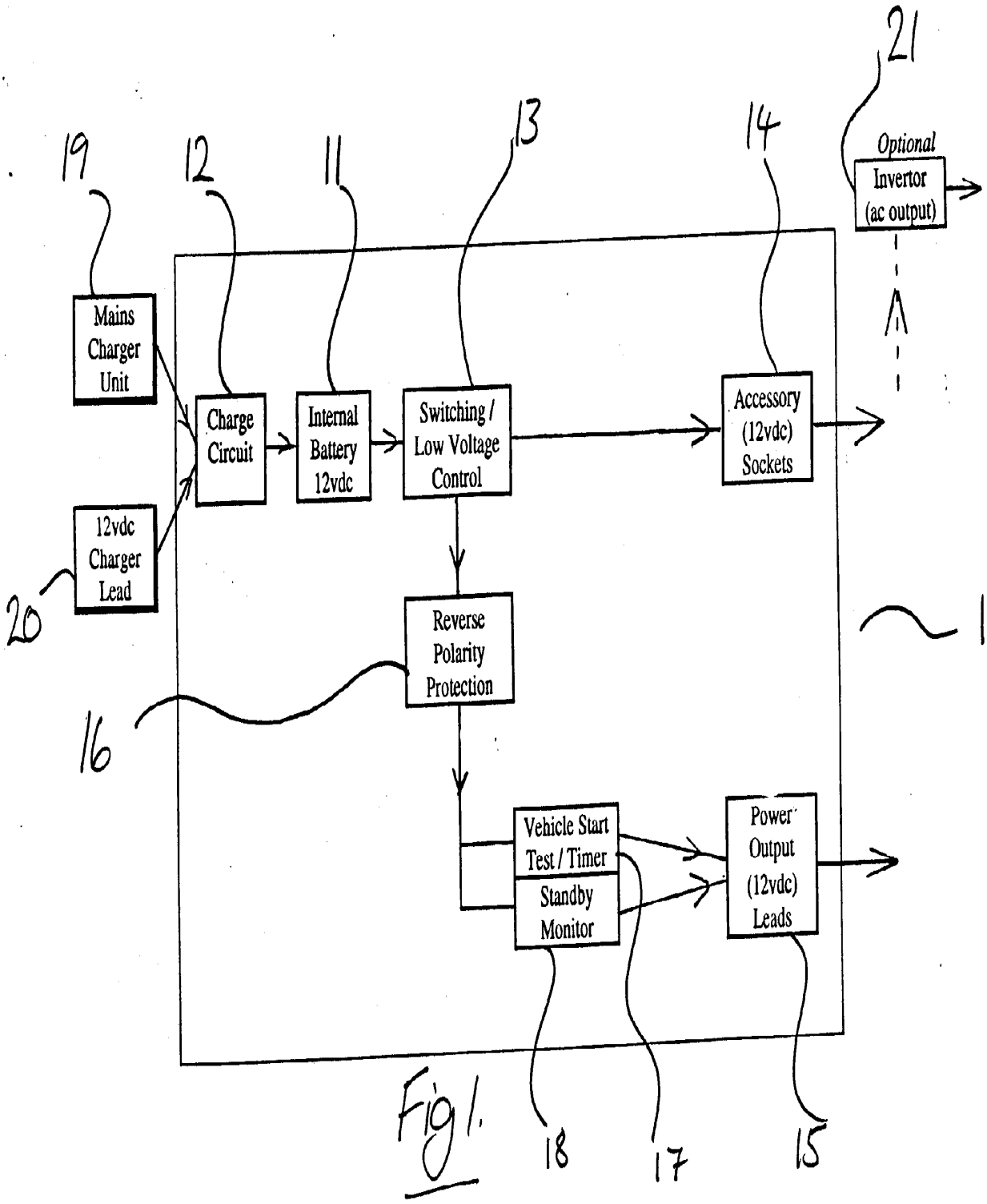


Fig 1.

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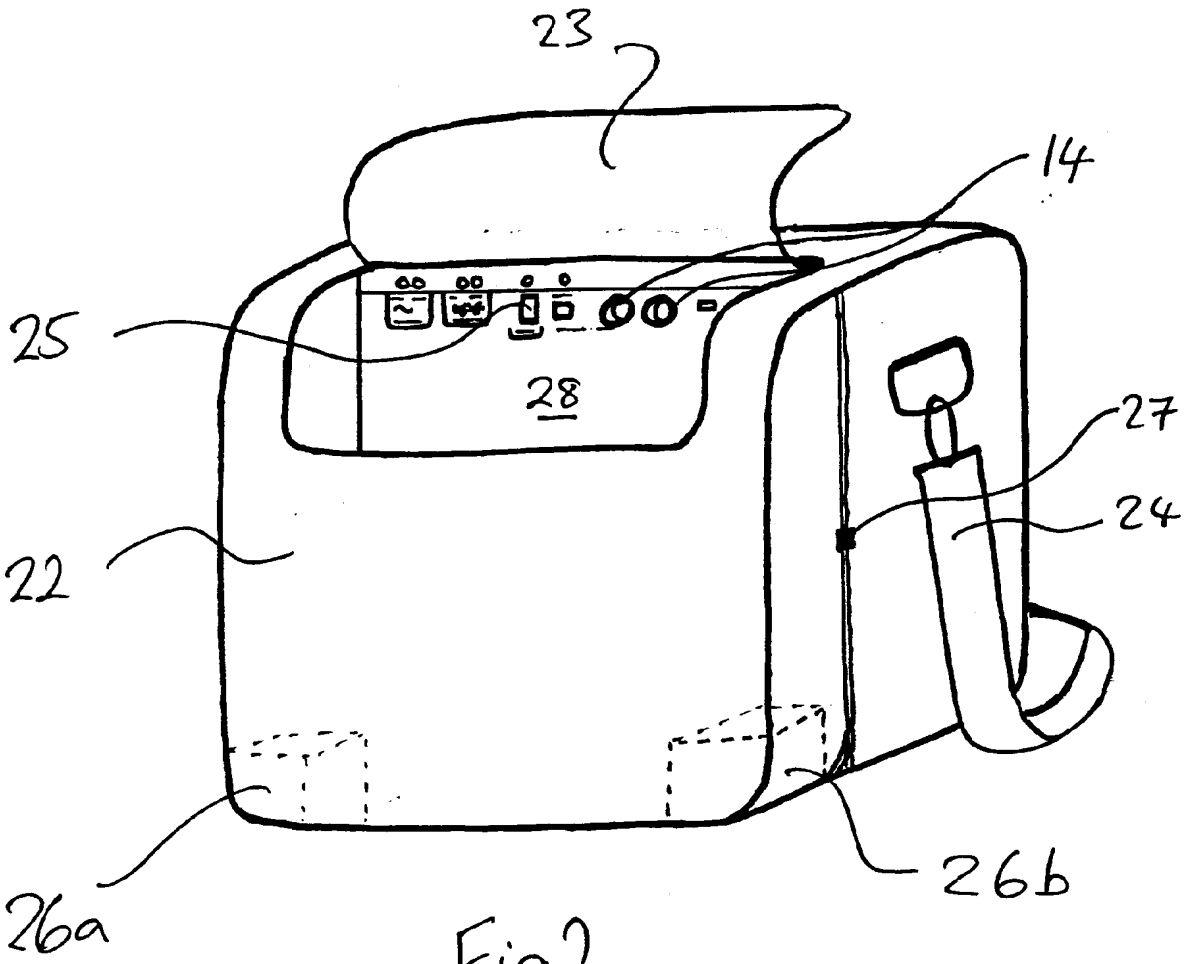


Fig2.

