【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１●８が、（－）端子側に端子１１３が、それぞれ固定されている．端子１●８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

面図。

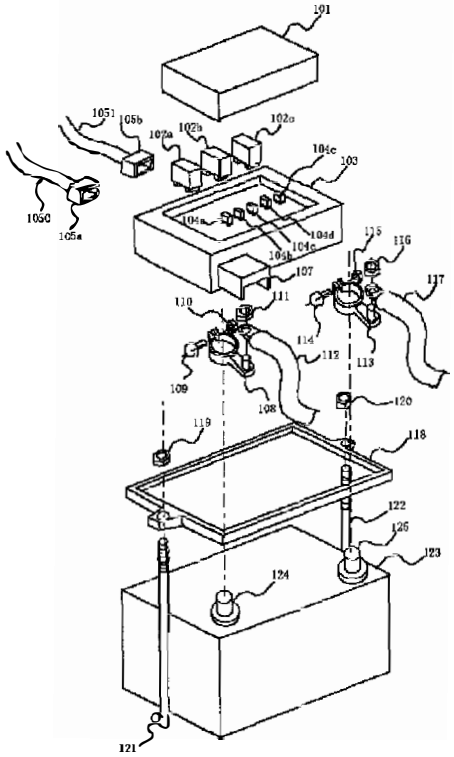
【図3】本発明におけるヒューズ・リレーボックスの内部回路構成図。

【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。

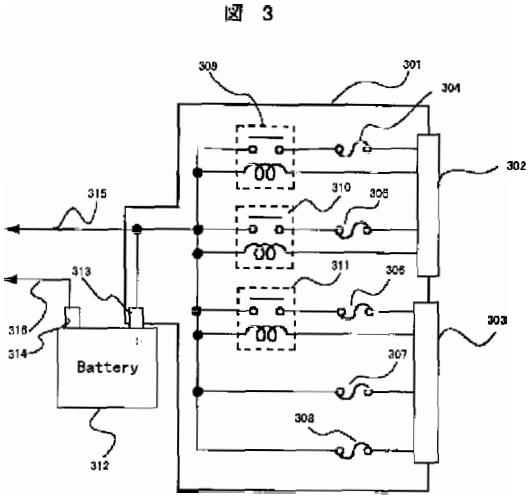
【図1】

図 1



【図3】

図 3



【図2】

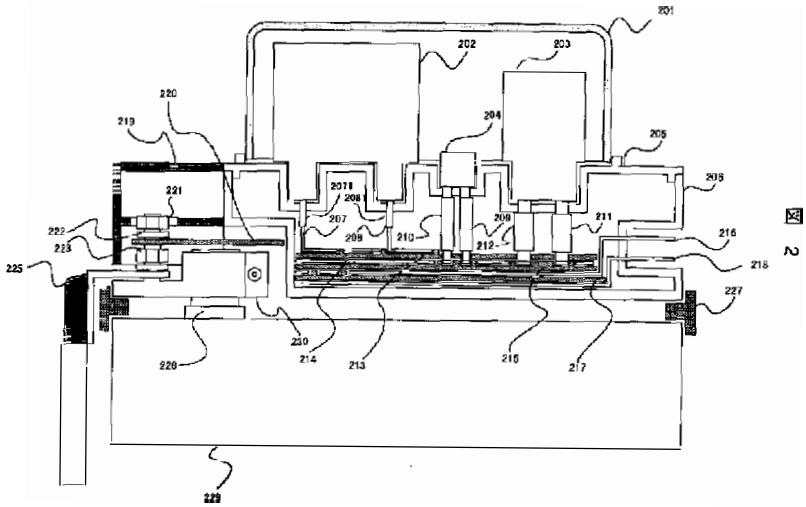


図 2

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フロントページの続き

(51)Int.Cl.[7]	識別記号	ＦＩ		（参考）
Ｆ●２Ｎ　11/08		Ｆ●２Ｎ　11/08	Ｌ	
Ｈ●２Ｇ　3/16		Ｈ●２Ｇ　3/16	Ｚ	

EXHIBIT 1002
Petitioner ADC (IPR2024-00577)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
18 February 2016 (18.02.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/025869 A1

(51) **International Patent Classification**:
H02M 3/18 (2006.01) *H02J 7/02* (2016.01)

(21) **International Application Number**:
PCT/US2015/045335

(22) **International Filing Date**:
14 August 2015 (14.08.2015)

(25) **Filing Language**: English

(26) **Publication Language**: English

(30) **Priority Data**:
62/037,379 14 August 2014 (14.08.2014) US

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(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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

Published:

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

(54) **Title**: COMPACT MULTIFUNCTIONAL BATTERY BOOSTER

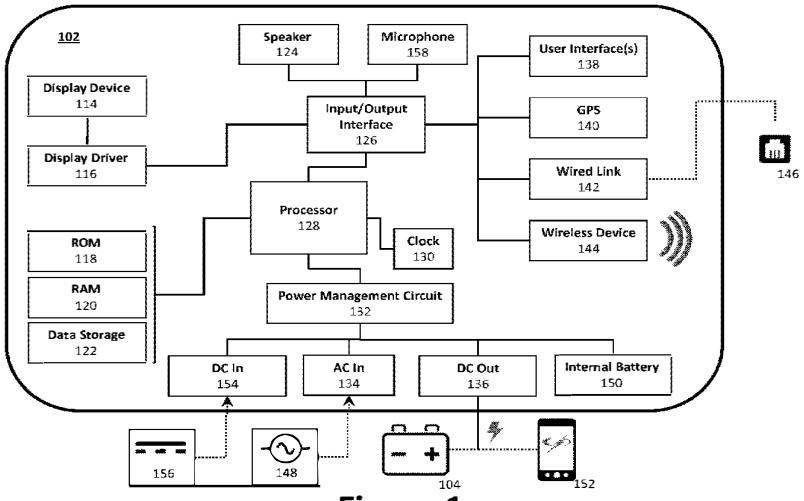


Figure 1

(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

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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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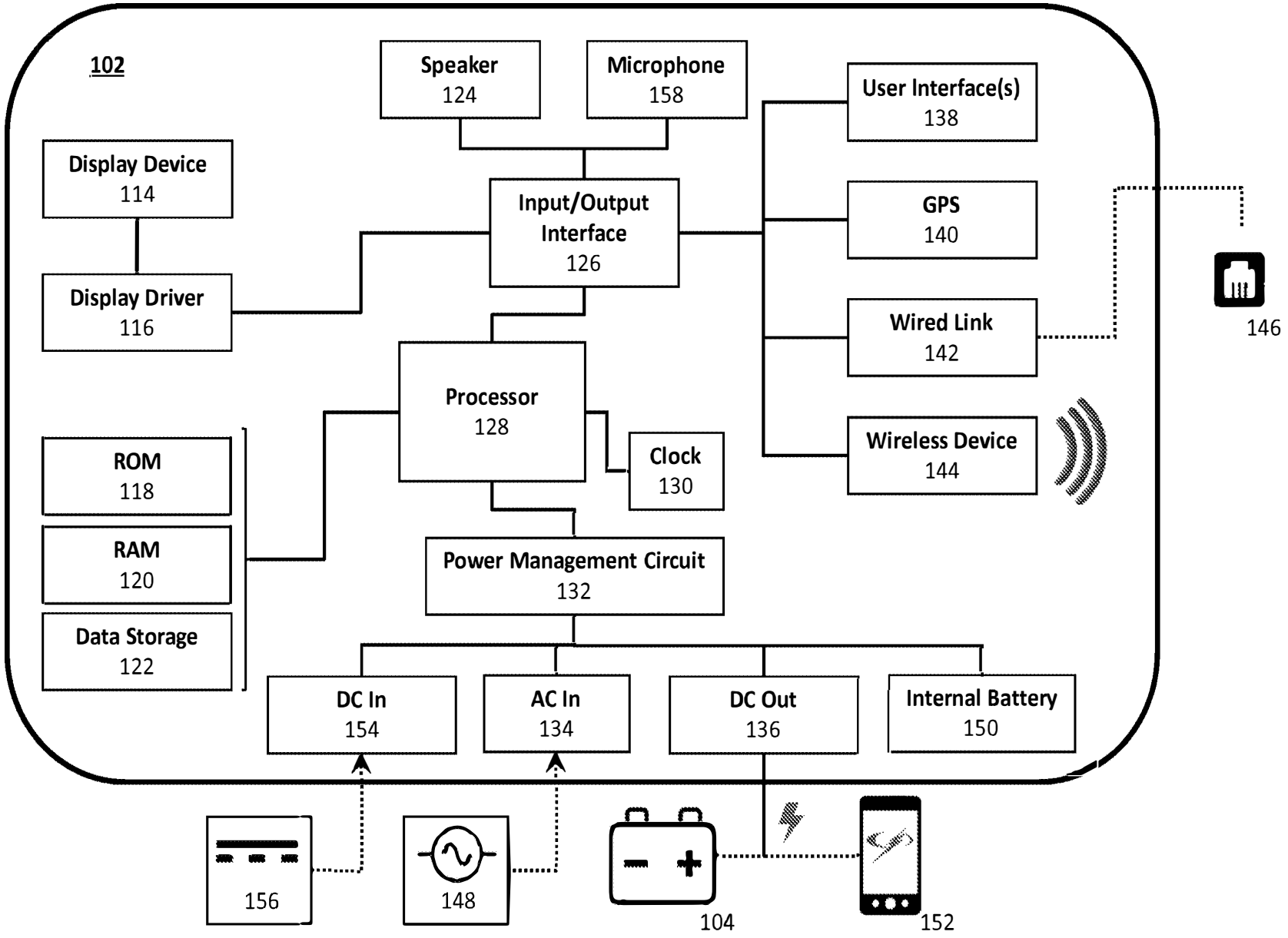

102
Speaker
124
Microphone
158
User Interface(s)
138
Display Device
114
Input/Output
Interface
126
GPS
140
Display Driver
116
Wired Link
142
146
Processor
128
ROM
118
Clock
130
Wireless Device
144
RAM
120
Power Management Circuit
132
Data Storage
122
DC In
154
AC In
134
DC Out
136
Internal Battery
150
156
148
104
152

Figure 1

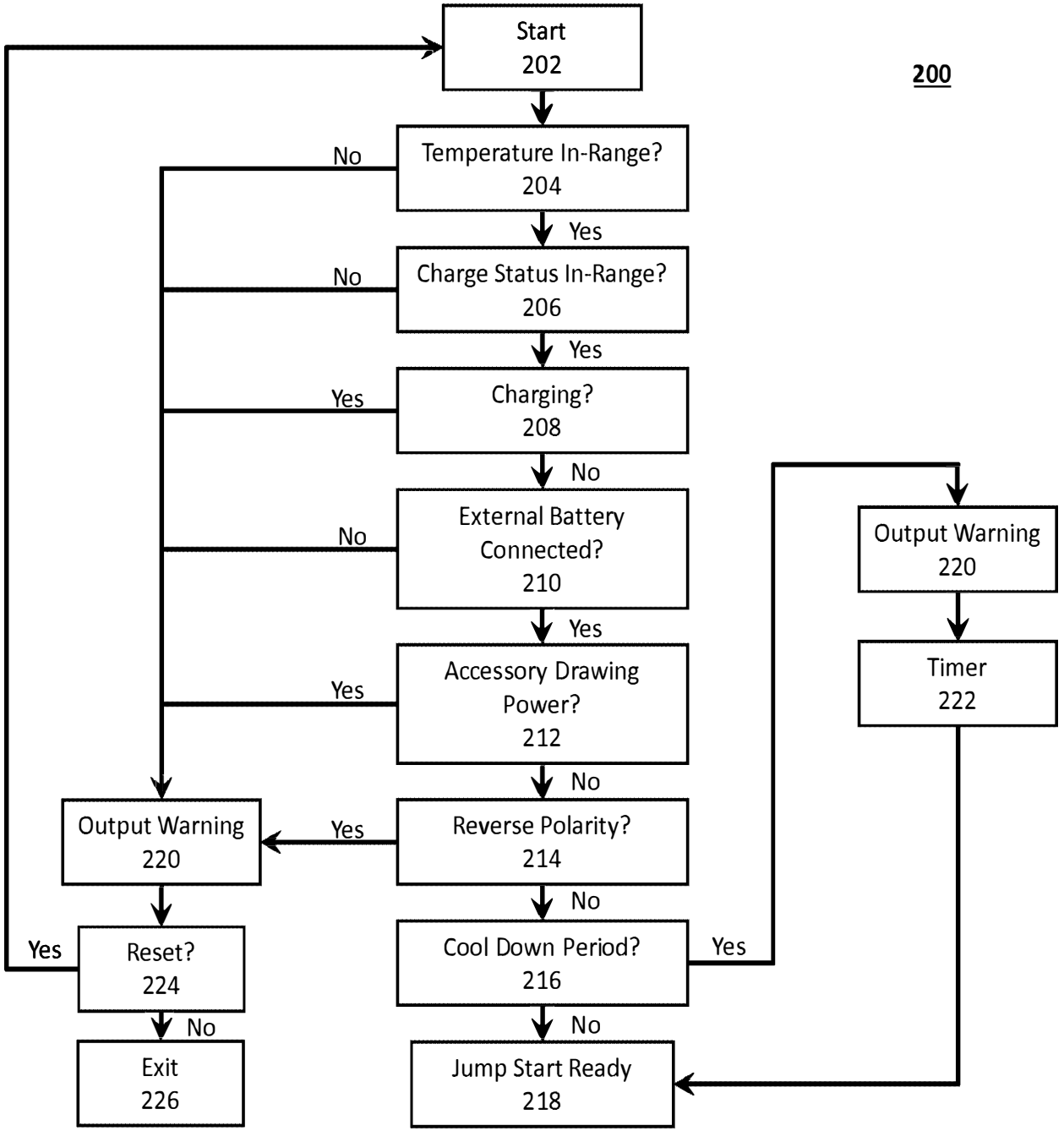

200
Start
202
Temperature In-Range?
204
Charge Status In-Range?
206
Charging?
208
External Battery Connected?
210
Accessory Drawing Power?
212
Reverse Polarity?
214
Cool Down Period?
216
Jump Start Ready
218
Output Warning
220
Timer
222
Reset?
224
Exit
226
No
Yes

Figure 2

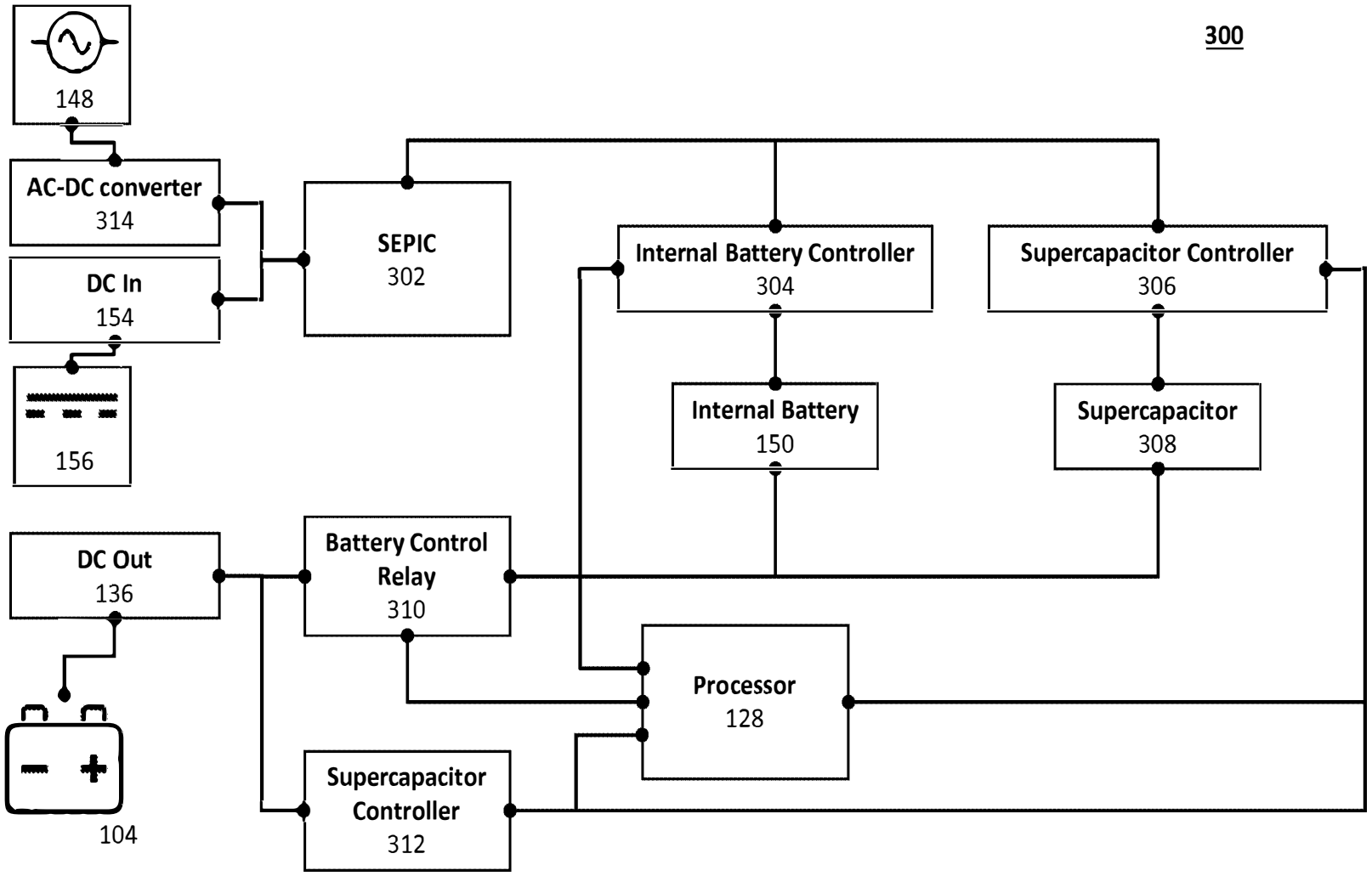


Figure 3

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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
"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
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)

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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
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		EP 1994623 A2	26 Nov 2008
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		US 2007182362 A1	09 Aug 2007
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		US 2010060231 A1	11 Mar 2010
		US 2012068669 A1	22 Mar 2012
		WO 2007082168 A2	19 Jul 2007

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
		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

Form PCT/ISA/210 (patent family annex) (January 2015)

EXHIBIT 1002
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Espacenet

CN103066662A Emergency power supply

Applicants: LEI XINGLIANG

Inventors: LEI XINGLIANG

Classifications:

IPC ***H02J7/00; H02J9/00;***

CPC **B60L8/003 (EP,US); H02J1/00 (US); H02J1/122 (EP); H02J9/04 (US); H02J9/061 (EP,US);** H02J1/122 (US); Y02T10/7083 (EP,US); Y10T307/625 (EP,US);