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US 20140197795 A1

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(54) Title of the Invention: **An apparatus and method for charging a battery pack, and decoupling the charging voltage from the battery pack voltage**
Abstract Title: **Battery charging circuit with balancing**

(57) A charging circuit for a battery pack 300 has a battery pack controller 140 and several battery modules 200 connected in series. Each battery module 200 has a battery/capacitor charge controller 240, and has multiple batteries connected in parallel and multiple capacitors connected in parallel. The battery pack controller 140 calculates a balanced state of charge for each battery module 200, and each battery/charge controller 240 uses specific charge voltage and current to charge the batteries and capacitors to an optimum balanced state of charge, which takes account of the state of health of all batteries in the pack 300. The charging circuit allows the battery pack 300 to be recharged by any voltage regardless of the pack output voltage. Charging time is reduced by eliminating the stop/start process of conventional active or passive balancing.

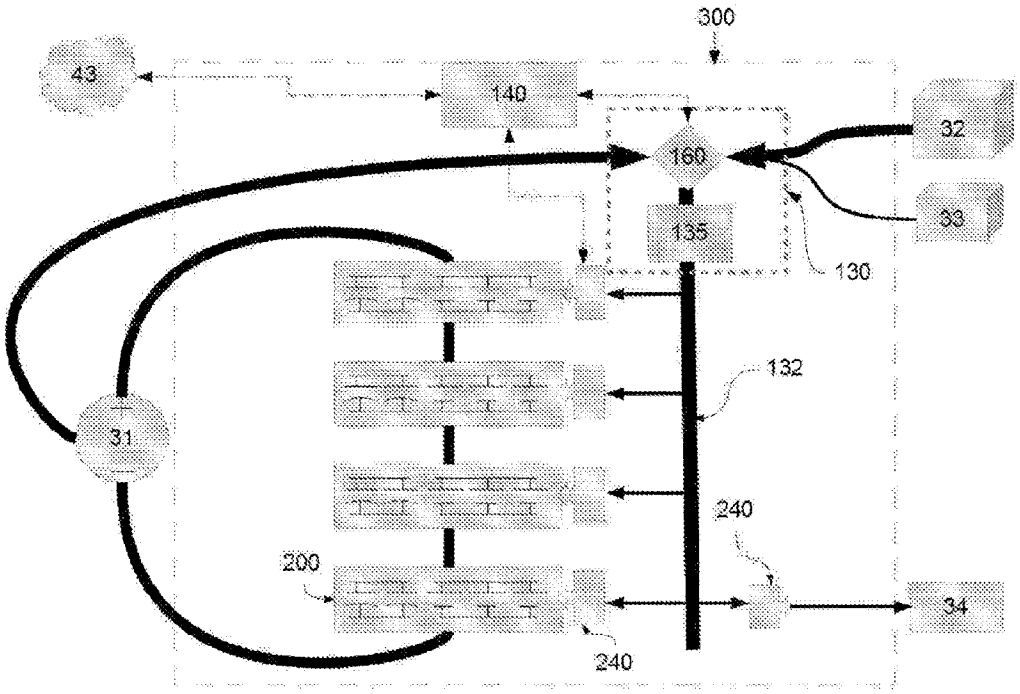


Figure – 4

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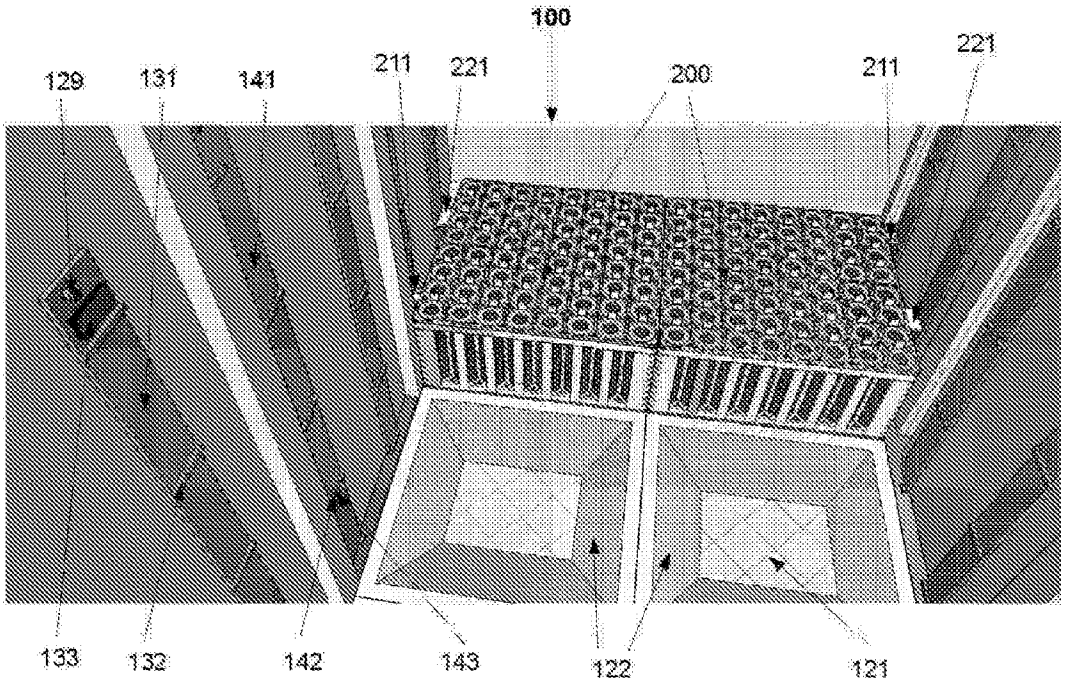


Figure – 2.2

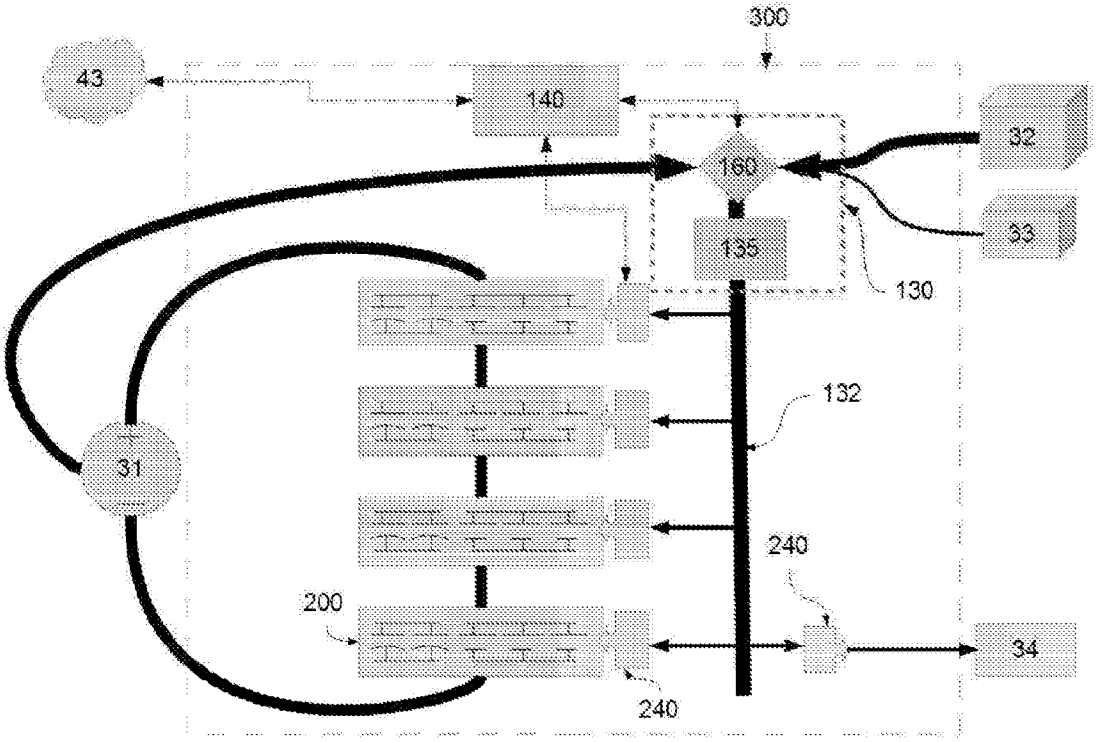


Figure – 4

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Description:

Title of description

An apparatus and method for charging a battery pack, and decoupling the charging voltage from the battery pack voltage

Technical Field

Battery packs used in large electric vehicles e.g. cars, trucks, buses, vans, trains, boats to supply high voltage power to electric motors. This invention relates to large battery pack technology.

Background information

Vehicles use ICEs to power its drive train. For electric vehicles a battery pack is needed to supply large power to electric motors.

Rechargeable batteries e.g. lithium Ion batteries, which are the building blocks of a battery pack, take long time to charge, depending upon its chemistry.

Large commercial vehicles with large battery packs require long charging times to charge the battery pack, and while the vehicle is being charged vehicles are not economically productive. For better utilisation of such vehicles the battery pack must charge in shortest possible time.

Battery charging/balancing– it is a key technology in a large battery pack which can power an electric vehicle. Given the high voltage requirements of a large battery pack of around 300v to over-500V DC; large number of Li-on batteries which have nominal voltage of around 3.6V need to be connected in series and parallel to achieve high voltage and high current.

During charging, the whole of battery pack, with large number of serially connected batteries is charged through a single high voltage DC charger. During this process individual batteries charge to different voltages, resulting in some batteries overcharging while some undercharging. This happens due to individual battery's inherent chemistry and history of usage. This overcharge can result in significant degradation of the batteries. To solve this overcharging and undercharging issue, there are various methods used in the industry to balance (equalise) the charge across the battery pack– these methods are broadly classified as Active and Passive.

a) *Active balancing methods* transfer the current from highly charged batteries to less charged batteries during the charging process – this method achieves excellent balancing results however it slows the charging process as the charging has to be stopped to avoid damage to the overcharged batteries until the charge is reduced to the max level allowed by the chemistry. Thus Active method is a stop start charging/balancing process.
b) *Passive balancing methods* simply waste the excess charge of overcharged batteries through resistors and thus easier to implement, however this method create heat in the vicinity of batteries and reduces the charging efficiency.

Drawbacks of the current charging/balancing process:

a. The charging process has to stop until an overcharge battery is brought back into the tolerance range of the charging. The charging is resumed when the overcharged issue is

rectified. For a very large battery with thousands of small batteries this stop start process consumes a lot of charging time.

b. If a battery or group of batteries are failed, it's not possible to simply replace the failed batteries with new batteries as it would result in old batteries with lower capacity and new batteries with high capacity. The active or passive balancing methods would not be able to distinguish the new batteries from the old batteries and likely to end up overcharging old batteries.

How this invention solves the technical problems, and how it is different

This invention solves the current technical problems through many innovative steps:

1. Decoupling of charging voltage from the output voltage of the battery pack – this invention decouples the input voltage from the battery pack output voltage which is based on battery pack configuration. Hence the battery packs of any configuration can be charged using large chargers and charging voltage is no longer tied to the battery pack voltage.
2. Charging and Balancing the batteries - This innovation measures SoC from a group of batteries and voltage from a group of capacitors connected in parallel and uses a algorithm which calculates the 'balanced SoC' and 'balanced voltage' for all the said groups. Battery/capacitor charge controllers installed inside battery modules (BMs), charge each of this said group with a specific voltage and current. The individual batteries and individual capacitors which are connected in parallel are then allowed to self balance within their respective groups. This extends the life of the batteries as these are not overcharged and then charge removed. This also saves time to charge the battery pack.

The key objectives of the inventions in this disclosure are:

1. Decoupling of the charging voltage from the output voltage of the battery pack. The battery pack can be charged at any voltage whereas the discharging voltage is determined by the configuration of the battery pack.
2. Extend the life of the battery pack;
3. Fast charging of the battery pack.

Brief about Drawings

- Figure 4- the schematic circuit diagram of overall system of charging of the batteries/capacitors
- Figure 2.2 – shows the charging terminals and the BMs inside a battery pack

Detailed description of preferred embodiment, and how it is manufactured

The inventions will be explained through preferred examples of selective charging circuit (300).

The aim of this invention from technical point of view is to design an apparatus of a battery pack charger, to:

a. provide faster charging of the batteries by saving time spent on charging the batteries and then removing the charge from the overcharged batteries to balance the batteries/capacitors;
b. decouple the DC charging voltage from the DC output voltage. The battery pack can be charged at any DC voltage e.g. up to 1200v, while the battery pack DC output voltage is pre-defined;
c. electrical modular designs of the battery pack, so that a battery module (BM) can be replaced or taken out of the electrical circuit, without disrupting the electrical connection of other BMs.

The second aim of this invention, from usability of the battery pack point of view, is to design an apparatus of a battery pack charger, to:

a. extend the range of the battery pack , by maximising battery pack capacity utilisation and storing regenerative current with minimal losses;
b. extend the longevity of the batteries, by not overcharging weak batteries, while fully charging the stronger batteries;

In this disclosure, SoC is the State of Charge (SoC) which is a gauge of charge with in battery usually expressed in percentage e.g. 80% charge. It is expressed as % of manufactured capacity. State of Charge (SoC) of each battery/capacitor can be measured by any method including coulomb counting methods. Depth of Discharge (DoD) is how much charge is left before the battery/capacitor is recharged.

SoH means remaining capacity compared to manufactured capacity e.g. 95% of remaining capacity.

In this disclosure, Battery pack controller (140) determines the failure of a battery or a battery module (BM) (200). Battery pack controller's algorithm takes into battery's history of charging, impedance, SoH, thermal runaway etc and determines the failure of the battery, or if more than one battery is failed inside a BM, battery pack controller (140) deems the BM as a failed BM. In this disclosure the failure of batteries or capacitors or BM refers to Battery pack controller's declared failure.

In this particular embodiment the battery pack has a configuration of 128S64P, with 128 battery modules (BMs) connected in series, and each BM has a configuration of 62 batteries connected in parallel and 2 capacitors in parallel.