Priorities: CN201310004817A 2013-01-07

Application: CN103066662A·2013-01-07

Publication: CN103066662A·2013-04-24

Published as: CN103066662A;**CN103066662B; EP2942852A1; EP2942852A4; EP2942852B1; ES2727664T3; US2015340907A1; US9954391B2; WO2014106407A1**

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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(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)授权公告号 CN 103066662 A
(43)申请公布日 2013.04.24

(21)申请号 201310004817.1

(22)申请日 2013.01.07

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代理人 胡彬

(51)Int.Cl.
H02J 7/00(2006.01)
H02J 9/00(2006.01)

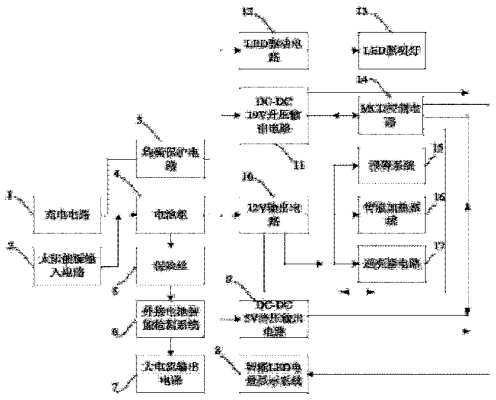
权利要求书3页 说明书7页 附图3页

(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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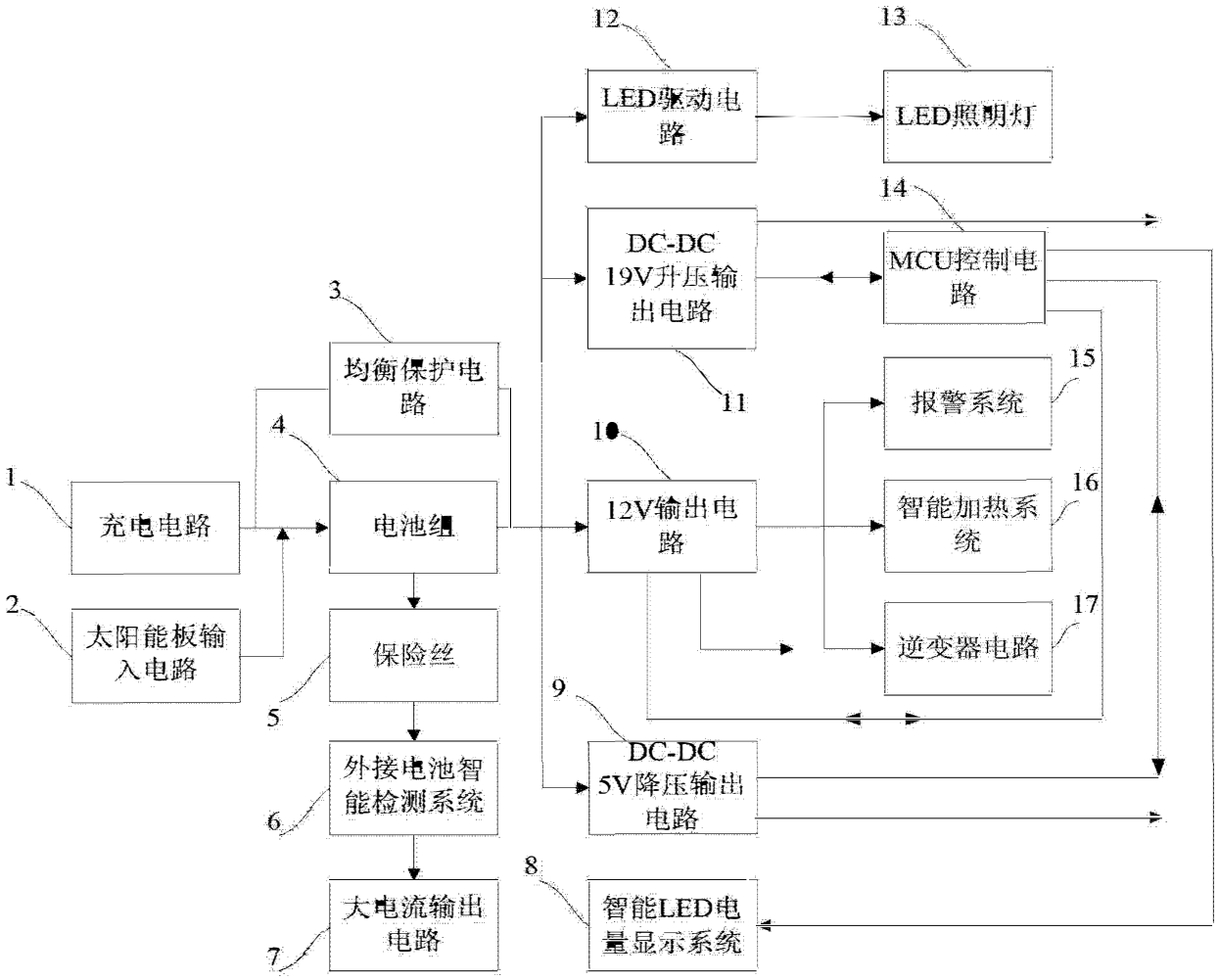


图 1

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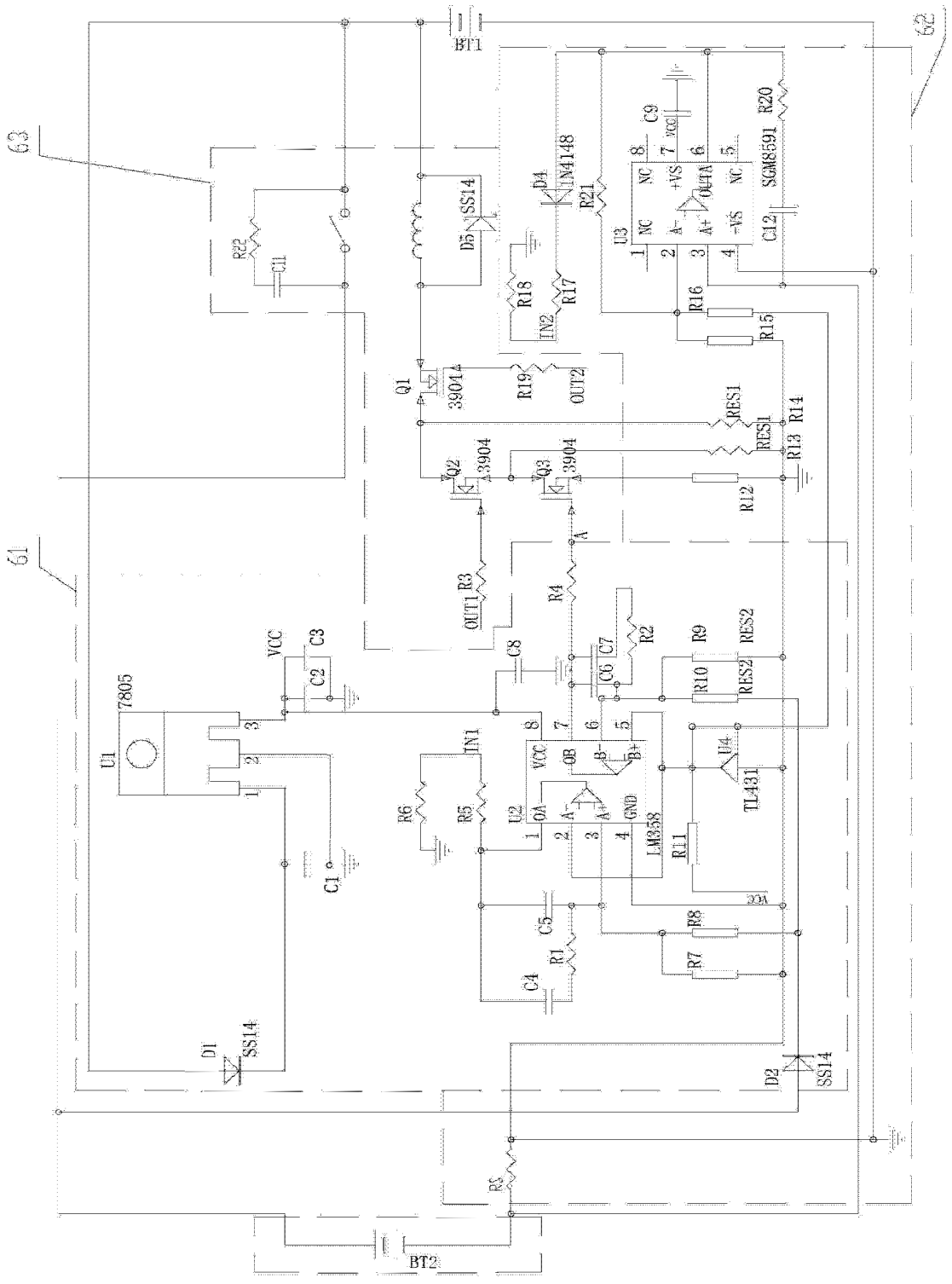


图 2

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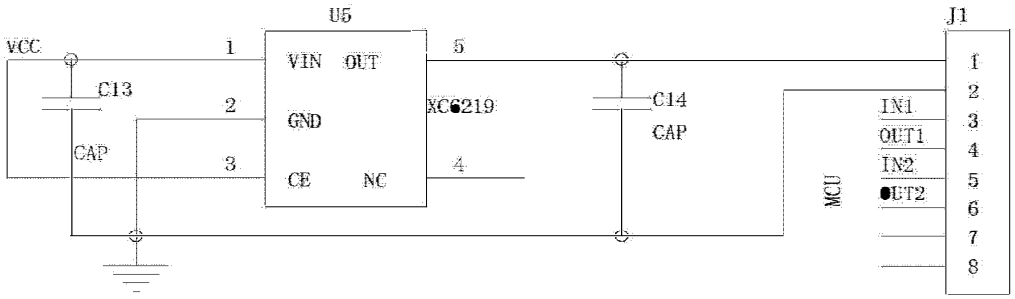


图 3

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(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 616 409 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **94301838.2**

(51) Int. Cl.[5] : **H02J 7/00**

(22) Date of filing : **15.03.94**

(30) Priority : **17.03.93 GB 9305446**

(43) Date of publication of application :
21.09.94 Bulletin 94/38

(84) Designated Contracting States :
AT BE CH DE DK ES FR GB GR IE IT LI LU MC NL PT SE

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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.

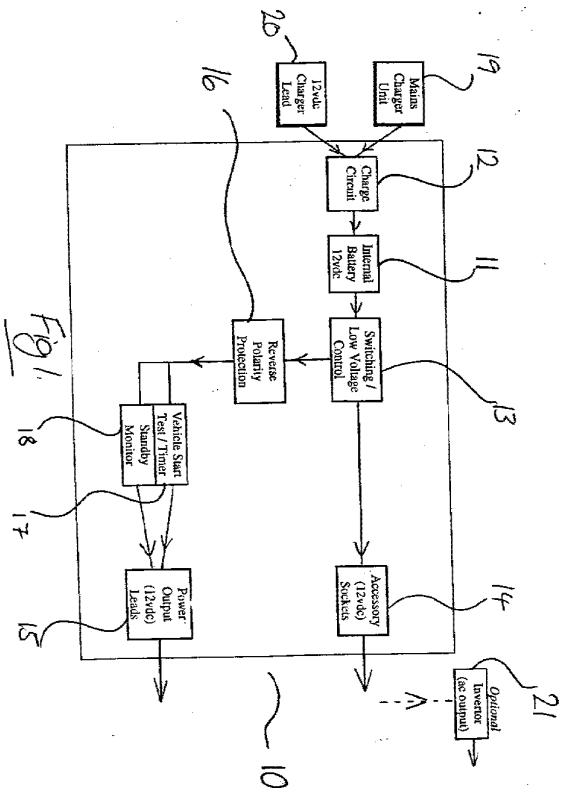


Fig 1

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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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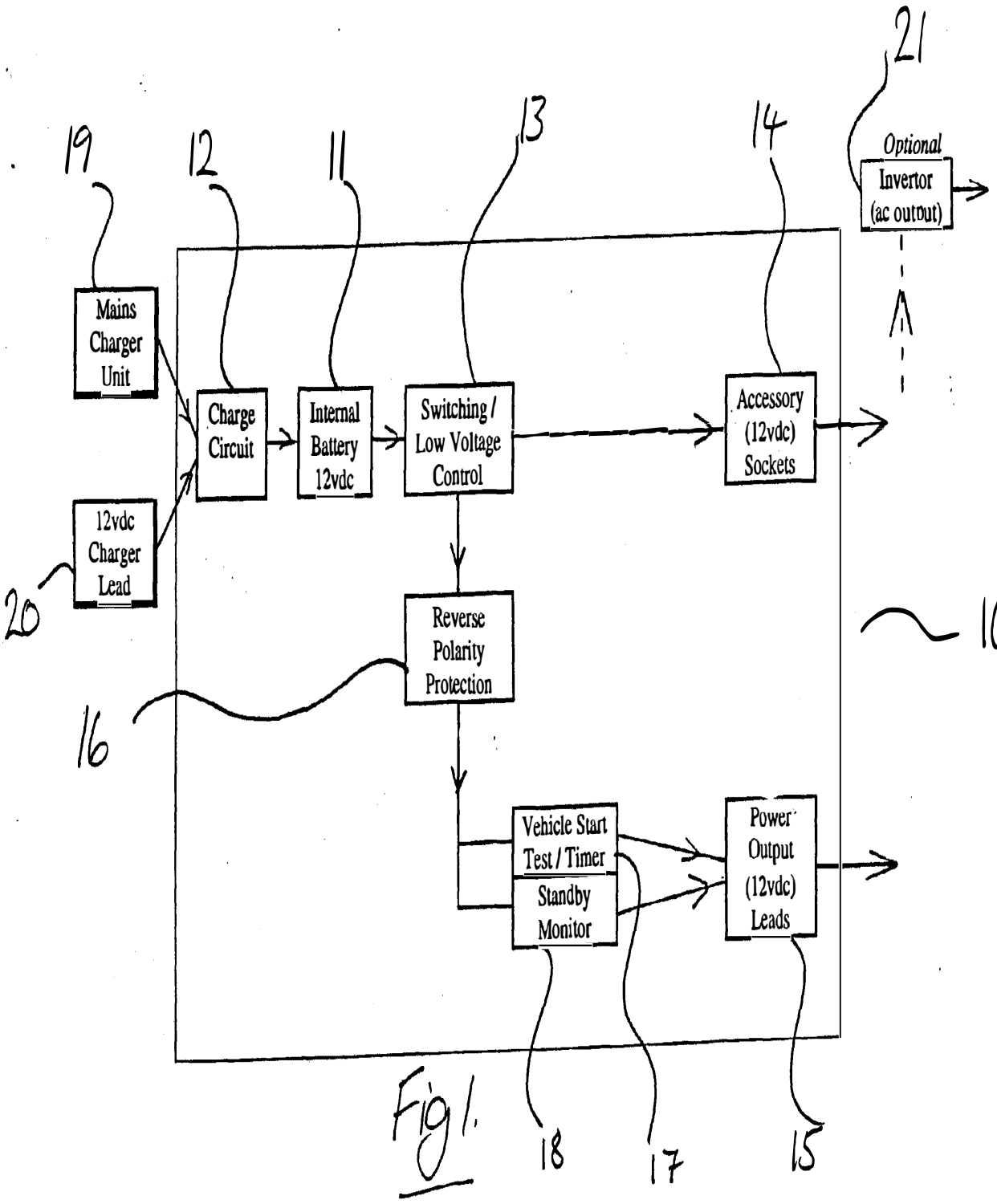


Fig 1.

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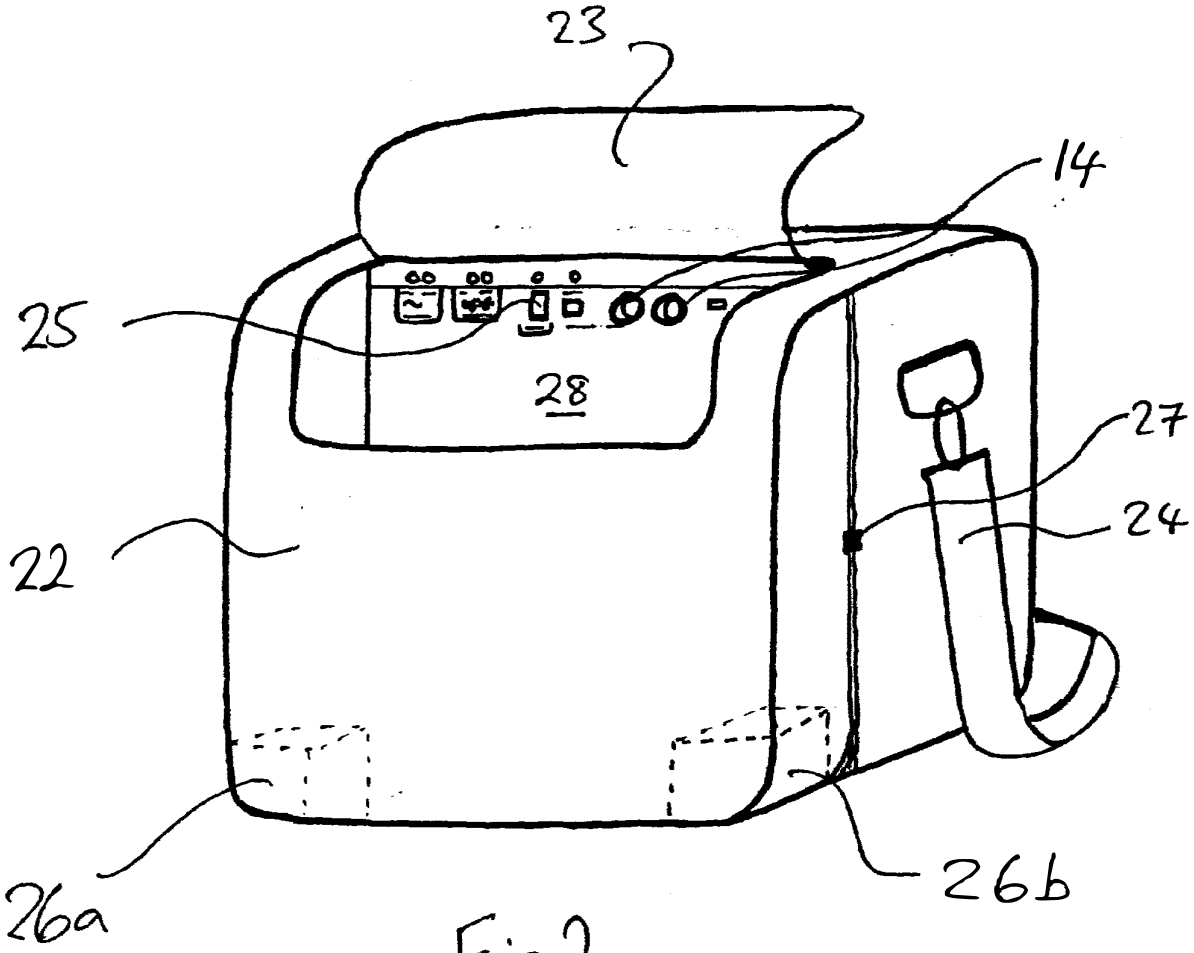


Fig2.