In this particular embodiment BM has 62 cylindrical lithium-ion (Li-ion) rechargeable batteries (220) and 2 capacitors. In another embodiment it could be derivative of Li-ion or any other chemistry; in the shape of cylinder, tower, pouch or prismatic or any other shape. Further the batteries could be of high energy density. In this disclosure all these rechargeable batteries (220) of different chemistries and shapes are referred to as Batteries (220) in plural and Battery in singular. In this particular embodiment BM has 2 Electric double layer capacitors (EDLC) cylindrical capacitors, also

called supercapacitors. In another embodiment these capacitors could be Asymmetric Electrochemical Double Layer Capacitor (AEDLC), Lithium Ion capacitors, or grapheme supercapacitors. In this disclosure all capacitors of different electrochemical, chemistries and shapes are referred to as capacitors in plural and capacitor in singular. In another embodiment there could be any number of batteries (220) and any number of capacitors (220) in a BM.

In another embodiment a group of batteries and a group of capacitors can be arranged together inside a larger pack, without the mechanical casing of a BM. Each such group of batteries and capacitors is considered as one BM. If one or more such groups are connected in series or parallel, then multiple BMs are considered to be connected in series and parallel.

In this particular embodiment 128 BMs are connected in series. In another embodiment large batteries/capacitors can be horizontally and/or vertically arranged, using one or more mesh like structures, without using multiple BMs. In such an embodiment the electrical connections to the batteries/capacitors are embedded inside the mesh or laid above or below the mesh. In further embodiment part of the wiring can be based on radio signals, especially the control signals. For this disclosure each such mesh like structure is considered as one BM. In this disclosure, if multiple layers of mesh like are structures are stacked, each layer is considered as one BM and vertical layers of mesh are considered as vertically stacked BMs.

In this disclosure, the combination of batteries and capacitors is optional. The BM (200) can be created just with batteries. The BM (200) can also be created just with capacitors. Figure 4 is an illustration of a particular embodiment of a Charging circuit (300). In this circuit battery pack controller (140), is the master controller of all charging.

This invention creates a battery pack charger, which has two key components:

1. balanced charging circuit – it's an electronic hardware circuit.
2. balanced charging algorithm – it's an algorithm installed inside battery pack controller.

The balanced charging circuit has further four key sub-components:

1. Battery pack controller (140) which is a master controller and made up of hardware and software. This balanced charging algorithm is installed in this controller;
2. AC/DC – DC converter (135) which converts AC/DC to DC;
3. and Energy charging split circuit (160), which acts a slave to the battery pack controller(140);
4. battery/capacitor charge controller (240), which acts a slave to the battery pack controller(140)

Battery pack controller algorithm (140) controls the Energy charging split circuit (160) which controls the input to the AC/DC to DC converter (135). Energy charging split circuit (160) and AC/DC to DC converter (135), together form the power board (130)(not shown). The power board in this embodiment is installed inside the battery pack(100). In another embodiment the power board can be installed outside the battery pack (100).

The AC/DC to DC converter (135) is referred to as converter (135) in this disclosure. In this embodiment, when a regenerative current is sensed regenerative supply is connected to the converter (135). When an external AC or DC charger is manually connected to the vehicle, either DC

charger (32) or AC charger (33) is connected to the converter. In another embodiment only AC and/or DC street charger inputs are connected to the converter (135), and regenerative power is ignored which can be considered not worth storing.

In this embodiment the battery pack controller(140) is installed inside the battery pack, however in another embodiment it can be installed outside the battery pack (100).

In this embodiment AC/DC -DC converter (135) is an isolated AC (single phase and three phase) to DC, and DC to DC buck converter. In another embodiment the converter (135) can be bi-directional AC to DC to AC, as well as DC to DC converter, an additional switch may also be connected (not shown) which connects the converter's output to external AC terminal (33) and input to the High output of the battery pack.

As shown in figure 4, the AC/DC – DC converter (135) supplies the DC charging bus (132). In this embodiment, the voltage of the charging bus (132) is at intermediate level e.g. 20v or 48v. It's a step-down from the input high voltage DC and input high voltage AC(single and three phase), and higher than the maximum battery voltage of 4.2V or the capacitor voltage of 2.7v. In another embodiment the voltage of the charging bus can be the same as the DC street charger (32) voltage. In another embodiment the voltage of the charging bus voltage can be same as the max voltage of the batteries e.g. 4.2V.

In figure 4, the voltage of DC street charger (32) can be anything from 60v to 1500v depending upon the street charger. Battery pack output voltage of DC bus in this embodiment is 128*4.2v = max 537.6V. However in another embodiment of 160S256P configuration the Battery pack output voltage of DC bus is 160*4.2v = 672V. Both of these configurations can be charged by a charger having any voltage from 60v to 1500v. One of the innovation here is that any battery configuration can be charged by this innovative battery pack charger using any input voltage.

High voltage in this disclosure is referred to charging and discharging voltage of 60v to 1500v.

As shown in the figure 4, in this embodiment each BM (200) has a Battery/capacitor charge controllers (240), which is acting as slaves to the battery pack controller (140). In this embodiment, as shown in figure 4, a Battery/capacitor charge controller (240) charges a group of the batteries as well as a group of capacitors, within the BM (200); which are electrically connected in parallel, with a specific charging voltage and specific charging current, as per the instructions sent by battery pack controller (140) over the communication line I^2C or SMbus or PMbus. However in another embodiment, the group of batteries connected in parallel are divided into sub-groups and there could be plurality of battery/capacitor charge controllers (240) within each BM, responsible to charge each sub-group. In further embodiment, the group of batteries may have serial as well as parallel connections, and there could be further sub-groups, with each sub-group having its own set of batteries electrically connected in parallel and sub-groups are electrically connected in series. In another embodiment there could be one battery charge controller (240) for each battery and one capacitor charge controller for each capacitor.

In this disclosure electronic connection means when two devices communicate with each other through electronic (digital or analogue) signals e.g. electronic connection between battery pack

controller (140) and a sensor or electronic connection between battery pack controller(140) and battery charge controller (240).

In this disclosure all the charging circuit, which includes SoC/voltage measurement devices, current measurement devices, temperature measurement devices etc, responsible for the charging the batteries and capacitors as per the instructions from the battery pack controller is referred to as battery/capacitor charge controller. Battery/capacitor charge controller (240) can be built using Integrated circuits or other electronic components. In this disclosure any electronic circuit doing the function of charging battery/capacitor is referred to as battery/capacitor charge controller (240).

In this embodiment, the Battery/capacitor charge controllers (240) take the input power from the Charging bus (132). As shown in figure 4, in this embodiment all Battery/capacitor charge controllers (240) are electrically connected in parallel, to the charging bus (132). In another embodiment there is no charging bus (132) and each battery/capacitor charge controller (240) can be directly connected to the AC/DC converter (135).

In this embodiment, each BM (200) has a group of 62 electrically parallel connected batteries and a group of 2 electrically parallel connected capacitors, and each group of batteries and capacitors are separately charged, by the Battery/capacitor charge controller (240). However in other embodiment in each BM (200) there could be series as well parallel electrically connected batteries e.g. BM configuration of 2S256P, where there are 2 sets of 248 parallel connected batteries and 2 sets of 4 parallel connected capacitors, in such an embodiment of a BM, the Battery/capacitor charge controllers (240) will charge two sets of 248 batteries separately with their own voltage and current, and two sets of 4 capacitors separately.

In this embodiment, battery pack controller (140), gets the measurements of voltage, SoC etc from each battery and each capacitor supplied by the battery charge controller, and calculates the 'balanced SoC' and 'balanced voltage' for the said group of batteries and the said group of capacitors. In another embodiment battery pack controller (140) can get voltage and SoC from a sample of batteries and a sample of capacitors to calculate the balanced SoC and the balanced voltage.

Balanced SoC is the SoC, calculated by the algorithm, such that all batteries in all the BMs within the Battery pack (100) are charged to the same SoC. Optimum balanced SoC is the maximum balanced SoC for all the BMs taking into account the SoH of the weakest BM in the series. Optimum balanced SoC is less than 100% e.g. if the weakest BM in series has a remaining capacity of 95%, then 95% is the Optimum balanced SoC for the whole battery pack..

Optimum balanced voltage for the capacitors however is based on the maximum current demands as determined by the battery pack controller. PI note: In this embodiment voltage is assumed to be proportional to the SoC levels of the capacitors. If however in another embodiment capacitors may have voltage which is not proportional to the SoC levels, then SoC is used for capacitors as well. Maximum current demands are specific to the application of the battery pack e.g. stop/start bus has high regenerative current storage demand and performance electric vehicle has high peak current demand.

In this disclosure, Balanced SoC and Balanced Voltage are the equalised charging for batteries and capacitors respectively, at any point during the charging process. Optimum balanced SoC and Optimum balanced voltage are the maximum equalised charging for batteries and capacitors respectively.

As shown in the figure 4, Battery pack controller (140) is connected to the cloud based operational centre (43). The battery pack controller creates a log of history of usage of each battery/capacitor and each BM. Using the history of usage e.g. history of charging, terminal voltages, senor data etc, in this embodiment, operational centre (43) software calculates its SoH for each battery/capacitor and each BM, these calculation are specific to the battery pack depending upon the ageing of the battery pack. In this disclosure SoH refers to operational centre calculated SoH. Battery pack controller sends sensor and context data to the operational centre for it to calculate the SoH of the batteries. In another embodiment SoH is calculated by the battery pack controller using its compute capacity.

Battery pack controller then calculates in real time, charging voltage and charging current to be used by each battery/capacitor charge controller (240) based on the existing SoC of the batteries/capacitors and the optimum balanced SoC and optimum balanced Voltage. Battery pack controller then selectively instructs each Battery/capacitor charge controller (240) using its ID, to charge the batteries/capacitors (220) with a specific charging voltage and specific charging current.

Battery pack controller continues the step by step process of calculating the Balanced SoC and Balanced Voltage and charging the batteries and capacitors, until the optimum balanced SoC is reached for the batteries and balanced voltage is reached for the capacitors, or there is no charging current available.

As shown in figure 4, in this embodiment, all Battery/capacitor charge controllers (240) have the same input voltage through the charging bus (132), and these charge controllers (240) dynamically change the output to charging voltage and charging current which is specific to the group/sub-group of batteries or capacitors (220), as per the instructions from the battery pack controller (140).

While getting and while getting charged by the battery charge controller, all the batteries (220) as well as capacitors (220) which are electrically connected in parallel within each group or subgroup, are allowed to self balance, within their respective group/subgroups. Self balance means batteries/capacitors connected in parallel pass current from higher charge battery/capacitor to lower charged battery/capacitor until all the batteries or capacitors connected in parallel are balanced charged or have the same voltage.

As shown in figure 4, one or more auxiliary batteries e.g. low voltage lead acid batteries or gel batteries, are also charged by DC-DC converter or battery charge controller(240) connect to the charging bus (132) as its input.

In this embodiment of electrical configuration of 128S64P, 128 BMs are electrically connected in series. As shown in figure 4, there is a separate charging for each BM(200). All BMs(200) are charged simultaneously through separate battery/capacitor charge controllers(240).

One of the key innovations here is instead of charging all the BMs connected in series through a high voltage single power supply, this innovation selectively charges each group of batteries where all the

batteries are electrically connected in parallel, with a separate power supply. Hence the battery pack can be charged by any voltage (depending upon the range of the converter) as it is being converted into the charging bus voltage, and the battery pack output voltage can be designed to match the motor controller voltage. This decouples the DC charging voltage/current from the DC output voltage/current. The DC street chargers that need to put in say 350KWhr power into vehicles have to maximise on the voltage to say 1000v and minimise on the current to say 350amps, as higher current means thicker charging cables. For the same power, electric motors (31) being powered by the battery pack, conversely want higher current and lower voltage, as torque is proportional to the current. Hence this innovation allows that the battery pack of 100KW can be charged by a 3KW charger, 30KW charger, 100KW and even 350KW charger. This innovative battery pack charger is agnostic to the battery pack output voltage.

Another innovation is, instead of overcharging some BMs and undercharging some BMs as would have been case if we charge all the BMs connected in series, through a single high voltage power supply; this innovation selectively charges each group of batteries/capacitors directly to the 'Balanced SoC' and 'Balanced voltage' without having to through the stop start balancing process. This speeds up the charging process, as this innovation does not need to stop charging until an overcharged BM has lost its charge. The overcharging is less common with this invention as all the BMs are charged to a specific voltage using a specific current. However if an overcharge occurs in a given group of batteries, this innovation will simply stop charging the said group of batteries/BM, and continue with the others, until the said group of batteries/BM has self balanced or the said BM/s has the same level of charging as other BMs. The battery pack controller software will continue to take SoC readings of the said BM/s, and will only restart when the overcharge is rectified.

Another innovation is that the battery pack controller's algorithm calculates the balanced SoC and Balanced voltage, and charges all the groups of batteries connected in series to the maximum of Optimum balanced SoC. The algorithm uses learning from the previous charging, e.g. what was the calculated balanced SoC and how much SoC was achieved using a specific charge voltage and charge current. The charge current/charge voltage relationship with the SoC changes as the batteries age, as weaker batteries charge quickly and also take in less charge than stronger batteries to reach the same SoC levels. Thus unevenly aged batteries can be balanced and it maximises capacity utilisation.

Another innovation is the algorithm takes the SoH of the batteries into account to calculate Optimum balanced SoC. This allows for uneven ageing of the batteries/capacitors, and at the same time it maximises the capacity utilisation of all groups of batteries connected in series.

The algorithm gets informed by the operation centre about the SoH of the batteries and it keeps a log of each battery's health (SoH) levels which goes down as the batteries age. Thus when a failed BM (200) is replaced in the battery pack, this log is updated with the SoH of the batteries of the new BM, and the battery pack controller (140) knows that the new BM has higher capacity and it will reset the Optimum balanced SoC to the next weakest BM. This innovation saves having to discard the entire battery pack if a single BM needs changing.

Further innovation here is that batteries connected in parallel within a group or subgroup, inside a BM, are self balanced to speed up the charging process. In this embodiment the charging process is actually balanced charging only 128 BMs, and while the 128 BMs are being balanced charged, the 62

batteries within each BM are self balancing in tandem. There are 128*62 = 7936 batteries in all the BMs; the battery controller's algorithm is only actively balancing 128 sets of batteries. This also speeds up the charging process.