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(12) UK Patent Application (19) GB (11) 2584424 (13) A

(43) Date of A Publication 09.12.2020

(21) Application No: 1907492.1

(22) Date of Filing: 28.05.2019

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(51) INT CL:
H02J 7/00 (2006.01)

(56) Documents Cited:
US 7489106 B1 **US 20140197795 A1**
US 20110241623 A1

(58) Field of Search:
INT CL **H02J**
Other: **EPODOC, WPI**

(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.

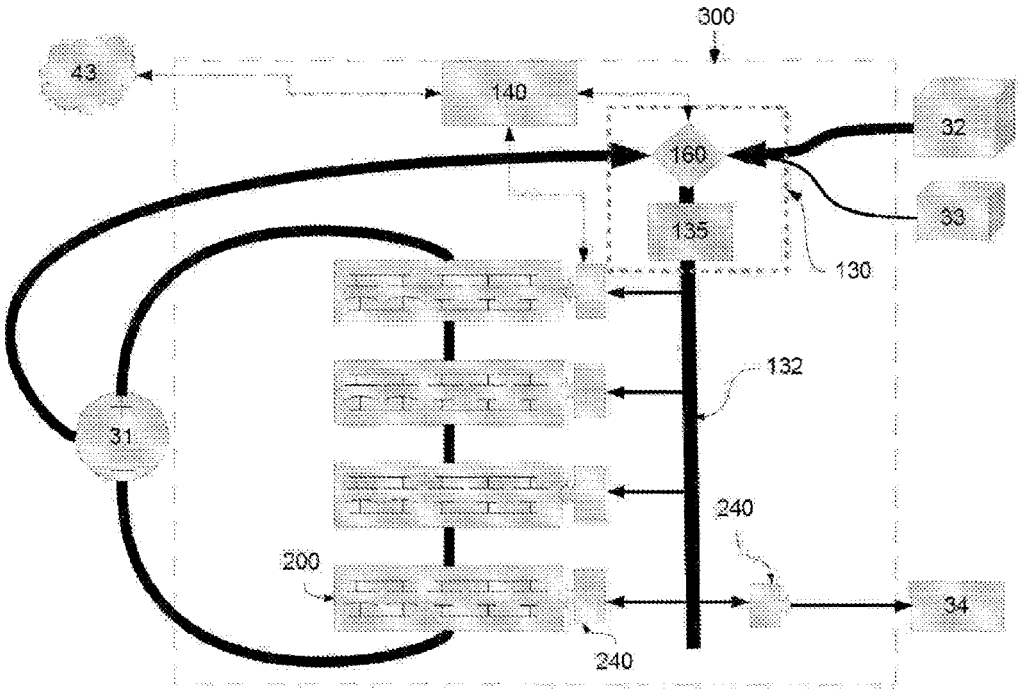


Figure – 4

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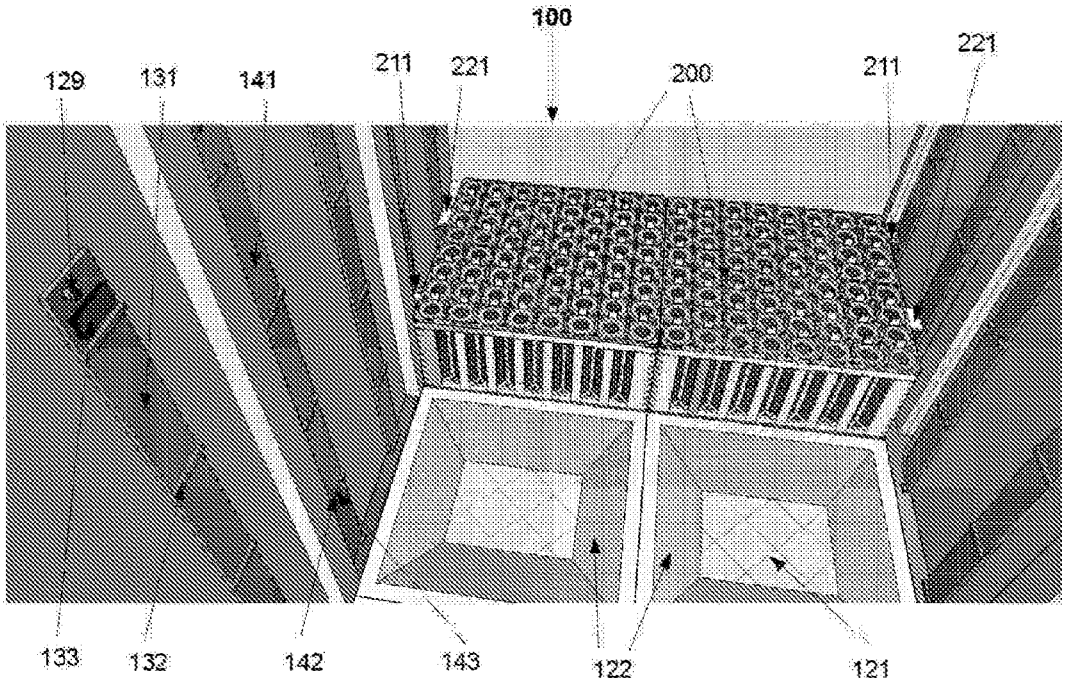


Figure – 2.2

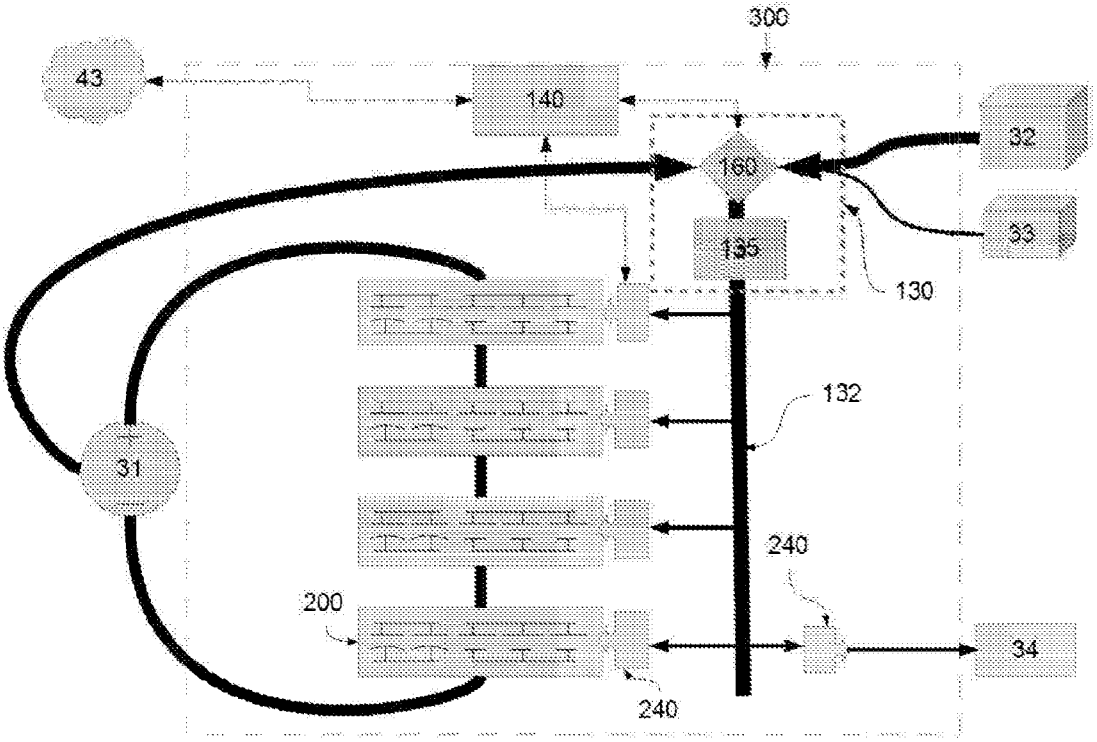


Figure – 4

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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

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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).

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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

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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

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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

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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. Pl 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.

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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

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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

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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

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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:

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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.

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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

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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

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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

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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.

18 12 19

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

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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

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(12) 按照专利合作条约所公布的国际申请

(19) 世界知识产权组织
国 际 局

(43) 国际公布日
2014 年 7 月 10 日 (10.07.2014)

WIPO | PCT

(10) 国际公布号
WO 2014/106407 A1

(51) 国际专利分类号:
H02J 7/00 (2006.01) *H02J 9/00* (2006.01)

(21) 国际申请号: PCT/CN2013/086774

(22) 国际申请日: 2013 年 11 月 8 日 (08.11.2013)

(25) 申请语言: 中文

(26) 公布语言: 中文

(30) 优先权:
201310004817.1 2013 年 1 月 7 日 (07.01.2013) CN

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(81) 指定国 (除另有指明，要求每一种可提供的国家保护): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW。

(84) 指定国 (除另有指明，要求每一种可提供的地区保护): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), 欧亚 (AM, AZ, BY, KG, KZ, RU, TJ, TM), 欧洲 (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG)。

[见续页]

(54) **Title**: EMERGENCY POWER SOURCE

(54) **发明名称** : 应急电源

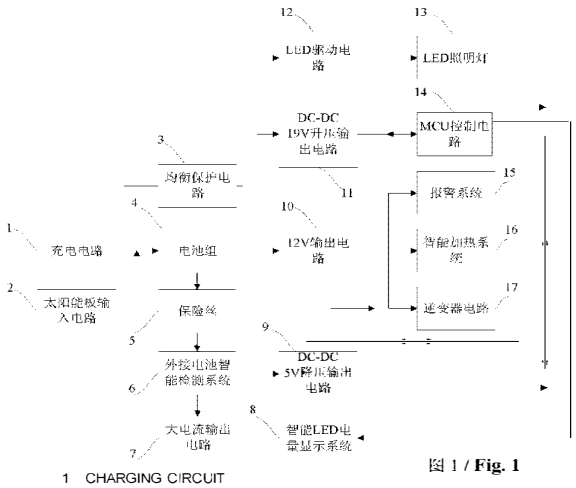


图 1 / **Fig. 1**

1 CHARGING CIRCUIT
2 SOLAR ENERGY PANEL INPUT CIRCUIT
3 EQUALIZATION PROTECTION CIRCUIT
4 BATTERY PACK
5 FUSE
6 EXTERNAL BATTERY INTELLIGENT DETECTION SYSTEM
7 HEAVY-CURRENT OUTPUT CIRCUIT
8 INTELLIGENT LED ELECTRIC-QUANTITY DISPLAY SYSTEM
9 DC-DC 5 V VOLTAGE-DROP OUTPUT CIRCUIT
10 12 V OUTPUT CIRCUIT
11 DC-DC 19 V VOLTAGE-BOOST OUTPUT CIRCUIT
12 LED DRIVE CIRCUIT
13 LED ILLUMINATION LAMP
14 MCU CONTROL CIRCUIT
15 ALARM SYSTEM
16 INTELLIGENT HEATING SYSTEM
17 INVERTER CIRCUIT

(57) Abstract: An emergency power source comprises a housing. A battery pack (4) is arranged in the housing for storing electric energy. The input end of the battery pack (4) is connected to a charging circuit (1) for charging the battery pack (4) and the output end of a solar energy panel input circuit (2), the output end of the battery pack (4) is connected to a heavy-current output circuit (7) for outputting a heavy current when an automobile starts, and an external battery intelligent detection system (6) is connected between the battery pack (4) and the heavy-current output circuit (7). The emergency power source is convenient for charging, can output a heavy current for starting an automobile, and can also accurately control heavy-current output.

(57) 摘要: 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）和太阳能板输入电路（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）。应急电源自身充电方便，可以大电流输出用于汽车启动，还能准确控制大电流输出。

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本国际公布:

— 包括国际检索报告(条约第 21 条(3))。

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应急电源

技术领域

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

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。

现有中国专利文献 CN 101685974 A 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

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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

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。

为达到此目的，本发明采用以下技术方案：

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。

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。

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

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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。

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。

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。

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。

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。

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

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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。

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。

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。

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，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

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一起。

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。

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

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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。

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

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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

图 1 是本发明应急电源的原理示意图；

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；

图 3 是图 2 中的外接电池智能检测系统的电路原理图二。

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

下面结合附图和具体实施例对本发明作进一步说明。

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

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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。

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。

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

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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。

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黑电瓶夹碰撞造成的短路。

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。

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

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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。

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。

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。

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，

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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。

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

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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。

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。

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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权 利 要 求 书

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

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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

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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。

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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：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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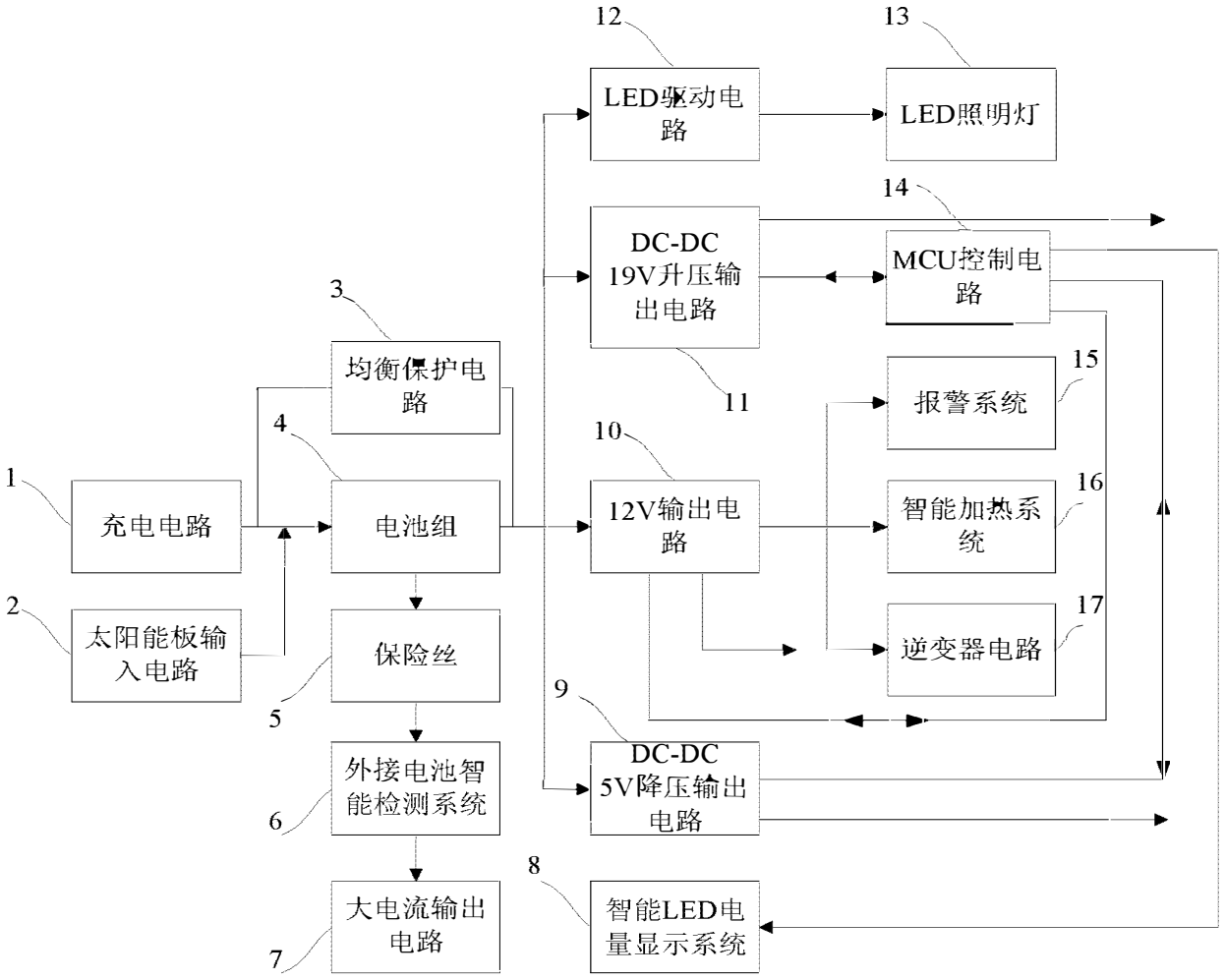


图 1

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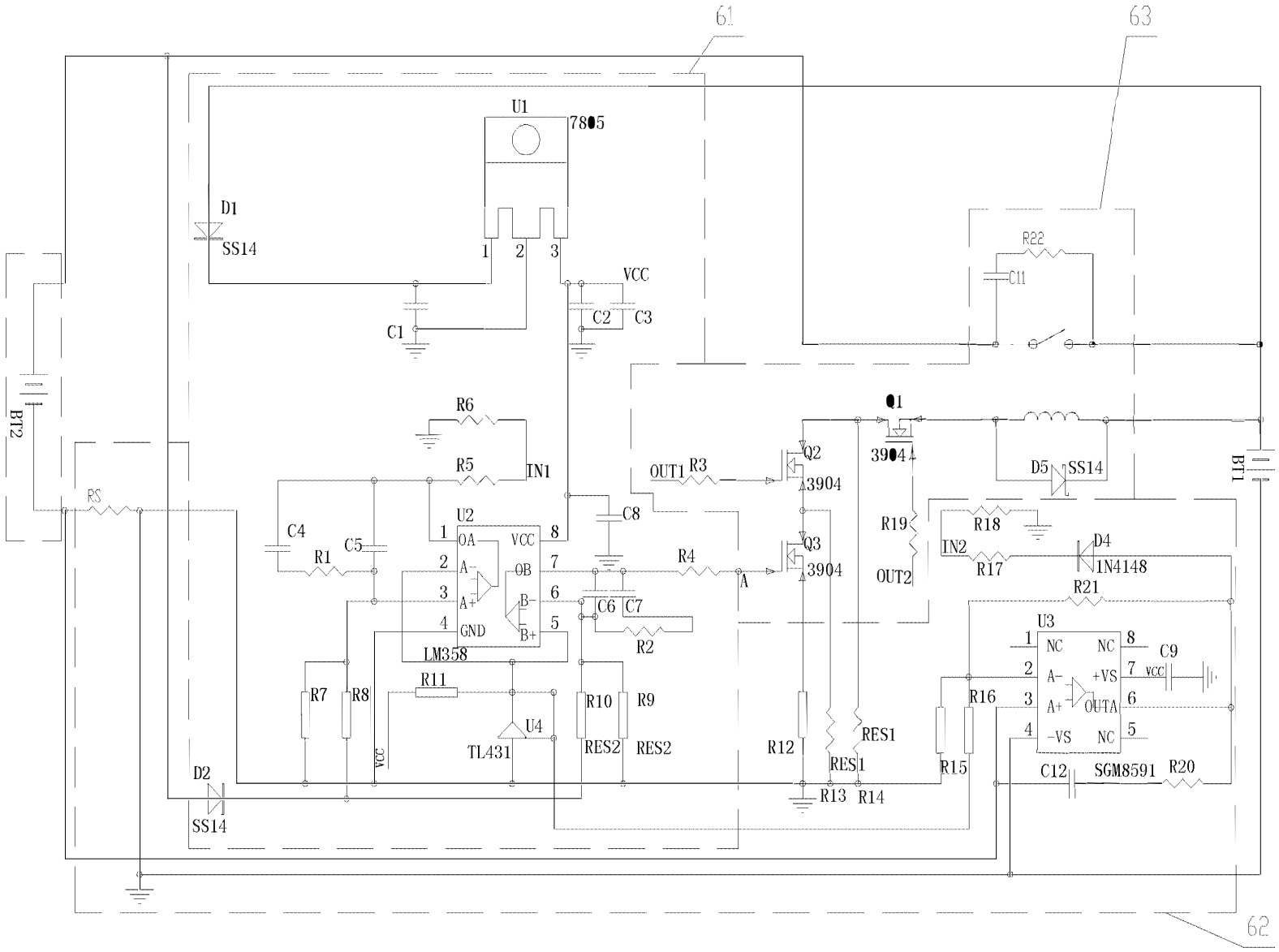


图 2

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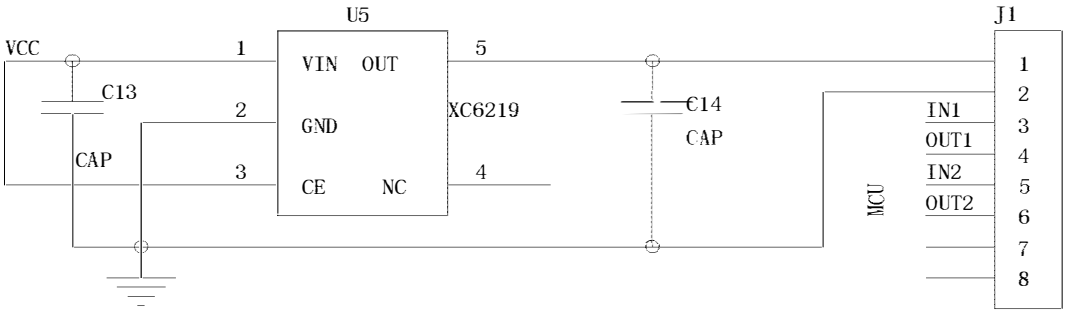


图 3

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Petitioner ADC (IPR2024-00577)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/086774

A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H02J7/00; H02J9/00; H02J; B60R16

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)

CNPAT, WPI, EPODOC: emergency, power, supply, battery, control, identify, detect, temperature, Lei Xingliang

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 102496985 A (LEI, Xingliang) 13 June 2012 (13.06.2012) description, paragraphs [0005] to [0026] and figures 1 to 6	1-13
Y	CN 201766385 U (CHEN, De) 16 March 2011 (16.03.2011) description, paragraphs [0036] to [0062] and figures 1 to 3	1-13
Y	CN 202309139 U (SHANGHAI GUANGWEI ELECTRIC CO LTD et al.) 04 July 2012 (04.07.2012) description, paragraphs [0012] to [0034] and figures 1 to 6	1-13
Y	CN 202405344 U (SHAO, Hanqi) 29 August 2012 (29.08.2012) description, paragraphs [0004], [0047], [0056] and [0057]	6-8
P, X	CN 103066662 A (LEI, Xingliang) 24 April 2013 (24.04.2013) claims 1 to 13	1-13

☐ 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
18 January 2014 (18.01.2014)	20 February 2014 (20.02.2014)
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer HUO, Yan Telephone No. (86-10) 62411950

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

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/086774

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	CN 203056633 U (LEI, Xingliang) 10 July 2013 (10.07.2013) claims 1 to 13	1-13
A	CN 2659752 Y (LONGSHENG WIRE & CABLE CO LTD) 01 December 2004 (01.12.2004)	1-13

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

EXHIBIT 1002
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2013/086774

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 102496985 A	13.06.2012	WO 2013082982 A1	13.06.2013
CN 201766385 U	16.03.2011	None	
CN 202309139 U	04.07.2012	None	
CN 202405344 U	29.08.2012	None	
CN 103066662 A	24.04.2013	None	
CN 203056633 U	10.07.2013	None	
CN 2659752 Y	01.12.2004	None	

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

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/086774

Continuation of: A. CLASSIFICATION OF SUBJECT MATTER:

H02J 7/00 (2006.01) i

H02J 9/00 (2006.01) i

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

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国际检索报告

国际申请号
PCT/CN2013/086774

A. 主题的分类

参见附加页

按照国际专利分类(IPC)或者同时按照国家分类和 IPC 两种分类

B. 检索领域

检索的最低限度文献(标明分类系统和分类号)

IPC: H02J7/00， H02J9/00，H02J，B60R16

包含在检索领域中的除最低限度文献以外的检索文献

在国际检索时查阅的电子数据库(数据库的名称，和使用的检索词（如使用）)

CNPAT, WPI, EPODOC: 应急电源，车，救急，电瓶，检测，温度，雷星亮, emergency, power, supply, battery, control, identify

C. 相关文件

类 型*	引用文件，必要时，指明相关段落	相关的权利要求
Y	CN 102496985 A (雷星亮) 13.6 月 2012 (13.06.2012) 说明书第[0005]-[0026]段，图 1-6	1-13
Y	CN 201766385 U (陈德) 16.3 月 2011 (16.03.2011) 说明书第[0036]-[0062]段，图 1-3	1-13
Y	CN 202309139 U (上海广为美线电源电器有限公司等) 04.7 月 2012 (04.07.2012) 说明书第[0012]-[0034]段，图 1-6	1-13
Y	CN 202405344 U (邵汉琦) 29.8 月 2012 (29.08.2012) 说明书第[0004]、[0047]、[0056]和[0057]段	6-8
P,X	CN 103066662 A (雷星亮) 24.4 月 2013 (24.04.2013) 权利要求 1-13	1-13
P,X	CN 203056633 U (雷星亮) 10.7 月 2013 (10.07.2013) 权利要求 1-13	1-13
A	CN 2659752 Y (龙口龙盛电线电缆有限公司) 01.12 月.2004 (01.12.2004) 全文	1-13

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国际检索实际完成的日期	国际检索报告邮寄日期
18.1 月 2014 (18.01.2014)	**20.2 月 2014 (20.02.2014)**
ISA/CN 的名称和邮寄地址： 中华人民共和国国家知识产权局 中国北京市海淀区蓟门桥西土城路 6 号 100088 传真号： (86-10)62019451	受权官员 霍艳 电话号码：(86-10) **62411950**

PCT/ISA/210 表(第 2 页) (2009 年 7 月)

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国际检索报告
关于同族专利的信息

国际申请号
PCT/CN2013/086774

检索报告中引用的专利文件	公布日期	同族专利	公布日期
CN 102496985 A	13.06.2012	WO 2013082982 A1	13.06.2013
CN 201766385 U	16.03.2011	无	
CN 202309139 U	04.07.2012	无	
CN 202405344 U	29.08.2012	无	
CN 103066662 A	24.04.2013	无	
CN 203056633 U	10.07.2013	无	
CN 2659752 Y	01.12.2004	无	

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续 A. 主题的分类

H02J 7/00 (2006.01) i

H02J 9/00 (2006.01) i

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Espacenet

DE102010062708A1 Mobiles Startgerät

Applicants: BOSCH GMBH ROBERT [DE]

Inventors: ZELLER ARMIN [DE]

Classifications:
IPC ***B60R16/03; F02N11/08; F02N11/12; F02N11/14; H02H3/18;***

CPC **H02J7/345 (EP,US)**; **H02J9/002 (EP,US)**; F02N11/0866 (EP,US); F02N11/12 (EP,US); H02J2310/46 (EP);

Priorities: DE102010062708A 2010-12-09

Application: DE102010062708A1 2010-12-09

Publication: DE102010062708A1 2012-06-14

Published as: **CN103228905A**; **CN103228905B**; DE102010062708A1; **DE102010062708B4**; **US2013320764A1**; **WO2012076475A2**; **WO2012076475A3**

Mobiles Startgerät

ABSTRACT DE102010062708A1
A mobile energy supply device (1) for an electric starter for starting an internal combustion engine has an internal battery (2); and at least one capacitor (14) which can be connected in parallel to the internal battery (2).

Ein mobiles Energieversorgungsgerät (1) für einen Elektrostarter zum Starten eines Verbrennungsmotors hat eine interne Batterie (2); und wenigstens eine Kondensator (14), der parallel zu der internen Batterie (2) anschließbar ist.

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(19) Deutsches Patent- und Markenamt

(10) **DE 10 2010 062 708 A1** 2012.06.14

(12) # Offenlegungsschrift

(21) Aktenzeichen: **10 2010 062 708.9**
(22) Anmeldetag: **09.12.2010**
(43) Offenlegungstag: **14.06.2012**

(51) Int Cl.: ***F02N 11/08*** (2006.01)
F02N 11/14 (2006.01)
H02H 3/18 (2012.01)
F02N 11/12 (2012.01)
B60R 16/03 (2012.01)

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(56) Für die Beurteilung der Patentfähigkeit in Betracht gezogene Druckschriften:

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DE	**10 2005 018 620**	**B4**
DE	**103 04 557**	**A1**
DE	**10 2008 014 346**	**A1**
DE	**20 2006 015 805**	**U1**

Prüfungsantrag gemäß § 44 PatG ist gestellt.

Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

(54) Bezeichnung: **Mobiles Startgerät**

(57) Zusammenfassung: Ein mobiles Energieversorgungsgerät (1) für einen Elektrostarter zum Starten eines Verbrennungsmotors hat eine interne Batterie (2); und wenigstens eine Kondensator (14), der parallel zu der internen Batterie (2) anschließbar ist.

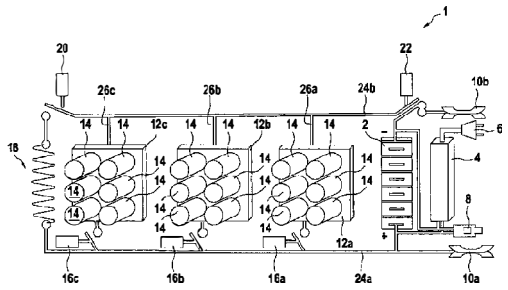


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Beschreibung

[0001] Die Erfindung betrifft ein mobiles Startgerät für Verbrennungsmotoren, insbesondere mobiles Energieversorgungsgerät für einen Elektrostarter, der zum Starten eines Verbrennungsmotors eines Kraftfahrzeugs vorgesehen ist, und ein Verfahren des Betreibens eines Elektrostarters zum Starten eines Verbrennungsmotors.

Stand der Technik

[0002] Im Stand der Technik sind mobile Energieversorgungsgeräte für Fahrzeuge bekannt, die eine interne Batterie in einem tragbaren Gehäuse enthalten. An dem Gehäuse sind Kabel vorgesehen, um die Batterie elektrisch mit der Starterbatterie eines Verbrennungsmotors in einem Kraftfahrzeug zu verbinden.

[0003] Um die zum Starten des Verbrennungsmotors notwendige elektrische Leistung bereitstellen zu können, muss eine relativ große Batterie mit ca. 20–40 Ah verwendet werden. Dies hat zur Folge, dass die bekannten Energieversorgungsgeräte ein relativ hohes Gewicht von ca. 10 bis 20 kg haben. Die maximale Startleistung ist durch die Größe der verbauten Batterie definiert und somit nicht regelbar.

Offenbarung der Erfindung

[0004] Eine Aufgabe der Erfindung ist es, ein mobiles Energieversorgungsgerät für einen Elektrostarter zum Starten eines Verbrennungsmotors zur Verfügung zu stellen, das geeignet ist, die notwendige Startleistung entsprechend der Größe des Fahrzeugmotors bereitzustellen und dabei ein geringes Gewicht aufweist.

[0005] Diese Aufgabe wird erfindungsgemäß durch ein Energieversorgungsgerät gelöst, das eine Batterie und wenigstens einen parallel zu der Batterie anschließbaren Kondensator aufweist.

[0006] Die Erfindung umfasst auch ein Verfahren zum Betreiben eines Elektrostarters, der zum Starten eines Verbrennungsmotors vorgesehen ist, wobei das Verfahren die Schritte umfasst:
Parallelschalten wenigstens eines Kondensators mit einer internen Batterie, um den Kondensator durch die interne Batterie aufzuladen und
elektrisches Verbinden des Kondensators und der internen Batterie mit dem Fahrzeug, um den Elektrostarter mit Strom aus der internen Batterie und dem Kondensator zu betreiben.

[0007] Durch einen parallel zur internen Batterie angeschlossenen Kondensator kann. die in der Regel nur für kurze Zeit benötigte hohe elektrische Startleistung, die während des Startvorgangs zum Antreiben des Elektrostarters notwendig ist, auf die interne Batterie und den Kondensator aufgeteilt werden. So kann die notwendige elektrische Startleistung von einer kleineren internen Batterie zur Verfügung gestellt werden.

[0008] Da der Kondensator bzw. die Kondensatoren ein deutlich geringeres Gewicht als eine Batterie aufweist, kann die notwendige Startleistung so von einem deutlich kleineren Energieversorgungsgerät bereitgestellt werden, das ein merklich geringeres Gewicht als herkömmliche Energieversorgungsgeräte aufweist.

[0009] In einem erfindungsgemäßen Energieversorgungsgerät wird der wenigstens eine Kondensator parallel zur internen Batterie angeschlossen und durch diese geladen, nachdem das Energieversorgungsgerät mit dem Fahrzeug bzw. der Starterbatterie des Fahrzeugs verbunden worden ist. Die zum Betreiben des Elektrostarters notwendige Energie wird dann gleichzeitig von der internen Batterie und dem Kondensator zur Verfügung gestellt. In der Schaltung der internen Batterie und dem Kondensator kann ein Widerstand oder Strombegrenzungselektronik vorgesehen sein, um den Ladestrom des Kondensators zu begrenzen und eine Beschädigung des Kondensators und/oder der internen Batterie und/oder des Elektrostarters durch einen zu großen Ladestrom zu vermeiden.

[0010] In einer Ausführungsform ist der bzw. sind die Kondensatoren als Mehrschichtkondensatoren bzw. Ultra-Cap-Kondensatoren ausgebildet. Derartige Kondensatoren weisen eine besonders hohe Leistungsdichte auf und sind daher besonders geeignet, um bei geringem Volumen und geringem Gewicht die notwendige elektrische Startleistung zur Verfügung zu stellen. Mit derartigen Kondensatoren. kann daher ein besonders leichtes und kompaktes mobiles Energieversorgungsgerät realisiert werden.

[0011] In einer Ausführungsform weist das Energieversorgungsgerät mehrere Kondensatoren auf. Gruppen von Kondensatoren sind in mehreren Blöcken angeordnet, wobei die Blöcke selektiv parallel zur internen Batterie anschließbar sind. Durch selektives Zuschalten der Blöcke kann die zur Verfügung gestellte elektrische Startleistung in mehreren Stufen gezielt eingestellt werden. Dies ermöglicht es, mit dem gleichen Energieversorgungsgerät sowohl kleine (Benzin-)Motoren mit einem geringen Startstrombedarf als auch große (Diesel-)Motoren mit einem sehr hohen Startstrombedarf sicher und zerstörungsfrei zu starten. Bei einer zu geringen Startleistung könnte der Motor nicht erfolgreich gestartet werden. Eine zu hohe Startleistung könnte eine Zerstörung des Elektrostarters zur Folge haben.

[0012] In einer Ausführungsform ist ein Ladegerät zum Laden der internen Batterie in das Energiever-

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sorgungsgerät integriert. Dies ermöglicht ein autonomes Laden der internen Batterie, ohne dass hierzu ein externes Ladegerät erforderlich ist.

[0013] Die Bedienbarkeit des Energieversorgungsgeräts wird vereinfacht und die Zuverlässigkeit erhöht, da das Laden unabhängig von einem zusätzlichen Ladegerät erfolgen kann. In einer Ausführungsform kann das in das Energieversorgungsgerät integrierte Ladegerät auch zum Laden der Starterbatterie des Fahrzeugs verwendet werden. Auf ein zusätzliches Ladegerät zum Laden der Fahrzeugbatterie kann so verzichtet werden.

[0014] In einer Ausführungsform ist in das Energieversorgungsgerät ein Verpolschutz integriert, der den Stromfluss unterbricht und/oder ein optisches und/oder ein akustisches Warnsignal ausgibt, wenn das Energieversorgungsgerät "falsch", d. h., mit vertauschten Polen an die Elektrik des Fahrzeugs angeschlossen wird.

[0015] Eine Beschädigung des Energieversorgungsgeräts und/oder der Fahrzeugelektronik durch eine falsch gepolte Stromversorgung wird so zuverlässig vermieden. Durch die optische bzw. akustische Anzeige wird der Bediener auf seinen Fehler hingewiesen und kann ihn beseitigen. Die Bedienbarkeit des Energieversorgungsgeräts wird somit vereinfacht.

[0016] In einer Ausführungsform ist das Energieversorgungsgerät mit einer elektronischen Schaltung ausgestattet, die das Laden der internen Batterie und des Kondensators, den Startvorgang, inklusive des Zu- bzw. Abschaltens von Kondensatoren bzw. Gruppen von Kondensatoren und die Steuerung von Anzeige- und/oder Warnelementen steuert. Eine solche elektronische Schaltung ermöglicht einen zuverlässigen und sicheren Betrieb des Energieversorgungsgeräts, da der Betrieb fortlaufend überwacht wird und Bedienfehler weitestgehend ausgeschlossen bzw. korrigiert werden können.

[0017] Insbesondere kann eine Beschädigung der internen Batterie durch Über- oder Tiefentladen und eine Überlastung aufgrund eines zu hohen Startstromes zuverlässig vermieden werden, da die elektronische Schaltung die Kondensatoren bzw. Kondensatorblöcke so zuschaltet, dass zuverlässig der von dem jeweiligen Elektrostarter benötigte Startstrom zur Verfügung gestellt wird.

[0018] In einer Ausführungsform weist das Energieversorgungsgerät wenigstens einen Widerstand auf, der parallel zu dem Kondensator bzw. zu den Kondensatoren schaltbar ist, um den/die Kondensator(en) zu entladen. So können die Kondensatoren nach dem Abschluss des Startvorgangs über den Widerstand zuverlässig und vollständig entladen werden, so dass Gefahren, die von geladenen Kondensatoren ausgehen, wie z. B. Kriechströme, Lichtbögen oder Funkenschlag bei geöffnetem oder beschädigtem Gerät, zuverlässig vermieden werden. Die Sicherheit des Energieversorgungsgeräts wird dadurch erhöht.