Further innovation is that each BM stores all its share of regenerative energy in capacitors, as the regenerative energy normally has large current and only available for few seconds, which may not be enough time to store in the Batteries. The capacitors inside each BM maximise its storage of regenerative energy and charge up to optimum balanced voltage. The optimum balanced voltage for capacitors is calculated by the battery pack controller.

Further innovation is that the Energy charging split circuit (160) switches the inputs to DC-DC the converter between, high voltage DC supply, AC supply and regenerative energy. As only one of the inputs is used at any one time, this makes the most effective use of the DC –DC converter part of the converter.

In this embodiment, batteries within the battery pack are from the same manufacturer; have the same chemistry; have the same capacity, have the same voltage, and these batteries are balanced charged at the time of the manufacture of the battery pack, and preferably the capacitors within the battery pack are from the same manufacturer; have the same chemistry; have the same capacity, have the same voltage, and these capacitors are balanced charged at the time of the manufacture of the battery pack. In another embodiment, batteries can be from different manufacturers, and capacitors can also be from different manufacturers. In another embodiment, Batteries and capacitors can have different capacity which are connected in parallel, while keeping the BMs connected in series having equal current capacity.

Example of intended use

- Power unit for large electric vehicles e.g. trucks, SUVs, vans, trains
- Backup power unit for hospitals, data centres and industrial units
- Energy storage unit for solar panels

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Claims

An apparatus for charging a battery pack, and decoupling the charging voltage from the battery pack voltage

1. The charging circuit of battery pack, is an apparatus, comprises:
    a. a battery pack controller, which acts as a master controller of all charging functions of batteries, preferably and capacitors;
    b. inside each battery module (BM), one or more groups of batteries are electrically connected in parallel, preferably and one or more groups of capacitors are also electrically connected in parallel;
    c. there is at least one battery/capacitor charge controller inside each BM, which charges batteries, preferably and capacitors, and acts as a slave to the battery pack controller;
    d. battery pack controller's balanced charging algorithm calculates the Balanced SoC for said group of batteries; preferably and calculates Balanced voltage for said group of capacitors;
    e. battery pack controller selectively instructs each battery/capacitor charge controller to charge the said groups of batteries, and preferably said groups of capacitors, with a specific Charge voltage and Charge current; or preferably charge to Balanced SoC;
    f. said group of batteries and preferably said group of capacitors, during and after getting charged by the battery/capacitor charge controller self balance in their respective groups;
    g. the battery charge controllers continue the charging process, until either all the BMs have reached the optimum balanced SoC for batteries, preferably and optimum balanced voltage for capacitors, or there is no supply of charging current.
2. The Balanced charging algorithm of claim 1 calculates the said Balanced SoC for batteries, preferably and Balanced voltage for capacitors, based on:
    a. the existing SoC of the said groups of batteries, and preferably existing voltage of said group of capacitors;
    b. optimum balanced SoC for the said group of batteries;
    c. and preferably optimum balanced Voltage for the said group of capacitors.
3. The Balanced charging algorithm claim of 1 calculates the balanced SoC to balance the said groups of batteries, based on the algorithm as explained using an example:
    a. if there are 3 groups in series, first group has existing SoC of 30%, second group has SoC of 29%, and the third has SoC of 31%;
    b. assuming 1 amp hr of new current to each of the said group of batteries will bring up the SoC of the said group of batteries group by 1%;
    c. if the battery charger has 3 amp hr to distribute; it will allocate 1 amp hr to the first group, 2 amp to the second group and zero to the third group; thus all the three groups are balanced charged to 31% SoC, thus 31% will be the Balanced SoC;
    d. if the charger had 4amp hr to distribute, it would have distributed 3 amps hr as explained above and then distributed 0.333 amp hr equally to all the three groups; thus group 1 would have got 1+0.333= 1.333 amp hr; group 2 would have got

2+0.333=2.333 amp hr and group 3 would have got 0.333 amp hr; thus all the three groups are balanced charged to 31.33% SoC , thus 31.33% will be the Balanced SoC;

e. if the charger had 1amp hr to distribute, it would have given 1 amp to the group which is most out of balance; thus group 1 would have got zero; group 2 would have got 1amp hr and group 3 would have got zero; thus the three groups are charged to 30%, 30%, 31%, thus the pack is still unbalanced, as there is not sufficient supply of charge available to balance the battery pack;

f. Battery pack controller continues with the above steps until either all the said groups have reached their optimum balanced SoC, or there is no supply of charging current;

g. If any group of batteries has reached optimum balanced SoC earlier than others, the battery pack controller skips its charging.

4. The Balanced charging algorithm of claim of 1 preferably calculates the balanced Voltage to balance the said groups of capacitors, based on the algorithm as explained using an example:

   a. if there are 3 groups in series, first group has existing voltage of 3v, second group has existing voltage of 2v, and the third has existing voltage of 3.5v;

   b. assuming 1 amp hr of new current to each of the said group of capacitors will bring up the voltage of the said group of capacitors group by 1v;

   c. if the battery charger has 2 amp hr to distribute; it will allocate 0.5 amp hr to the first group, 1.5amp hr to the second group and zero to the third group; thus all the three groups are balanced charged to 3.5v, thus 3.5v will be the 'Balanced voltage';

   d. if the charger had 3amp hr to distribute, it would have distributed 2 amps hr as explained above and then distributed 0.333 amp hr equally to all the three groups; thus group 1 would have got 0.5+0.333= 0.833amp hr; group 2 would have got 1.5+0.333=1.833amp hr and group 3 would have got 0.333amp hr; thus all the three groups are balanced charged to 3.888v, thus 3.88v will be the 'Balanced voltage';

   e. if the charger had 1amp to distribute, it would have given 1 amp hr to the group which is most out of balance; thus group 1 would have got zero; group 2 would have got 1amp and group 3 would have got zero; thus the three groups are charged to 3v, 3v, 3.5v, thus the pack is still unbalanced, as there is not sufficient supply of charge available to balance the battery pack;

   f. Battery pack controller continues with the above steps until either all the groups of capacitors have reached their optimum balanced voltage, or there is no supply of charging current;

   g. If any group of capacitors has reached optimum balanced SoC earlier than others, the battery pack controller skips its charging

5. The battery pack charging circuit of claim 1 also consists of decoupling of input AC/DC voltage to the battery pack, from the battery pack's output AC/DC voltage.

6. The balanced charging algorithm of claim 1 collects measurements of existing SoC of batteries, and preferably existing voltage of capacitors, prior to the charge cycle and preferably during the charge cycle.

7. The Balanced charging algorithm of claim 1 also calculates the said Charge voltage and Charge current which is specific to each said group of batteries, preferably and capacitors, based on:

a. the existing SoC of the said groups of batteries, and preferably voltage for said group of capacitors;
b. balanced SoC of the batteries, preferably and balanced voltage for capacitors;
c. learning from the previous charge cycles the relationship between charge voltage/charge current and achieved SoC of batteries preferably and achieved Voltage of capacitors.