[0019] In einer Ausführungsform weist das Energieversorgungsgerät eine Anzeigevorrichtung auf, welche den Zustand des Energieversorgungsgeräts und insbesondere den Ladezustand der internen Batterie und/oder des Kondensators anzeigt.

[0020] Die Anzeigevorrichtung kann eine oder mehrere LEDs enthalten, die den jeweiligen Betriebszustand des Energieversorgungsgeräts anzeigen. Die. Betriebszustände können beispielsweise durch verschiedene Farbkombinationen angezeigt werden. So kann z. B. eine blaue LED anzeigen, ob das Gerät ein- oder ausgeschaltet ist. Der Ladezustand der internen Batterie kann z. B. durch eine oder mehrere LEDs in den Farben grün, gelb und rot angezeigt werden. Ebenso kann die ausgewählte Startleistung, d. h. die Anzahl der parallel zu der internen Batterie geschalteten Kondensatoren, durch eine oder mehrere LEDs in einer oder verschiedenen Farben angezeigt werden.

[0021] Weitere Anzeigen können die Verbindung des Ladegeräts mit einer externen Stromversorgung, eine Verpolung der Anschlüsse, einen Defekt der internen Batterie und/oder der Starterbatterie des Fahrzeugs und/oder die Startbereitschaft des Energieversorgungsgeräts anzeigen.

[0022] Die Erfindung wird im Folgenden unter Bezugnahme auf die beigefügte Figur näher erläutert.

[0023] Die Figur zeigt ein schematisches Schaltbild eines Ausführungsbeispiels eines erfindungsgemäßen Energieversorgungsgeräts **1**.

[0024] Das Energieversorgungsgerät **1** weist eine interne Batterie **2** auf, welche mit einer Steuerelektronik **4** verbunden ist, die Steuerelektronik **4** weist z. B. eine Ladeschaltung auf und ist über einen ersten Stecker **6** mit einer externen Stromversorgung, insbesondere einer herkömmlichen 110–230 V Steckdose, verbindbar, um die interne Batterie **2** zu laden. Die interne Batterie **2** ist ferner elektrisch mit einem zweiten elektrischen Stecker **8** verbunden, der es ermöglicht, die interne Batterie **2** elektrisch mit einer Niederversorgungsspannung, insbesondere einem 12 V Bordnetz eines Kraftfahrzeugs zu verbinden.

[0025] Die interne Batterie **2** des in der Figur gezeigten Ausführungsbeispiels weist mehrere Zellen auf und ist bspw. ein herkömmlicher Bleiakku, wie er in der Kraftfahrzeugtechnik bekannt ist.

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[0026] Der in der Figur unten dargestellte Pluspol der internen Batterie **2** ist über eine (Plus-)Stromversorgungsleitung **24a** mit einer ersten (Plus-)Polklemme **10a** verbunden. Die (Plus-)Stromversorgungsleitung **24a** verbindet den Pluspol der internen Batterie **2** auch mit einer Anzahl von Schaltern **16a**, **16b**, **16c**, welche im geschlossenen Zustand die (Plus-)Stromversorgungsleitung **24a** jeweils mit einem dem jeweiligen Schalter **16a**, **16b**, **16c** zugeordneten Kondensatorblock **12a**, **12b**, **12c** elektrisch verbinden, und im geöffneten Zustand den jeweiligen Kondensatorblock **12a**, **12b**, **12c** elektrisch von der (Plus-)Stromversorgungsleitung **24a** trennen.

[0027] Jeder der Kondensatorblöcke **12a**, **12b**, **12c** weist in dem in der Figur gezeigten Ausführungsbeispiel sechs schematisch dargestellte Kondensatoren **14** auf. Die in den Kondensatorblöcken **12a**, **12b**, **12c** angeordneten Kondensatoren **14** können jeweils die gleiche Kapazität oder unterschiedliche Kapazitäten aufweisen. Auch können die einzelnen Kondensatorblöcke **12a**, **12b**, **12c** anders als in dem in der Figur gezeigten Ausführungsbeispiel jeweils mit einer unterschiedlichen Anzahl an Kondensatoren **14** ausgestattet sein, um eine flexible Wahl der von dem Energieversorgungsgerät **1** zur Verfügung gestellten Startleistung über einen großen Bereich zu ermöglichen. Beispielsweise kann die Kapazität der einzelnen Kondensatorblöcke **12a**, **12b**, **12c** so ausgebildet sein, dass ein Kondensatorblock **12a**, **12b**, **12c** jeweils die doppelte Kapazität des vorangehenden Kondensatorblocks **12a**, **12b**, **12c** aufweist.

[0028] Die Kondensatorblöcke **12a**, **12b**, **12c** sind über eine zweite (Minus-)Stromversorgungsleitung **24b** und einen Hauptschalter **22** elektrisch mit dem zweiten (Minus-)Pol der internen Batterie **2** und einer zweiten (Minus-)Polklemme **10b** verbindbar.

[0029] Durch einen Kurzschlussschalter **20** ist die erste (Plus-)Stromversorgungsleitung **24a** über einen Widerstand **18** elektrisch mit der zweiten (Minus-) Stromversorgungsleitung **24b** verbindbar, um bei geschlossenen Schaltern **16a**, **16b**, **16c** ein Entladen der Kondensatoren **14** in den Kondensatorblöcken **12a**, **12b**, **12c** zu ermöglichen.

[0030] Um das in der Figur gezeigte Energieversorgungsgerät **1** für den Betrieb vorzubereiten, wird es über den ersten elektrischen Stecker **6** oder den zweiten elektrischen Stecker **8** mit einer externen Stromquelle verbunden, um die interne Batterie **2** aufzuladen. Das Aufladen der internen Batterie **2** wird durch eine Steuerelektronik **4** überwacht und gesteuert.

[0031] Für einen Startvorgang wird das Energieversorgungsgerät **1** mit geladener interner Batterie **2** an das Fahrzeug bzw. die Starterbatterie des Fahrzeugs angeschlossen. Insbesondere wird das Energieversorgungsgerät **1** mit Hilfe der Polklemmen **10a**, **10b** elektrisch mit dem Elektrostarter, der zum Starten eines Verbrennungsmotors ausgebildet ist, verbunden.

[0032] Durch Schließen des Hauptschalters **22** und wenigstens eines der Schalter **16a**, **16b**, **16c** wird wenigstens einer der Kondensatorblöcke **12a**, **12b**, **12c** mit der internen Batterie **2** verbunden, so dass die Kondensatoren **14** in den mit der internen Batterie **2** verbundenen Kondensatorblöcken **12a**, **12b**, **12c** mit Strom aus der internen Batterie **2** geladen werden. In den Zuleitungen **26a**, **26b**, **26c** zu den Kondensatorblöcken **12a**, **12b**, **12c** können weitere, in der Figur nicht gezeigte Strombegrenzer, z. B. in der Form von Widerständen, vorgesehen sein, um den Ladestrom zu begrenzen.

[0033] Während des Startvorgangs fließt gleichzeitig Strom aus der internen Batterie **2** und den Kondensatoren **14** der zugeschalteten Kondensatorblöcke **12a**, **12b**, **12c** durch den Elektrostarter und treibt diesen an, um den Verbrennungsmotor zu starten. Dadurch, dass neben dem Strom aus der internen Batterie **2** auch Strom aus den Kondensatoren der zugeschalteten Kondensatorblöcke **12a**, **12b**, **12c** zur Verfügung steht, kann der zum Starten des Verbrennungsmotors notwendige Startstrom mit einer kleinen und leichten internen Batterie **2** zur Verfügung gestellt werden.

[0034] Es kann auch nur die interne Batterie **2** mit dem Fahrzeug bzw. der Starterbatterie des Fahrzeugs verbunden werden, wenn die Startkraft bei einem kleinen Verbrennungsmotor für das Fahrzeug bzw. den Elektrostarter ausreicht.

[0035] Nach dem Abschluss des Startvorgang, oder wenn nach dem Laden der Kondensatoren **14** kein Startvorgang durchgeführt wird, werden die Kondensatoren **14** durch Schließen des Kurzschlussschalters **20** über den Widerstand **18** entladen, um die Gefahr, die von den geladenen Kondensatoren **14** ausgehen kann, zu beseitigen. Dies geschieht nur, wenn das Energieversorgungsgerät **1** ausgeschaltet wird und nachdem die Polklemmen **10a**, **10b** von der Starterbatterie abgeklemmt worden sind.

[0036] Die Stromversorgungskabel **24a**, **24b** weisen vorzugsweise einen Querschnitt von wenigstens 20 mm^2 auf, um den notwendigen Startstrom möglichst verlustfrei bereitstellen zu können und eine thermische Erwärmung der Stromversorgungskabel **24a**, **24b** während des Startvorgangs zu vermeiden.

[0037] Durch das Parallelschalten der Kondensatoren **14** in den Kondensatorblöcken **12a**, **12b**, **12c** mit der internen Batterie **2** werden die Kondensatoren **14** auf das gleiche Spannungsniveau wie die interne Batterie **2** geladen.

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[0038] Während des Startvorgangs unterstützen die Kondensatoren **14** die internen Batterie **2**, indem sie den hohen Strombedarf bereitstellen, der notwendig ist, um das Losbrechmoment des Elektrostarters zu überwinden. Die Kondensatoren **14**, die vorzugsweise als Mehrschicht- oder Ultra-Cap-Kondensatoren ausgebildet sind, können die gespeicherte Ladung in kurzer Zeit in Form eines sehr hohen Stromes abgeben.

[0039] Durch das kaskadierbare Zuschalten der Kondensatorblöcke **12a**, **12b**, **12c** kann die Startleistung geregelt und eingestellt werden, da jeder Kondensatorblock **12a**, **12b**, **12c** eine bestimmte, durch die Größe (Kapazität) und Anzahl der Kondensatoren **14** vorgegebene Strommenge speichern kann und sich die in den parallel geschalteten Kondensatorblöcken **12a**, **12b**, **12c** gespeicherte Energiemenge sowie der während des Startvorgangs verfügbare Strom summieren.

Patentansprüche

1. Mobiles Energieversorgungsgerät (**1**) für einen Elektrostarter zum Starten eines Verbrennungsmotors mit
einer Batterie (**2**); und
wenigstens einem parallel zu der Batterie (**2**) anschließbaren Kondensator (**14**).

2. Mobiles Energieversorgungsgerät (**1**) nach Anspruch 1, wobei wenigstens ein Kondensator als Mehrschichtkondensator bzw. Ultra-Cap-Kondensator ausgebildet ist.

3. Mobiles Energieversorgungsgerät (**1**) nach einem der vorangehenden Ansprüche, wobei das Energieversorgungsgerät (**1**) mehrere Kondensatoren (**14**) aufweist, die in mehreren Kondensatorblöcken (**12a**, **12b**, **12c**) angeordnet sind.

4. Mobiles Energieversorgungsgerät (**1**) nach Anspruch 3, wobei die einzelnen Kondensatorblöcke (**12a**, **12b**, **12c**) gezielt zu- und abschaltbar sind.

5. Mobile Energieversorgung nach einem der vorangehenden Ansprüche, wobei das Energieversorgungsgerät (**1**) ein Ladegerät (**4**) aufweist, das zum Laden der Batterie (**2**) ausgebildet ist.

6. Mobiles Energieversorgungsgerät (**1**) nach einem der vorangehenden Ansprüche, das zusätzlich einen Widerstand (**18**) aufweist, der derart mit den Kondensatoren (**14**) verbindbar ist, dass die Kondensatoren (**14**) über den Widerstand (**18**) entladen werden.

7. Mobiles Energieversorgungsgerät (**1**) nach einem der vorangehenden Ansprüche, das zusätzlich einen Verpolschutz (**4**) aufweist, der derart ausgebildet ist, dass er einen Stromfluss unterbricht und/oder ein akustisches/optisches Warnsignal ausgibt, wenn das mobile Energieversorgungsgerät (**1**) in falscher Polung mit dem Elektrostarter verbunden ist.

8. Mobiles Energieversorgungsgerät (**1**) nach einem der vorangehenden Ansprüche, welches eine elektronische Steuerschaltung (**4**) aufweist, die ausgebildet ist, den Betrieb des Energieversorgungsgeräts (**1**) zu steuern und zu überwachen.

9. Verfahren des Betreibens eines Elektrostarters zum Starten eines Verbrennungsmotors mit den Schritten:
Verbinden der Batterie (**2**) mit dem Elektrostarter;
Verbinden wenigstens eines Kondensators (**14**) mit einer Batterie (**2**), um den Kondensator (**14**) aufzuladen;
Verbinden des Kondensators (**14**) und der Batterie (**2**) mit dem Elektrostarter um den Elektrostarter zum Starten des Verbrennungsmotors anzutreiben.

10. Verfahren nach Anspruch 9, welches zusätzlich den Schritt aufweist, den Kondensator (**14**) nach dem Starten des Verbrennungsmotors über einen Widerstand (**18**) zu entladen.

Es folgt ein Blatt Zeichnungen

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Fig.

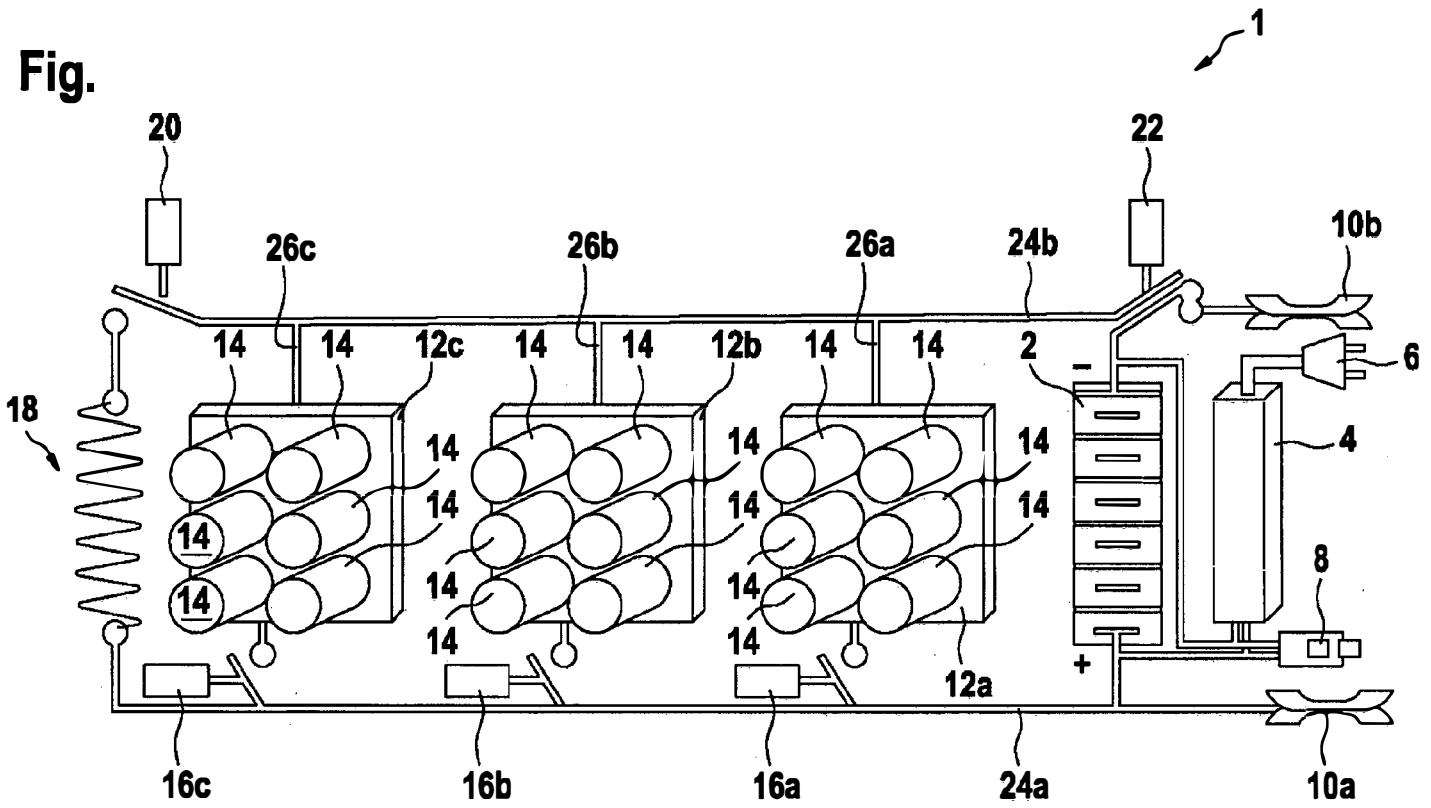


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Espacenet

CN202918052U Hybrid battery

Applicants: LEI XINGLIANG

Inventors: LEI XINGLIANG

Classifications:
IPC ***H02J7/00; H02J9/06;***

Priorities: CN201220612671U 2012-11-19

Application: CN201220612671U·2012-11-19

Publication: CN202918052U·2013-05-01

Published as: CN202918052U

Hybrid battery

Abstract

The utility model relates to a hybrid battery. The hybrid battery comprises a casing, and also comprises a first energy storing device, a second energy storing device, a detection control circuit, a battery state detection display device, an equalization circuit, and a charging circuit connected between the first energy storing device and the second energy storing device, a cathode pole is led out from cathode ends of the first and second energy storing devices, an anode end of the first energy storing device is connected with a first static contact of a relay, an anode end of the second energy storing device is connected with a second static contact of the relay, the detection control circuit is connected with a coil of the relay, an anode pole is led out from an input end of the relay, the first energy storing device, the second energy storing device, the equalization circuit, the charging circuit, and the relay are arranged inside the casing, and the anode pole and the cathode pole are connected with an anode and a cathode of an electrical device respectively. The hybrid battery has the advantages of high reliability, long service life and environmental friendliness.

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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

(10)授权公告号 CN 202918052 U
(45)授权公告日 2013.05.01

(21)申请号 201220612671.X

(22)申请日 2012.11.19

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(51)Int.Cl.
H02J 9/06(2006.01)
H02J 7/00(2006.01)

(ESM)同样的发明创造已同日申请发明专利

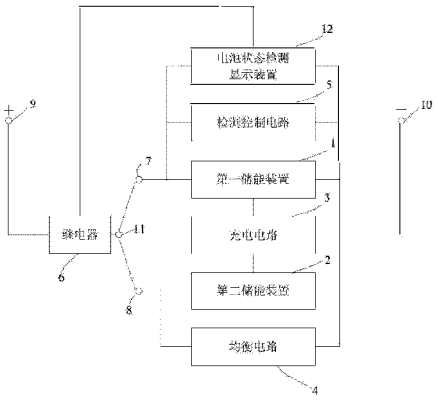
权利要求书1页 说明书4页 附图1页

(54)实用新型名称

一种混合电池

(57)摘要

本实用新型涉及一种混合电池，包括外壳，还包括第一储能装置，第二储能装置，检测控制电路，电池状态检测显示装置，均衡电路，连接于第一储能装置与第二储能装置之间的充电电路，所述第一储能装置与第二储能装置的负极端引出负极极柱，所述第一储能装置的正极端与继电器的第一静触点连接，所述第二储能装置的正极端与继电器的第二静触点连接，所述检测控制电路与继电器的线圈连接，所述继电器的输入端引出正极极柱；所述第一储能装置、第二储能装置、检测控制电路、均衡电路、充电电路、继电器设置于外壳的内部，所述正极极柱、负极极柱分别与电气设备的正极、负极连接。该混合电池可靠性高、使用寿命长且环保。



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1. 一种混合电池，包括外壳，其特征在于，还包括用于小电流时供电的第一储能装置（1），与用于瞬间启动时供电的第二储能装置（2），与第一储能装置（1）并联连接的检测控制电路（5）、用于检测及显示第一储能装置（1）使用状态的电池状态检测显示装置（12），与第二储能装置（2）并联连接的用于保护第二储能装置（2）的均衡电路（4），连接于第一储能装置（1）与第二储能装置（2）之间、用于对第二储能装置（2）充电的充电电路（3），所述第一储能装置（1）与第二储能装置（2）的负极端引出负极极柱（10），所述第一储能装置（1）的正极端与继电器（6）的第一静触点（7）连接，所述第二储能装置（2）的正极端与继电器（6）的第二静触点（8）连接，所述检测控制电路（5）与继电器（6）的线圈连接，所述继电器（6）的输入端引出正极极柱（9），所述正极极柱（9）、负极极柱（10）分别与汽车用电设备的正极、负极连接；所述检测控制电路（5）检测经过第一储能装置（1）的电流，当该电流为小电流时，继电器（6）中的衔铁的动触点（11）与第一静触点（7）连通，动触点（11）与第二静触点（8）断开，此时，第一储能装置（1）与正极极柱（9）、负极极柱（10）连通，由第一储能装置（1）给汽车供电；当该电流为大电流时，继电器（6）中的衔铁的动触点（11）与第一静触点（7）断开，动触点（11）与第二静触点（8）连通，此时，第二储能装置（2）与正极极柱（9）、负极极柱（10）连通，由第二储能装置（2）给汽车供电；所述第一储能装置（1）、第二储能装置（2）、检测控制电路（5）、均衡电路（4）、充电电路（3）、继电器（6）均设置于外壳的内部。

2. 根据权利要求 1 所述的一种混合电池，其特征在于，所述小电流的范围为 20A ～ 100A，所述大电流为大于 100A。

3. 根据权利要求 1 所述的一种混合电池，其特征在于，所述继电器（6）中的衔铁的动触点（11）与第一静触点（7）或第二静触点（8）连通后，保持 1 ～ 10s 后复位。

4. 根据权利要求 1 所述的一种混合电池，其特征在于，所述第一储能装置（1）为铅酸蓄电池或锂电池组，第二储能装置（2）为超级电容器组或锂电池组。

5. 根据权利要求 4 所述的一种混合电池，其特征在于，所述铅酸蓄电池的标称电压为 12V ～ 24V。

6. 根据权利要求 4 所述的一种混合电池，其特征在于，所述锂电池组由 4 ～ 12 个锂电池串联连接而成，所述锂电池组中的锂电池容量为 1Ah ～ 80Ah。

7. 根据权利要求 4 所述的一种混合电池，其特征在于，所述超级电容器组由 4 ～ 12 个超级电容器串联连接而成。

8. 根据权利要求 4 所述的一种混合电池，其特征在于，所述超级电容器组中的超级电容器的规格为 50 ～ 3000F。

9. 根据权利要求 1 所述的一种混合电池，其特征在于，所述充电电路（3）的输出电压范围为 12V ～ 36V，输出电流为 0.1A ～ 10A。

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一种混合电池

技术领域

[0001] 本实用新型涉及一种新能源电池，尤其涉及一种用于启动内燃机和其他电气设备的混合电池。

背景技术

[0002] 汽车通常利用起动机来启动发动机，起动机由电池提供电能，例如铅酸蓄电池。发动机工作时，汽车发电机通过铅酸蓄电池向汽车内用电设备供电，起到稳压的作用；发动机停机后，由铅酸蓄电池直接给车内设备供电；发动机启动时，需要铅酸蓄电池瞬间提供高达几百安的电流以保证汽车顺利启动；然而，瞬间大电流放电对铅酸蓄电池的寿命和性能均会产生极大的损害，而且铅酸蓄电池本身功率密度低，瞬间放电能力不足，又不属于环保产品。相比之下，超级电容器具有快充快放的功能，使用寿命高达 50 万次。如能结合两者的优势，将铅酸蓄电池与超级电容器结合起来使用，既能满足技术需要，又具有经济环保的社会效益。

[0003] 现有中国专利文献 CN 201927685U 公开的一种新能源电池，包括壳体，所述的壳体包括有电池壳体、电容器壳体，电池壳体内设有串联在一起的铅酸电池组，铅酸电池组内设有隔板，其上连接有铅酸极柱，电容器壳体内设有超级电容器，超级电容器上连接有电容极柱，铅酸极柱与电容极柱之间通过金属线连接在一起。该申请主要是解决现有技术所存在的铅酸蓄电池功率密度低，瞬间放电能力不足，为保证起动能力，选择高于实际需求的容量，大电流充放电造成蓄电池寿命短，成本高，重量重，体积大等的技术问题。但在发动机启动过程中，仍然是由铅酸蓄电池与超级电容一起供电，导致瞬间经过铅酸蓄电池的电流也不会太低，并没有完全起到保护铅酸蓄电池的作用；仅仅将铅酸蓄电池和超级电容器简单并联，并没有充分发挥超级电容器的优势。

实用新型内容

[0004] 本实用新型的目的在于提出一种混合电池，该混合电池可根据电流大小，有效地在第一储能装置与第二储能装置之间切换，在小电流时，通过第一储能装置供电，在启动瞬间需要大电流时，通过第二储能装置供电，避免第一储能装置在启动瞬间因大电流放电造成损伤，有效地保护第一储能装置，并充分利用第二储能装置的快充快放特性，保证在第一储能装置出现故障时汽车仍能正常启动，该混合电池使用寿命长且环保。

[0005] 为达到此目的，本实用新型采用以下技术方案：

[0006] 一种混合电池，包括外壳，还包括用于小电流时供电的第一储能装置，与用于瞬间启动时供电的第二储能装置，与第一储能装置并联连接的检测控制电路、用于检测及显示第一储能装置使用状态的电池状态检测显示装置，与第二储能装置并联连接的用于保护第二储能装置的均衡电路，连接于第一储能装置与第二储能装置之间、用于对第二储能装置充电的充电电路，所述第一储能装置与第二储能装置的负极端引出负极极柱，所述第一储能装置的正极端与继电器的第一静触点连接，所述第二储能装置的正极端与继电器的第二

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静触点连接，所述检测控制电路与继电器的线圈连接，所述继电器的输入端引出正极极柱，所述正极极柱、负极极柱分别与汽车用电设备的正极、负极连接；所述检测控制电路检测经过第一储能装置的电流，当该电流为小电流时，继电器中的衔铁的动触点与第一静触点连通，动触点与第二静触点断开，此时，第一储能装置与正极极柱、负极极柱连通，由第一储能装置给汽车供电；当该电流为大电流时，继电器中的衔铁的动触点与第一静触点断开，动触点与第二静触点连通，此时，第二储能装置与正极极柱、负极极柱连通，由第二储能装置给汽车供电；所述第一储能装置、第二储能装置、检测控制电路、均衡电路、充电电路、继电器均设置于外壳的内部。

[0007] 其中，所述小电流的范围为 20A ～ 100A，所述大电流为大于 100A。

[0008] 其中，所述继电器中的衔铁的动触点与第一静触点或第二静触点连通后，保持 1 ～ 10s 后复位。

[0009] 其中，所述第一储能装置为铅酸蓄电池或锂电池组，第二储能装置为超级电容器组或锂电池组。

[0010] 其中，所述铅酸蓄电池的标称电压为 12V ～ 24V。

[0011] 其中，所述锂电池组由 4 ～ 12 个锂电池串联连接而成，所述锂电池组中的锂电池的容量为 1Ah ～ 80Ah。

[0012] 其中，所述超级电容器组由 4 ～ 12 个超级电容器串联连接而成。

[0013] 其中，所述超级电容器组中的超级电容器的规格为 50 ～ 3000F。

[0014] 其中，所述充电电路的输出电压范围为 12V ～ 36V，输出电流为 0.1A ～ 10A。

[0015] 本实用新型的有益效果为：本实用新型的混合电池利用检测控制电路实时检测流经第一储能装置的电流大小，并控制继电器的连通与断开，当汽车正常行驶或发动机停机使用车内设备时，流经第一储能装置的电流为小电流，继电器中的衔铁的动触点与第一静触点连通，动触点与第二静触点断开，此时，第一储能装置与正极极柱、负极极柱连通，由第一储能装置给汽车供电和实现稳压功能；当汽车启动瞬间，需要储能装置瞬间放电，形成大电流时，继电器中的衔铁的动触点与第一静触点断开，动触点与第二静触点连通，此时，第二储能装置与正极极柱、负极极柱连通，由第二储能装置向汽车供电；而当汽车处于任意时刻，第一储能装置通过充电电路持续给第二储能装置充电，使得电能有效存储不致被浪费；同时，第二储能装置两端并联连接有均衡电路，该均衡电路将第二储能装置两端的电压稳定在一定值，起到保护第二储能装置的作用。本实用新型的混合电池的第一储能装置为铅酸蓄电池或锂电池组，第二储能装置为超级电容器组或锂电池组，该混合电池有效地将传统铅酸蓄电池的成熟低成本与超级电容器的优越的充放电性能结合起来，并通过继电器在铅酸蓄电池与超级电容器组之间切换，不仅切换及时准确，而且继电器本身没有输入电压，不会形成分压，延长混合电池的使用寿命，实现绿色环保的目的。该混合电池即使当第一储能装置由于寿命终结、内阻增大、停转发动机在车内休息时导致第一储能装置电量耗尽，也还有第二储能装置中已经储存的电量用于启动汽车。

附图说明

[0016] 图 1 是本实用新型的混合电池电路连接示意图。

[0017] 图中：1- 第一储能装置；2- 第二储能装置；3- 充电电路；4- 均衡电路；5- 检测控

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制电路 ;6- 继电器 ;7- 第一静触点 ;8- 第二静触点 ;9- 正极极柱 ;10- 负极极柱 ;11- 动触点 ;12- 电池状态检测显示装置。

具体实施方式

[0018] 下面结合附图和具体实施例对本实用新型作进一步说明。

[0019] 如图 1 所示，一种混合电池，包括外壳，还包括用于小电流时供电的第一储能装置 1，与用于瞬间启动时供电的第二储能装置 2，与第一储能装置 1 并联连接的检测控制电路 5、用于检测及显示第一储能装置 1 使用状态的电池状态检测显示装置 12，与第二储能装置 2 并联连接用于保护第二储能装置 2 的均衡电路 3，连接于第一储能装置 1 与第二储能装置 2 之间、用于对第二储能装置 2 充电的充电电路 3，第一储能装置 1 与第二储能装置 2 的负极端引出负极极柱 10，第一储能装置 1 的正极端与继电器 6 的第一静触点 7 连接，第二储能装置 2 的正极端与继电器 6 的第二静触点 8 连接，检测控制电路 5 与继电器 6 的线圈连接，继电器 6 的输入端引出正极极柱 9，正极极柱 9、负极极柱 10 分别与汽车的正极、负极连接 ;检测控制电路检测经过第一储能装置 1 的电流，当该电流为小电流时，继电器 6 中的衔铁的动触点 11 与第一静触点 7 连通，动触点 11 与第二静触点 8 断开，此时，第一储能装置 1 与正极极柱 9、负极极柱 10 连通，由第一储能装置 1 向汽车供电 ;当该电流为大电流时，继电器 6 中的衔铁的动触点 11 与第一静触点 7 断开，动触点 11 与第二静触点 8 连通，此时，第二储能装置与正极极柱 9、负极极柱 10 连通，由第二储能装置 2 向汽车供电 ;第一储能装置 1、第二储能装置 2、检测控制电路 5、均衡电路 4、充电电路 3、继电器 6 均设置于外壳的内部。

[0020] 进一步地，小电流与大电流的切换范围可以自由设定，在本实施例中，小电流的范围为 20A ～ 100A，大电流为大于 100A 以上的电流。当继电器 6 的第一静触点 7 或第二静触点 8 连通后，设定保持 1 ～ 10s 后复位。

[0021] 优选的，在本实施例中，继电器 6 的初始状态为衔铁的动触点 11 与第一静触点 7 连通，与第二静触点 8 断开的状态 ;当继电器 6 的线圈两端施加输入电压，衔铁的动触点 11 与第一静触点 7 断开，与第二静触点 8 连通，保持 1 ～ 10s 后复位，线圈两端的电压消失，继电器 6 恢复到初始状态，即衔铁的动触点 11 与第一静触点 7 连通，与第二静触点 8 断开。

[0022] 具体地，第一储能装置 1 为铅酸蓄电池或锂电池组，第二储能装置 2 为超级电容器组或锂电池组 ;锂电池组由 4 ～ 12 个锂电池串联连接而成，锂电池的容量为 1Ah ～ 80Ah ;优选的，在本实用新型中的锂电池也即锂离子电池。铅酸蓄电池的标称电压为 12V ～ 24V ;超级电容器组由 4 ～ 12 个超级电容器串联连接而成，超级电容器的规格为 50 ～ 3000F。优选的，在本实施例中，第一储能装置 1 为铅酸蓄电池，第二储能装置 2 为超级电容器组。充电电路 3 为 DC-DC 充电电路，该充电电路 3 的输出电压范围为 12V ～ 36V，输出电流为 0.1A ～ 10A。

[0023] 本实用新型的混合电池外部设置有外壳，将第一储能装置 1、第二储能装置 2、检测控制电路 5、均衡电路 4、充电电路 3、继电器 6 均设置于外壳内部，外壳对内部装置和电路起到保护作用 ;另外，将内部电路的正极端和负极端分别穿过外壳，引出正极极柱 9 和负极极柱 10，该正极极柱 9 与负极极柱 10 与汽车用电设备的正负极线材连接。

[0024] 本实用新型的混合电池利用检测控制电路 5 实时检测汽车是否处于启动状态，即

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实时检测流经第一储能装置 1 的电流大小，并控制继电器 6 中的衔铁的动触点 11 与第一静触点 7、第二静触点 8 的连通与断开。当汽车正常行驶或发动机停机使用车内设备时，流经第一储能装置 1 的电流为小电流，检测控制电路不提供切换电信号给继电器 6，此时，继电器 6 中的线圈两端没有输入电压，则继电器 6 不动作，保持在初始连接状态，即继电器 6 中的衔铁的动触点 11 与第一静触点 7 连通，动触点 11 与第二静触点 8 断开，第一储能装置 1 与正极极柱 9、负极极柱 10 连通，由第一储能装置 1 向汽车供电和稳压；当汽车启动的瞬间，需要第一储能装置 1 瞬间放电，形成瞬间大电流时，检测控制电路 5 发出切换电信号给继电器 6，在继电器 6 中的线圈两端施加电压，线圈中随即产生电流，从而产生电磁效应，衔铁在电磁力的吸引作用下克服返回弹簧的拉力吸向铁芯，从而带动衔铁的动触点 11 与第二静触点 8 连通，同时与第一静触点 7 断开，此时，第二储能装置 2 与正极极柱 9、负极极柱 10 连通，由第二储能装置 2 向汽车供电；而当汽车处于任意时刻，第一储能装置 1 通过充电电路 3 持续给第二储能装置 2 充电，使得电能快速有效地存储在第二储能装置 2 中；同时，第二储能装置 2 两端并联连接有均衡电路 4，该均衡电路 4 将第二储能装置 2 两端的电压稳定在一定数值范围，起到保护第二储能装置 2 的作用。本实用新型的混合电池的第一储能装置 1 为铅酸蓄电池或锂电池组，第二储能装置 2 为超级电容器或锂电池组，该混合电池有效地将传统铅酸蓄电池的成熟低成本优势与超级电容器的优越的充放电性能结合起来，并通过继电器在铅酸蓄电池与超级电容器之间切换，不仅能做到切换及时准确，而且继电器 6 本身没有输入电压，不会形成分压，延长混合电池的使用寿命，实现绿色环保的目的。该混合电池在第一储能装置 1 的两端并联设置电池状态检测显示装置 12，可以实时检测和显示第一储能装置 1 的使用状态，如电量的饱和度或者使用寿命等，可以辅助判断该混合电池是否能正常使用；该混合电池即使当第一储能装置 1 由于寿命终结、内阻增大、停转发动机在车内休息导致第一储能装置 1 电量耗尽，也还有第二储能装置 2 中已经储存的电量可用以启动汽车，可靠性高。

[0025] 以上所述仅为本实用新型的优选实施例而已，并不用于限制本实用新型，对于本领域的技术人员来说，本实用新型可以有各种更改和变化。凡在本实用新型的精神和原则之内，所作的任何修改、等同替换、改进等，均应包含在本实用新型的保护范围之内。

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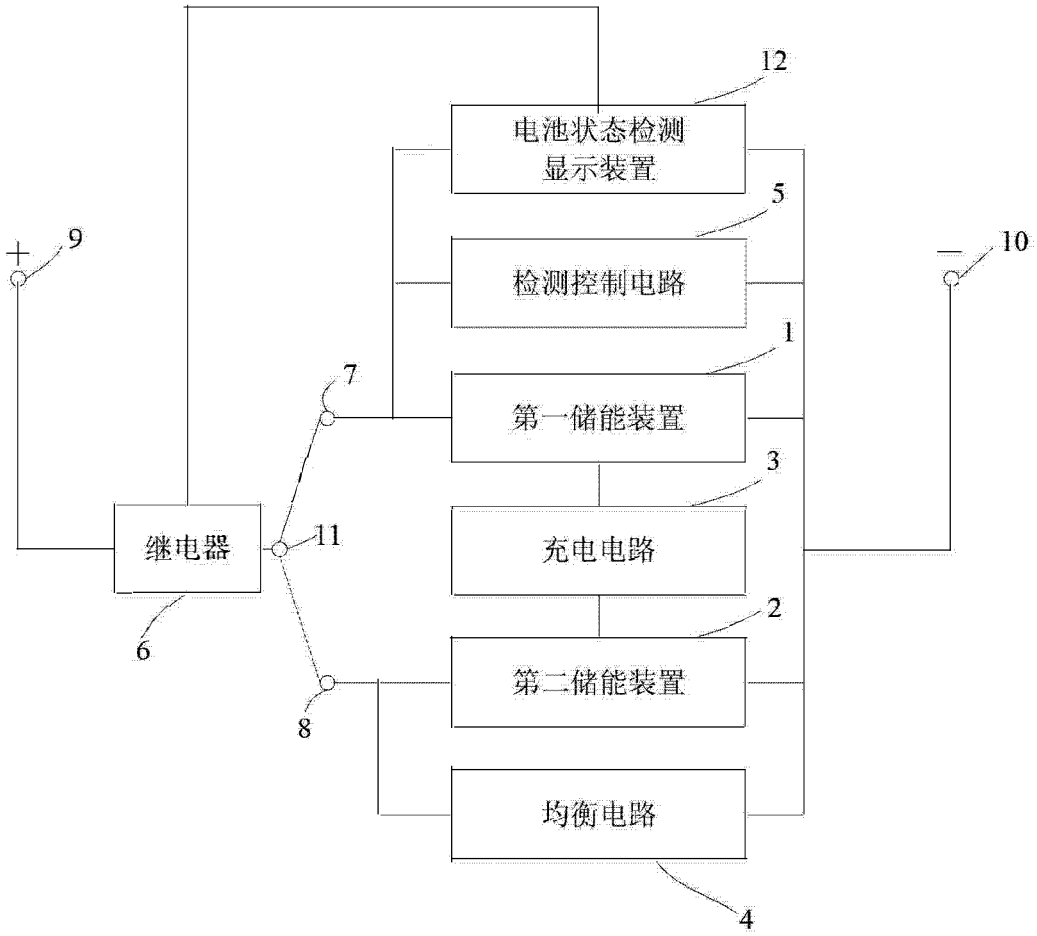