8. The Balanced charging algorithm of claim 1 also calculates the said Optimum Balanced SoC for all the said group of batteries or said BMs, based on:
    a. SoH of the weakest of said groups of batteries, when the said groups are electrically connected in series;
    b. SoH of the weakest of said BMs, when the said BMs are electrically connected in series.
9. The battery pack charging circuit of claim 1 also consists of all the said groups of batteries are equalised charged at balanced SoC and preferably all the said groups of capacitors are equalised charged at balanced Voltage, at any time during the charging process.
10. The battery pack controller of claim 1 also acts as a master controller to the following slave circuits:
    a. energy charging split circuit;
    b. battery charge controller.
11. The battery pack controller of claim 1 also communicates with battery charge controllers using the I^2C or SMBus or PMbus.
12. The battery/capacitor charging circuit of claim 1 also consists of an Energy charging split circuit, that switches the input to the DC to DC converter between:
    a. high voltage DC street charger;
    b. AC charger;
    c. and preferably regenerative current e.g. from the electric motors of electric vehicle.
13. The battery pack controller of claim 1 controls the Energy charging split circuit such that, batteries are charged through external high voltage DC charger or external AC charger, and capacitors are charged by the regenerative current/energy recovery.
14. The battery/capacitor charging circuit of claim 1 preferably also consists of auxiliary low voltage batteries (e.g. Lead acid batteries) electrically connected to the said charging bus through Battery charge controllers or DC-DC converters.
15. The battery pack charging circuit of claim 1 also consists of an AC/DC to DC converter that converts high voltage AC/DC input to interim level DC voltage output e.g. 12v or 24v or 48v; and supplies the Charging bus.
16. The battery charging circuit of claim 1 also consists of the inputs of the said Battery/capacitor charge controller/s are electrically connected to said charging bus.
17. The battery pack controller of claim 1 preferably also keeps a log of SoH for each battery and preferably each capacitor; and preferably for each BM, and preferably updates the log if a failed BM is replaced with a new BM.
18. The battery pack controller of claim 1 is also preferably electronically connected to an operational centre that calculates the SoH of the batteries and BMs, and creates a algorithm offline; algorithm that extends the BM's life and improves the safety of the battery pack e.g. updates of balanced charging algorithm etc, and SoH; and the algorithm is updated in battery pack controller periodically.

a.

19. The battery pack charging circuit of claim 1 also constitutes a replacement of a failed BM with a new BM to extend the life of the battery pack without effecting the balanced charging of other BMs.

A method for charging a battery pack, and decoupling the charging voltage from the battery pack voltage

20. A method of charging of a battery pack, comprising:
    a. a battery pack controller, acting as a master controller of all charging functions of batteries, preferably and capacitors;
    b. inside each BM, electrically connecting a group of batteries in parallel, preferably and electrically connecting a group of capacitors in parallel;
    c. installing Battery/capacitor charge controllers inside each BM,
    d. battery/capacitor charge controllers charging batteries, preferably and capacitors, inside each BM as per the instructions from the battery pack controller;
    e. battery pack controller collecting SoC of each battery and preferably voltage of each capacitor prior to the charging and during the charging;
    f. battery pack controller's algorithm calculating the Balanced SoC for said groups of batteries;
    g. battery pack controller's algorithm preferably also calculating the Balanced Voltage for said groups of capacitors
    h. the said battery pack controller selectively sending a message to each said group's Battery/capacitor charge controller to charge the said group of batteries, and preferably said groups of capacitors, using a specific Charge voltage and a specific Charge current, or preferably charge to a specific Balanced Soc;
    i. after and during the charging, allowing said group of batteries and preferably said group of capacitors, to self balance in their respective groups.
    j. the battery charge controllers continuing the step by step process of calculating balanced SoC for batteries and preferably balanced Voltage for capacitors, and charging the BMs, until either the BMs have reached the optimum balanced SoC for batteries, preferably and optimum balanced voltage for capacitors; or there is no supply of charging current.
21. The method of charging of battery pack of claim 20 also involves, in the event of one or more battery/capacitor within the said groups of batteries/capacitors are overcharged, the Battery/capacitor charge controllers responsible for charging the said group of batteries/capacitors, stopping further charging until the overcharge is self balanced or rectified, however continue charging the rest of the batteries or capacitors.
22. The method of charging of battery pack of claim 20 also involves sending a message/instructingthe said battery/capacitor charge controllers using their ID regardless of where it is located within the said battery pack.
23. The method of charging of battery pack of claim 20 also involves said battery pack controller regularly receiving SoC from each battery, and preferably voltage from each capacitor, and

calculating how much charge it would need to rebalance each and all the said groups in the battery pack prior to beginning the charge process.

24. The method of charging of battery pack of claim 20 also involves in the event of a failure of a battery/capacitor or plurality of batteries/capacitors, replacing the BM having one or more failed batteries/ capacitors with a new BM, updating the log of the SoH of the failed BM with the SoH of a new BM, without impacting the balancing of rest of said BMs in the battery pack.
25. The method of charging of battery pack of claim 20 also involves battery pack controller's algorithm controlling the battery charging split circuit such that capacitors are charged by the regenerative current, and batteries are charged by the external street based AC/DC chargers.

Glossary

Multi layer faced/sided PCB – printed circuit board with multi layers

Auxiliary low voltage batteries – low voltage batteries e.g. 12v lead acid batteries used for starting an ICE engine and vehicle electronics. Smartphone – personally held devices like phone or tablets e.g. iPhone or Samsung

Vehicle control system – control system of the vehicle

Amendments to the claims have been made as follows:

Claims

An apparatus for charging a battery pack, and decoupling the charging voltage from the battery pack voltage

1. The charging circuit of battery pack, is an apparatus, comprises:
    a. a battery pack controller, which acts as a master controller of all charging functions of batteries/capacitors;
    b. plurality of BMs are connected electrically in serial or groups of BMs are connected electrically in series where within each said group plurality of BMs are electrically connected in parallel, inside the battery pack;
    c. inside each battery module (BM), one or more groups of batteries/capacitors are electrically connected in parallel;
    d. there is at least one battery/capacitor charge controller inside each BM, which charges batteries/capacitors, and acts as a slave to the battery pack controller;
    e. battery pack controller's balanced charging algorithm, calculates the Balanced SoC/voltage for said group of batteries/capacitors;
    f. battery pack controller then selectively instructs each battery/capacitor charge controller to use a Charge voltage and Charge current, which is specific to each said BM or each said group of batteries/capacitors, until the Balanced SoC for batteries/ capacitors is achieved;
    g. said group of batteries/ capacitors, during and after getting charged by the battery/capacitor charge controller self balance in their respective groups;
    h. the battery charge controllers continue the above steps (e, f and g), until either all the BMs have reached the optimum balanced SoC/voltage for batteries/ capacitors, or there is no supply of charging current.
2. The Balanced charging algorithm of claim 1 calculates the Balanced SoC and Balanced Voltage to balance charge the entire battery pack, using the following algorithm:
    a. gather the history of charge current vs the increase in SoC for each group of batteries/ capacitors;
    b. gather the existing SoC/voltage of the said groups of batteries/capacitors;
    c. allocate the input current to all the groups of batteries/capacitors such that all the available current is given to the group of batteries/capacitors with the least SoC/voltage;
    d. continue with the above step C until the said group of batteries/capacitors in all the BMs in the series circuit have equal SoC/voltage levels;
    e. any remaining charge is equally divided in all the group of batteries and separately to all the group of capacitors;
    f. continue the above four steps (b, c, d and e) until there is no current supply or optimum balanced SoC/voltage is reached for the said group of batteries/capacitors.
3. The battery pack controller of claim 1 stops charging the said group of batteries/capacitors or BMs in the event of an overcharge in these groups of batteries/capacitors or BMs, and continue charging the other groups of batteries/capacitors or BMs, and restart when the

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said group of batteries or BMs have the same level of charging as other group of batteries or BMs .