图 1

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(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
22. September 2011 (22.09.2011)

PCT

(10) Internationale Veröffentlichungsnummer
WO 2011/113734 A1

(51) Internationale Patentklassifikation:
H02H 11/00 (2006.01) *F02N 11/08* (2006.01)

(21) Internationales Aktenzeichen: PCT/EP2011/053575

(22) Internationales Anmeldedatum:
10. März 2011 (10.03.2011)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
10 2010 011 276.3 13. März 2010 (13.03.2010) DE

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(81) Bestimmungsstaaten *(soweit nicht anders angegeben, für jede verfügbare nationale Schutzrechtsart)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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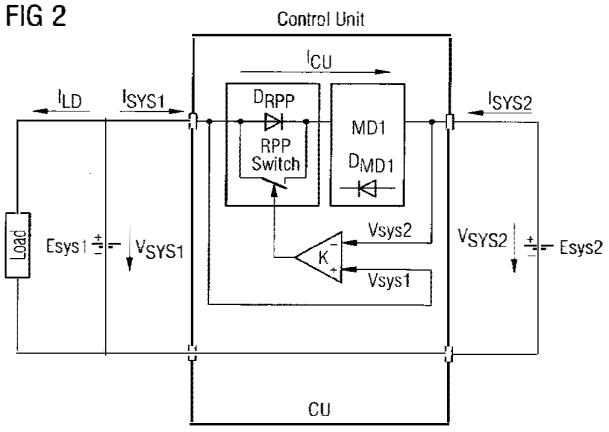
Veröffentlicht:

— *mit internationalem Recherchenbericht (Artikel 21 Absatz 3)*

(54) **Title**: ON-BOARD ELECTRICAL SYSTEM FOR A VEHICLE

(54) **Bezeichnung** : BORDNETZ FÜR EIN FAHRZEUG

FIG 2



(57) **Abstract**: In an on-board electrical system for a motor vehicle comprising: a first energy storage unit (Esys1) with a first voltage level (V_{SYS1}), a second energy storage unit (Esys2) with a second voltage level (V_{SYS2}); a control unit (CU) which controls the flow of current between the first energy storage unit (Esys1) and the second energy storage unit (Esys2) in both directions; a polarity-reversal protection diode (D_{RPP}) which connects the first energy storage unit (Esys1) for supplying operating voltage to the control unit (CU); and a switching element (Switch) for bridging the polarity-reversal protection diode (D_{RPP}) when the polarity of the first energy storage unit (Esys1) is correct; the first voltage level (V_{SYS1}) is compared with the second voltage level (V_{SYS2}) by means of a comparator (K) and the controllable switch (Switch) is moved to its open state when the first voltage level (V_{SYS1}) drops to a threshold voltage value (V_{sch}) which is below the second voltage level (V_{SYS2}).

(57) **Zusammenfassung**:

[Fortsetzung auf der nächsten Seite]

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Bei einem Bordnetz für ein Kraftfahrzeug umfassend: eine erste Energiespeichereinheit (Esys1) mit einem ersten Spannungsniveau (V_{SYS1}), eine zweite Energiespeichereinheit (Esys2) mit einem zweiten Spannungsniveau (V_{SYS2}); eine Steuereinheit (CU), die den Stromfluss zwischen der ersten Energiespeichereinheit (Esys1) und der zweiten Energiespeichereinheit (Esys2) in beiden Richtung steuert; eine Verpolschutzdiode (D_{RPP}), die die erste Energiespeichereinheit (Esys1) zur Betriebsspannungsversorgung mit der Steuereinheit (CU) verbindet; und ein Schaltelement (Switch) zur Überbrückung der Verpolschutzdiode (D_{RPP}) bei richtiger Polung der ersten Energiespeichereinheit (Esys1); wird mittels eines Komparators (K) das erste Spannungsniveau (V_{SYS1}) mit dem zweiten Spannungsniveau (V_{SYS2}) verglichen und bei Absinken des ersten Spannungsniveaus (V_{SYS1}) auf einen unter dem zweiten Spannungsniveau (V_{SYS2}) liegenden Spannungsschwellwert (V_{sch}) der steuerbare Schalter (Switch) in seinen geöffneten Zustand gesteuert.

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Beschreibung

Bordnetz für ein Fahrzeug

Die Erfindung betrifft ein Bordnetz für ein Fahrzeug, insbesondere ein Kraftfahrzeug gemäß Oberbegriff des Patentanspruchs 1.

Bordnetze heutiger Kraftfahrzeuge umfassen einen als Drehstrommaschine mit nachgeschalteter Gleichrichterschaltung ausgebildeten Generator als Energiewandler, eine oder mehrere Energiespeichereinheiten, bspw. Batterien sowie über das Bordnetz zu versorgende elektrische Verbraucher. Ein Verpolungsschutz wird bei solchen Bordnetzen durch die Gleichrichterdioden einer nachgeschalteten Gleichrichterschaltung realisiert.

Darüber hinaus sind auch Bordnetze mit zwei Energiespeichersystemen mit unterschiedlichen Nominalspannungen als Systemspannungen ohne Potentialtrennung bekannt, so zum Bsp. ein Energiespeichersystem, bspw. eine 12V-Batterie für Normalverbraucher des Kraftfahrzeugs und ein weiteres Energiespeichersystem, bspw. bestehend aus Doppelschichtkondensatoren (Ultra-caps) für Hochstromverbraucher.

Ein Batteriemanagement für Energiefluß- und Ruhestrommanagement zwischen diesen beiden Energiespeichersystemen wird von einer Steuereinheit bzw. einem Steuergerät bewirkt, wobei diese Steuereinheit von der 12V-Batterie mit einer Betriebsspannung versorgt wird. Als Verpolschutz dient ein Ventil, bspw. eine Verpolschutzdiode, die die 12V-Batterie mit der Steuereinheit verbindet.

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Nachteilig an einem solchen Bordnetz mit zwei Energiespeichersystemen ist ein Zustand, bei dem die Systemspannung der 12V-Batterie unter die Spannung der weiteren Energiespeichereinheit fällt und damit die Gefahr eines Ladungsabflusses in Richtung der 12V-Batterie aufgrund parasitärer Effekte in Halbleiter-Bauelementen der Steuereinheit besteht.

Aufgabe der Erfindung ist es daher, ein Bordnetz für ein Fahrzeug zu schaffen, bei dem ein solcher Ladungsabfluss verhindert wird.

Diese Aufgabe wird gelöst durch ein Bordnetz mit den Merkmalen des Patentanspruchs 1.

Hiernach ist bei einem Bordnetz für ein Fahrzeug, insbesondere ein Kraftfahrzeug, das
- eine erste Energiespeichereinheit mit einem ersten Spannungsniveau,
- eine zweite Energiespeichereinheit mit einem zweiten Spannungsniveau,
- eine Steuereinheit, die den Stromfluss zwischen der ersten Energiespeichereinheit und der zweiten Energiespeichereinheit in beiden Richtungen steuert, falls das zweite Spannungsniveau unter dem ersten Spannungsniveau liegt,
- eine Verpolschutzdiode, die die erste Energiespeichereinheit zur Betriebsspannungsversorgung mit der Steuereinheit verbindet, und
- ein Schaltelement zur Überbrückung der Verpolschutzdiode bei richtiger Polung der ersten Energiespeichereinheit umfasst,
erfindungsgemäß vorgesehen, dass

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- mittels einer Vergleichsschaltung, insbesondere eines Komparators das erste Spannungsniveau mit dem zweiten Spannungsniveau verglichen wird, und
- mittels Steuermittel, vorzugsweise des Komparators bei Absinken des ersten Spannungsniveaus auf einen unter dem zweiten Spannungsniveau liegenden Spannungsschwellwert der steuerbare Schalter in seinen geöffneten Zustand gesteuert wird.

Damit wird in einfacher und überraschender Weise der Verpolschutz für die Steuereinheit auch zur Verhinderung eines unerwünschten Ladungsaustausches zwischen den beiden Energiespeichereinheiten erzielt. Insbesondere sind keine zusätzlichen Leistungsbauelemente erforderlich. Ferner ist gemäß einer Weiterbildung der Erfindung mittels des vorgeschlagenen Komparators eine leichte Einstellmöglichkeit des Spannungsschwellwertes möglich.

Weitere vorteilhafte Ausgestaltungen der Erfindung sind mit den Merkmalen der abhängigen Patentansprüche gegeben.

Die Erfindung wird nachfolgend unter Bezugnahme auf die beigefügten Figuren näher erläutert. Es zeigen:

Figur 1 ein schematisches Blockschaltbild eines Ausführungsbeispiels des erfindungsgemäßen Bordnetzes für ein Kraftfahrzeug, und

Figur 2 ein detailliertes Blockschaltbild des Bordnetzes gemäß Figur 1.

Figur 1 zeigt ein Bordnetz, bestehend aus einer ersten Energiespeichereinheit Esys1 mit einer Nominalspannung V_{SYS1}, hier

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eine 12V-Batterie und einer zweiten Energiespeichereinheit Esys2 mit einer Nominalspannung V_{SYS2}, die ebenfalls eine Batterie, ein Doppelschichtkondensator oder ein anderes Speichermedium sein kann.

Die Nominalspannung V_{SYS1} der ersten Energiespeichereinheit Esys1, also deren Systemspannung ist größer als die Nominalspannung V_{SYS2} bzw. Systemspannung der zweiten Energiespeichereinheit Esys2: $V_{SYS1} > V_{SYS2}$.

Eine Steuereinheit CU verbindet die beiden nicht potentialgetrennten Energiespeichereinheiten Esys1 und Esys2 und steuert den Energieaustausch im Sinne eines Energiemanagements zwischen diesen beiden Energiespeichereinheiten Esys1 und Esys2, d. h. im Nominalzustand der beiden Systemspannungen ist sowohl ein Energieaustausch von der ersten Energiespeichereinheit Esys1 in Richtung der zweiten Energiespeichereinheit Esys2 als auch umgekehrt, von der zweiten Energiespeichereinheit Esys2 in Richtung der ersten Energiespeichereinheit Esys1 möglich.

Gemäß der detaillierten Darstellung nach Figur 2 sind an die erste Energiespeichereinheit Esys1 elektrische Verbraucher des Kraftfahrzeug angeschlossen, dargestellt als Systemlast Load, die von einem Laststrom I_{LD} versorgt werden. Der von der Steuereinheit CU gemanagte Energieaustausch zwischen den beiden Energiespeichereinheiten Esys1 und Esys2 erfolgt mittels der Systemströme I_{SYS1} und I_{SYS2}. Bei diesem Ausführungsbeispiel sind die beiden Energiespeichersysteme Esys1 und Esys2 nicht potentialgetrennt.

Die erste Energiespeichereinheit Esys1 liefert auch die Betriebsspannungsversorgung für die Steuereinheit CU, der zuge-

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hörige Laststrom ist mit I_{CU} bezeichnet, wobei zwischen der ersten Energiespeichereinheit Esys1 und der Steuereinheit CU eine Verpolschutzschaltung RPP (Reverse Polarity Protection) geschaltet ist, die bspw. aus einer Verpolschutzdiode D_{RPP} besteht und von einem steuerbaren Schalter Switch, bspw. einem Transistor oder einem mechanischen Schalter, wie einem Relais kurzgeschlossen werden kann.

Dieser Schalter Switch wird von einer Vergleichsschaltung, hier ein Komparator K angesteuert. Hierzu wird die Spannung V_{SYS1} der ersten Energiespeichereinheit Esys1 dem nicht invertierenden Eingang des Komparators K und die Spannung Esys2 der zweiten Energiespeichereinheit Esys2 dem invertierenden Eingang des Komparators K zugeführt.

Befinden sich die beiden Systemspannungen V_{SYS1} und V_{SYS2} auf ihrem Nominalwert, d.h. gilt $V_{SYS1} > V_{SYS2}$, so wird der Schalter Switch durch entsprechende Steuerung des Komparators K geschlossen, d.h. der Transistor in seinen leitenden Zustand gesteuert. So dass die Verpolschutzdiode D_{RPP} überbrückt wird.

Falls die Spannung V_{SYS1} der ersten Energiespeichereinheit Esys1 also bspw. eine 12V-Batterie aufgrund einer starken Entladung auf einen Spannungsschwellwert V_{sch} absinkt, der unter dem Spannungswert der Spannung V_{SYS2} der zweiten Energiespeichereinheit Esys2 liegt, also wenn $V_{SYS1} \leq V_{sch} < V_{SYS2}$ gilt, wird der Schalter Switch von dem Komparator K in seinen geöffneten Zustand gesteuert, so dass aufgrund der Verpolschutzdiode D_{RPP} ein Ladungsabfluss aus der zweiten Energiespeichereinheit Esys2 in Richtung der ersten Energiespeichereinheit Esys1 verhindert wird.

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Ein solcher Ladungsabfluss könnte aufgrund von parasitären Halbleiterelementen in der Steuereinheit CU entstehen, die in Figur 2 stellvertretend durch eine Diode D_{MD1} dargestellt sind. Ein solches parasitäres Halbleiterbauelement kann bspw. auch in einem von der Steuereinheit CU angesteuerten DC/DC-Wandler MD1 entstehen, bspw. als Bulk- oder Body-Diode eines High-Side-Transistors.

Der Spannungsschwellwert V_{sch} ist über die Steuereinheit CU einstellbar.

Falls die erste Energiespeichereinheit Esys1 mit falscher Polung an die Steuereinheit CU angeschlossen wird, ergibt sich für die Spannung V_{SYS1} der Energiespeichereinheit Esys1: $V_{SYS1} < 0$. Auch in diesem Zustand würde der Komparator K den Schalter Switch öffnen, d.h. den Transistor in seinen gesperrten Zustand steuern, so dass die Verpolschutzdiode D_{RPP} wirksam wird.

Der Komparator K kann mit einem zeitverzögerten Ansprechen ausgebildet werden, indem er bspw. mit einem Zeitglied verbunden wird. So erfolgt sowohl das Schließen des Schalters Switch als auch dessen Öffnen durch den Komparator K zeitverzögert.

Das oben erläuterte Ausführungsbeispiel zeigt ein erfindungsgemäßes Bordnetz ohne Potentialtrennung zwischen den beiden Energiespeichersystemen Esys1 und Esys2. Die Erfindung ist darauf natürlich nicht beschränkt, sondern kann ebenso für potentialgetrennte Systeme eingesetzt werden.

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Patentansprüche

1. Bordnetz für ein Fahrzeug, insbesondere ein Kraftfahrzeug umfassend
- eine erste Energiespeichereinheit (Esys1) mit einem ersten Spannungsniveau (V_{SYS1}),
- eine zweite Energiespeichereinheit (Esys2) mit einem zweiten Spannungsniveau (V_{SYS2}),
- eine Steuereinheit (CU), die den Stromfluss zwischen der ersten Energiespeichereinheit (Esys1) und der zweiten Energiespeichereinheit (Esys2) in beiden Richtungen steuert, falls das zweite Spannungsniveau (V_{SYS2}) unter dem ersten Spannungsniveau (V_{SYS1}) liegt,
- eine Verpolschutzdiode (D_{RPP}), die die erste Energiespeichereinheit (Esys1) zur Betriebsspannungsversorgung mit der Steuereinheit (CU) verbindet, und
- ein Schaltelement (Switch) zur Überbrückung der Verpolschutzdiode (D_{RPP}) bei richtiger Polung der ersten Energiespeichereinheit (Esys1),
dadurch gekennzeichnet dass,
- mittels einer Vergleichsschaltung (K), insbesondere eines Komparators das erste Spannungsniveau (V_{SYS1}) mit dem zweiten Spannungsniveau (V_{SYS2}) verglichen wird, und
- mittels Steuermittel (K), vorzugsweise des Komparators bei Absinken des ersten Spannungsniveaus (V_{SYS1}) auf einen unter dem zweiten Spannungsniveau (V_{SYS2}) liegenden Spannungsschwellwert (V_{sch}) der steuerbare Schalter (Switch) in seinen geöffneten Zustand gesteuert wird.

2. Bordnetz nach Anspruch 1,
dadurch gekennzeichnet, dass

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der Spannungsschwellwert (V_{sch}) einstellbar ist.

3. Bordnetz nach Anspruch 1 oder 2,
dadurch gekennzeichnet, dass
der Komparator (K) ein zeitverzögertes Ansprechverhalten aufweist.

4. Bordnetz nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet, dass
der steuerbare Schalter (Switch) als Halbleiterschalter, insbesondere als Transistor oder als elektromechanischer Schalter ausgeführt ist.

5. Bordnetz nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet, dass
das Bordnetz hinsichtlich der ersten und zweiten Energiespeichereinheit (Esys1, Esys2) ohne Potenzialtrennung ausgeführt ist.

6. Bordnetz nach einem der Ansprüche 1 bis 4,
dadurch gekennzeichnet, dass
das Bordnetz hinsichtlich der ersten und zweiten Energiespeichereinheit (Esys1, Esys2) mit Potenzialtrennung ausgeführt ist.

7. Bordnetz nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet, dass
der erste Energiespeicher (Esys1) als Betriebsspannungsquelle für einen Laststromkreis mit elektrischen Verbrauchern (Load) dient.

8. Bordnetz nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet, dass

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das erste bzw. zweite Spannungsniveau (V_{SYS1}, V_{SYS2}) jeweils die Nominalspannung der ersten bzw. zweiten Energiespeichereinheit (Esys1, Esys2) ist.

9. Bordnetz nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Steuereinheit (CU) mindestens ein elektrisches und/oder elektronisches Bauelement mit Durchlasseigenschaften umfasst.