4. The battery/capacitor charge controller of claim 1 consists of voltage/SoC measurement devices which send the data to the battery pack controller.
5. The battery pack charging circuit of claim 1 also consists of independent and selective charging of each battery module, and each group of batteries/capacitors connected in parallel with in each BM.
6. The balanced charging algorithm of claim 1 collects measurements of existing SoC/Voltage of batteries/capacitors, prior to the charge cycle and preferably during the charge cycle.
7. The Balanced charging algorithm of claim 1 also calculates the said Charge voltage and Charge current which is specific to each said group of batteries/capacitors, based on:
    a. the existing SoC/Voltage of the said groups of batteries/capacitors;
    b. balanced SoC/Voltage of the batteries/capacitors;
    c. learning from the previous charge cycles the relationship between charge voltage/charge current and achieved SoC/Voltage of batteries/capacitors.
8. The Balanced charging algorithm of claim 1 also calculates the said Optimum Balanced SoC for all the said group of batteries or said BMs, based on:
    a. SoH of the weakest of said groups of batteries, when the said groups are electrically connected in series;
    b. SoH of the weakest of said BMs, when the said BMs are electrically connected in series.
9. The battery pack charging circuit of claim 1 also consists of all the said groups of batteries/capacitors are equalised charged at balanced SoC/voltage relative to other group of batteries/capacitors, at any time during the charging process.
10. The battery pack controller of claim 1 also acts as a master controller to the following slave circuits:
    a. energy charging split circuit;
    b. battery charge controller.
11. The battery pack controller of claim 1 also communicates with battery charge controllers using the I^2C or SMBus or PMbus.
12. The battery pack charging circuit of claim 1 also consists of an Energy charging split circuit, that switches the input to the DC to DC converter between:
    a. high voltage DC street charger;
    b. AC charger;
    c. and preferably regenerative current.
13. The battery pack controller of claim 1 controls the Energy charging split circuit of claim 12 such that, external high voltage DC or external AC charge the batteries/capacitors, and preferably the regenerative current/energy recovery charge the capacitors.
14. The battery pack charging circuit of claim 1 preferably also consists of auxiliary low voltage batteries electrically connected to the said charging bus through Battery charge controllers or DC-DC converters.
15. The battery pack charging circuit of claim 1 also consists of an AC/DC to DC converter that converts high voltage AC/DC input to interim level DC voltage output; and supplies the Charging bus.

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16. The battery pack charging circuit of claim 1 also consists of the inputs of the said Battery/capacitor charge controller/s are electrically connected to said charging bus.
17. The battery pack controller of claim 1 preferably also keeps a log of SoH for each battery/ capacitor; and preferably for each BM, and preferably updates the SoH log of a failed BM with the SoH of the new BM, if a failed BM is replaced with a new BM.
18. The battery pack controller of claim 1 is also preferably electronically connected to an operational centre that calculates the SoH of the batteries and BMs, and creates the said balanced charging algorithm offline; the algorithm that extends the BM's life and improves the safety of the battery pack, and periodically performs updates of balanced charging algorithm and SoH etc.
19. The charging circuit of battery pack of claim 1 decouples the charging voltage from the battery pack's output voltage comprises, input voltage and current of the AC/DC to DC converters used to charge the battery pack are matched with the voltage and current of street chargers; and independently number of BMs/groups of batteries that are connected in series and parallel are matched with the voltage and current requirements of different vehicle's electric motors.

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A method for charging a battery pack, and decoupling the charging voltage from the battery pack voltage

20. A method of charging of a battery pack, comprising:
    a. a battery pack controller, acting as a master controller of all charging functions of batteries/ capacitors;
    b. inside each BM, electrically connecting a group of batteries/capacitors in parallel;
    c. installing Battery/capacitor charge controllers inside each BM,
    d. battery/capacitor charge controllers charging batteries/capacitors, inside each BM as per the instructions from the battery pack controller;
    e. battery pack controller collecting SoC/Voltage of each battery/capacitor prior to the charging and preferably during the charging;
    f. battery pack controller's algorithm calculating the Balanced SoC/Voltage for said groups of batteries/capacitors;
    g. the said battery pack controller selectively sending a message to each said group's Battery/capacitor charge controller, using a specific Charge voltage and a specific Charge current, to charge the said group of batteries/capacitors until a Balanced SoC or Balanced Voltage is achieved;
    h. after and during the charging, allowing said group of batteries/capacitors, to self balance in their respective groups.
    i. the battery charge controllers continuing the above steps (f,g and h), until either the BMs have reached the optimum balanced SoC/Voltage for batteries/capacitors; or there is no supply of charging current.
21. The method of charging of battery pack of claim 20 also involves, in the event of one or more battery/capacitor within the said groups of batteries/capacitors are overcharged, the Battery/capacitor charge controllers responsible for charging the said group of

batteries/capacitors, stopping further charging until the overcharge is self balanced or rectified, however continue charging the rest of the groups of batteries/capacitors.

22. The method of charging of battery pack of claim 20 also involves sending a message/instructing the said battery/capacitor charge controllers using their ID regardless of where it is located within the said battery pack.
23. The method of charging of battery pack of claim 20 also involves said battery pack controller regularly receiving SoC/Voltage from each battery/capacitor, and calculating how much charge it would need to rebalance each and all the said groups in the battery pack prior to beginning the charge process.
24. The method of charging of battery pack of claim 20 also involves in the event of a failure of a battery/capacitor or plurality of batteries/capacitors, replacing the BM having one or more failed batteries/capacitors with a new BM, updating the log of the SoH of the failed BM with the SoH of a new BM, without impacting the balancing of rest of said BMs in the battery pack.
25. The method of charging of battery pack of claim 20 also involves decoupling the charging voltage/current of the battery pack from the battery pack's output voltage/current, and matching the input voltage and current of the AC/DC to DC converters of the battery pack to standard chargers; and independently matching the battery packs output voltage and output current with the voltage and current of the motor controller/electric motors of different vehicles.

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Glossary

Multi layer faced/sided PCB – printed circuit board with multi layers

Auxiliary low voltage batteries – low voltage batteries e.g. 12v lead acid batteries used for starting an ICE engine and vehicle electronics.

Smartphone – personally held devices like phone or tablets e.g. iPhone or Samsung

Vehicle control system – control system of the vehicle

Intellectual Property Office

Application No: GB1907492.1 **Examiner:** Peter Thomas-Keefe

Claims searched: 1-25 **Date of search:** 10 July 2019

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1, 20 at least	US 7489106 B1 (TIKHONOV) column 1 lines 26-32, column 6 lines 12-28, column 6 line 47-column 8 line 18
X	1, 20 at least	US 2011/0241623 A1 (WADE et al.) paragraphs 0017-0025
A	-	US 2014/0197795 A1 (INST POLYTECHNIQUE GRENOBLE)

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[X] :

Worldwide search of patent documents classified in the following areas of the IPC

H02J

The following online and other databases have been used in the preparation of this search report

EPODOC, WPI

International Classification:

Subclass	Subgroup	Valid From
H02J	0007/00	01/01/2006