10. Bordnetz nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Steuereinheit (CU) ein Batteriemanagement durchführt.

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FIG 1

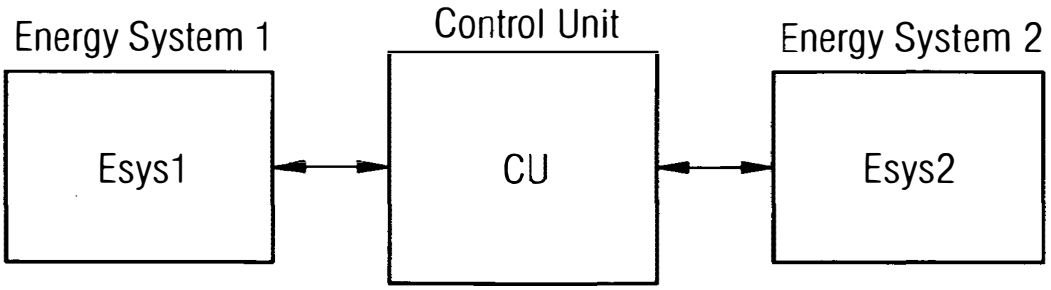


FIG 2

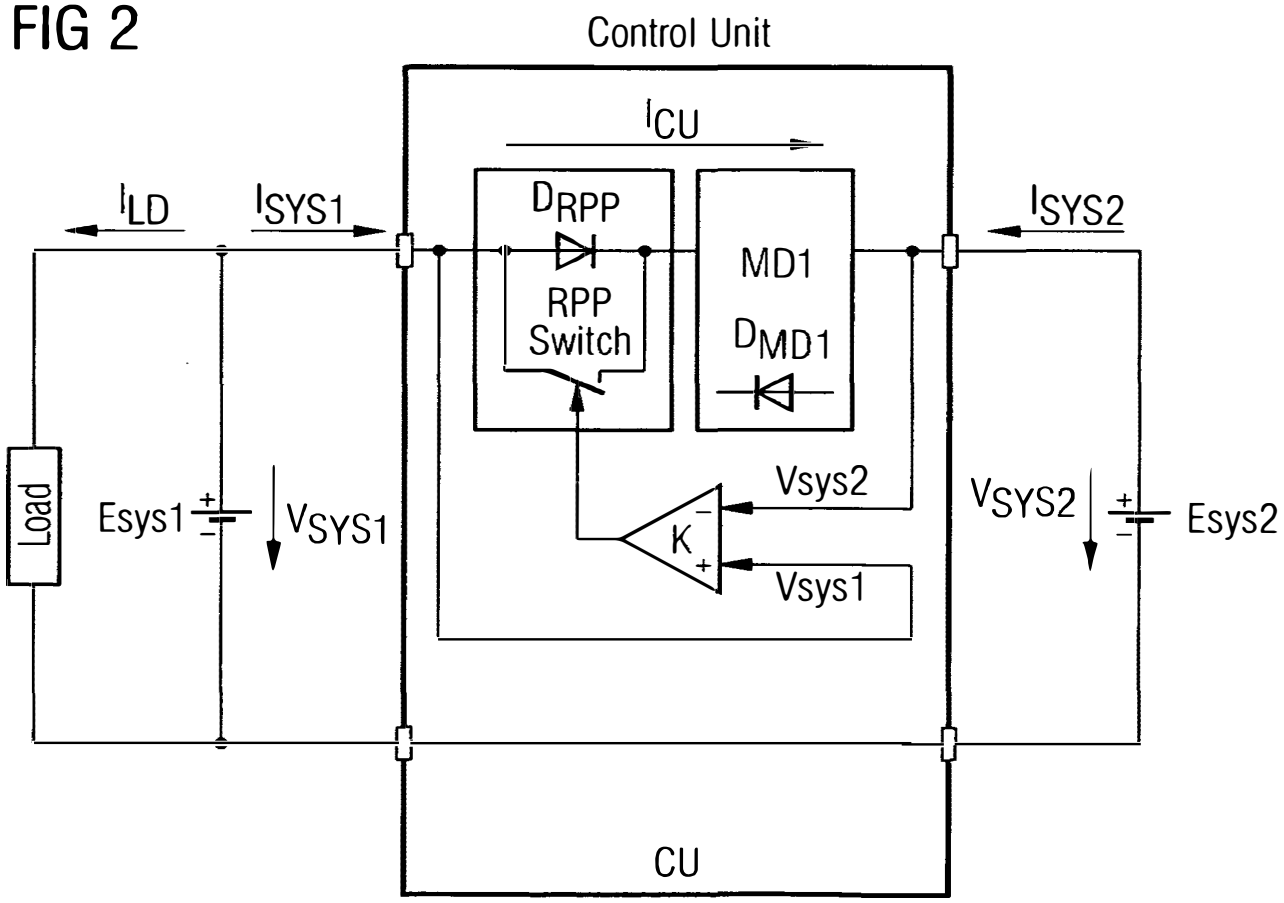


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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/053575

A. CLASSIFICATION OF SUBJECT MATTER
INV. H02H11/00 F02N11/08
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)
H02H F02N B60L H02J

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.
A	DE 39 30 091 A1 (STANDARD ELEKTRIK LORENZ AG [DE]) 14 March 1991 (1991-03-14) column 2, line 65 - column 3, line 51; figure	1,4
A	DE 10 2005 015993 A1 (BOSCH GMBH ROBERT [DE]) 19 October 2006 (2006-10-19) paragraphs [0013], [0014]; figure	1,5,7,8, 10
A	DE 41 38 943 C1 (BOSCH) 27 May 1993 (1993-05-27) abstract; figures 7,8	1,2,4,5, 7,10
A	DE 10 2006 036425 A1 (BAYERISCHE MOTOREN WERKE AG [DE]) 7 February 2008 (2008-02-07) the whole document	1,5,7,10

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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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
27 May 2011	08/06/2011

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	Krieger, Philippe

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Petitioner ADC (IPR2024-00577)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/053575

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 102 22 149 A1 (SIEMENS AG [DE]) 11 December 2003 (2003-12-11) abstract; figures	1,3,4
A	DE 100 01 485 A1 (DAIMLER CHRYSLER AG [DE]) 26 July 2001 (2001-07-26) abstract; figures 1,5	1
A	DE 10 2007 027498 A1 (DAIMLER CHRYSLER AG [DE]) 24 January 2008 (2008-01-24) the whole document	1

1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2011/053575

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DE 102005015993 A1	19-10-2006	NONE	
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		EP 0568655 A1	10-11-1993
		JP 3553932 B2	11-08-2004
		JP 6504832 T	02-06-1994
		US 5525891 A	11-06-1996
DE 102006036425 A1	07-02-2008	CN 101485062 A	15-07-2009
		EP 2047580 A2	15-04-2009
		WO 2008014945 A2	07-02-2008
		US 2010001581 A1	07-01-2010
DE 10222149 A1	11-12-2003	WO 03098765 A1	27-11-2003
		US 2005094332 A1	05-05-2005
DE 10001485 A1	26-07-2001	NONE	
DE 102007027498 A1	24-01-2008	NONE	

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/EP2011/053575

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
INV. H02H11/00 F02N11/08
ADD.

Nach der Internationalen Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
H02H F02N B60L H02J

Recherchierte, aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)
EPO-Internal

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
A	DE 39 30 091 A1 (STANDARD ELEKTRIK LORENZ AG [DE]) 14. März 1991 (1991-03-14) Spalte 2, Zeile 65 - Spalte 3, Zeile 51; Abbildung	1,4
A	DE 10 2005 015993 A1 (BOSCH GMBH ROBERT [DE]) 19. Oktober 2006 (2006-10-19) Absätze [0013], [0014]; Abbildung	1,5,7,8, 10
A	DE 41 38 943 C1 (BOSCH) 27. Mai 1993 (1993-05-27) Zusammenfassung; Abbildungen 7,8	1,2,4,5, 7,10
A	DE 10 2006 036425 A1 (BAYERISCHE MOTOREN WERKE AG [DE]) 7. Februar 2008 (2008-02-07) das ganze Dokument	1,5,7,10

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[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen [X] Siehe Anhang Patentfamilie

* Besondere Kategorien von angegebenen Veröffentlichungen :
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Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
27. Mai 2011	08/06/2011

Name und Postanschrift der Internationalen Recherchenbehörde	Bevollmächtigter Bediensteter
Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Krieger, Philippe

1

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INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
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C. (Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
A	DE 102 22 149 A1 (SIEMENS AG [DE]) 11. Dezember 2003 (2003-12-11) Zusammenfassung; Abbildungen	1,3,4
A	DE 100 01 485 A1 (DAIMLER CHRYSLER AG [DE]) 26. Juli 2001 (2001-07-26) Zusammenfassung; Abbildungen 1,5	1
A	DE 10 2007 027498 A1 (DAIMLER CHRYSLER AG [DE]) 24. Januar 2008 (2008-01-24) das ganze Dokument	1

1

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INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Internationales Aktenzeichen
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Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
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DE 102005015993 A1	19-10-2006	KEINE	
DE 4138943 C1	27-05-1993	WO 9311003 A1	10-06-1993
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		US 2005094332 A1	05-05-2005
DE 10001485 A1	26-07-2001	KEINE	
DE 102007027498 A1	24-01-2008	KEINE	

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
31 January 2019 (31.01.2019)

WIPO | PCT

(10) International Publication Number
WO 2019/021007 A1

(51) International Patent Classification:
H02J 7/14 (2006.01) *H02J 7/34* (2006.01)
H02J 7/00 (2006.01)

(21) International Application Number:
PCT/GB2018/052111

(22) International Filing Date:
26 July 2018 (26.07.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1712124.5 27 July 2017 (27.07.2017) GB

(71) Applicant: **INTERCAL (UK) LTD** [GB/GB]; 24 Hartlebury Close, Redditch Worcestershire B98 9LY (GB).

(72) Inventor: **HARDY, John**; 24 Hartlebury Close, Church Hill North, Redditch Worcestershire B98 9LY (GB).

(74) Agent: **MIDGLEY, Jonathan**; Helios Court, 1 Bishop Square, Hatfield Hertfordshire AL10 9NE (GB).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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

Published:
— *with international search report (Art. 21(3))*

(54) Title: BATTERY MANAGEMENT

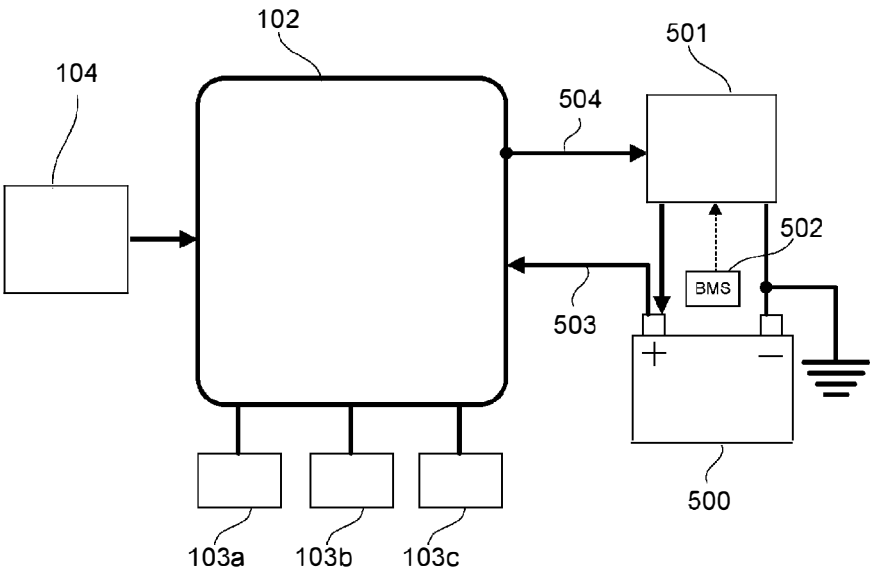


Figure 5

(57) Abstract: The invention provides a battery connection system to allow the connection of a battery such as a Lithium ion battery so that the battery is constantly available to provide power and regulation to the bus but wherein the charging of the battery can be regulated according to the requirements of the battery.

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BATTERY MANAGEMENT

The present invention relates to the field of battery management and more particularly to arrangements for managing the charge and discharge of rechargeable battery systems.

Very large numbers of land vehicles, aircraft and water-borne vessels are powered principally or wholly by internal combustion engines which operate in combination with a low voltage DC electrical system to provide ancillary services. These services vary widely depending on the application but commonly include engine starting, lighting, instrumentation and other equipment and ancillary appliances. Similar low voltage DC configurations may be found in other applications requiring electrical services where there is no permanent or reliable access to an electricity supply.

These electrical systems tend to incorporate a rechargeable battery which must be connected to a suitable source of electrical power for charging. The battery types currently most commonly used in these applications are Lead-acid (referred to herein as "PbAc") or Nickel-Cadmium (referred to herein as "Ni-Cad"). The use of Lithium ion (referred to herein as "Li-ion") batteries would in many circumstances be desirable for reasons of performance, weight saving or durability. However, their special nature creates difficulties in managing them safely and effectively within conventional configurations.

Li-ion batteries are in widespread use in a range of applications, including as the primary power sources in electric vehicles. As costs have reduced they have also become an attractive potential alternative to PbAc or Ni-Cad for providing ancillary power in motor vehicles, aircraft and waterborne vessels. Li-ion batteries can provide a number of advantages depending upon the application:

- They are smaller and lighter, typically being about a third of the weight of PbAc for a given amp-hour rating. This is a major advantage in aircraft but also has value in land vehicles and boats.
- They do not suffer from significant loss of capacity at high current discharge (the "Peukert effect"), which is a problem with PbAc batteries. This is important for starter motors and other high-power intermittent applications.

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- They typically have a far longer service life than PbAc equivalents, providing potentially reduced total lifetime costs, greater reliability and simpler maintenance.
- They are tolerant of habitual undercharging, which can be a common situation in some applications. In contrast, routine undercharging can degrade PbAc cells quickly.
- They are tolerant of long periods of inactivity (for example in recreational water craft used just a few times a year). In contrast PbAc batteries deteriorate relatively quickly if not routinely fully charged.
- They do not suffer from the phenomenon of "memory effect" observed in Ni-Cad batteries that have been incompletely discharged before recharging.

These advantages offer considerable improvements over the alternative options. However, there are some challenges with using Li-ion batteries, notably in ensuring the safe and effective management of the charging and discharging process. A PbAc battery can be charged from simple relatively crude devices without serious concerns for safety or operation of the battery. They tend to be tolerant of large variations in voltage and charging current.

In contrast, Li-ion batteries require smart micro-processor controlled chargers and battery management systems ("BMS") configured for the specific application. In order to prevent accelerated deterioration in performance, rapid cell failure and even thermal runaway and fire, precautions need to be undertaken to ensure the battery is operated correctly. For example, the cells in a Li-ion battery require positive charge termination and should not be left on a continuous float charge. The charge current needs to be controlled to avoid excessive charge current. Similarly, the charging device needs to ensure that excessive charge voltage is not applied to the cells. Li-ion batteries are also more sensitive to their operating temperature and cells should only be charged if the battery is within a defined temperature range.

In addition to managing the charging of Li-ion cells, they should also be protected from over-discharge and particularly the damaging effects of voltage reversal which can occur in series connected battery packs when individual cells are over discharged even though the battery as a whole is still able to provide charge.

Charging control for Li-ion cells and batteries is typically achieved using a suitable "Constant Current/Constant Voltage" (CC/CV) profile. Figure 1 shows such a typical

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CC/CV charge profile. At low states of charge, a controlled constant current is applied (the "CC" phase) to initially replenish the battery. As the charging progresses, the cell voltage increases. Subsequently, the battery/cell voltage reaches a predetermined value and the charging control system switches to a constant voltage profile (the "CV" phase). During this CV phase the current is progressively reduced in order to ensure permissible voltage levels are not exceeded. Once the battery is determined to be fully charged, further charging is stopped.

In order to prevent excessive discharge, control circuitry will also usually be included to isolate the battery during deep discharge before damaging low voltage thresholds are crossed. Some applications, notably in cold climates, will also require control devices to prevent charging outside of an acceptable temperature range.

While it is standard practice to install suitable BMS in applications using 12V and higher Li-ion batteries, special difficulties arise with integrating a BMS into the types of installation described above. For example, if the BMS cannot control contactors to isolate the battery in the event of a voltage or temperature excursion out of the range of desirable values then it is ineffective. If it can control contactors, it will have the ability to take the battery off line suddenly which may damage the alternator and other electrical components. Additionally, Li-ion batteries typically have different temperature limits for charge and discharge. In a conventional installation, the BMS would have to take the battery off line altogether below the minimum charging temperature (say 0ºC) even if the battery would be quite safe supplying power at lower temperatures (e.g. - 20ºC). Furthermore, with the above arrangement, the BMS cannot control the charge profile. With a discharged battery, if the alternator is capable of delivering, for example, 300 Amps, then that is the current that may flow, even if the battery limit is specified to be a lower value, e.g. 30 Amps. Similarly, charging cannot be terminated when the desired level of charge has been reached, as is normal for Li-ion batteries. The BMS cannot prevent charging without taking the battery offline altogether.

Apart from the battery, the electrical power required for the types of ancillary systems described here may be obtained from a number of sources. This is typically provided by an alternator or generator installed in the vehicle or craft, normally powered by an engine but occasionally powered from other sources such as regenerative braking through road wheels. Other on-board power generators of various types including solar panels and

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small wind turbines may sometimes be used. Additionally, when available, a static external supply may be used such as from the electrical grid or a portable generator.

In a typical configuration, such as in a car, the battery or batteries will be connected permanently to a low voltage bus bar along with an engine driven alternator or other on-board power source. The alternator voltage is typically set slightly above the battery voltage; so for example an ordinary car battery voltage peaks at around 12 Volts, but the alternator is likely to be regulated to around 14 Volts when powered. The excess voltage causes a charging current to flow into the battery. For the commonly used PbAc or NiCad batteries, this is a simple and effective means of ensuring that the battery is recharged and then has a continuous float charge when the engine is running.

Figure 2 shows a simplified schematic view of a typical low voltage DC bus in a car or other road vehicle. The battery and alternator are connected directly to the bus along with the various power consuming devices on the vehicle such as the lighting, wipers, audio devices and window heaters etc., shown in Figure 2. As will be apparent from Figure 2, the permanent connection of the bus to the battery means that whilst the engine is running to power the alternator, or another power source connected to the bus is available, then a float charge will be delivered to the battery.

With PbAc cells, the resulting constant ("float") charging is beneficial. The cells typically have a small self-discharge and float charging ensures they are always topped up and ready for use. In contrast, leaving a Li-ion battery permanently connected to a DC bus bar at or near its maximum voltage is associated with Lithium plating and/or the growth of dendrites which cause loss of capacity over time, increase the risk of early cell failure and occasionally may lead to thermal runaway of the type periodically reported in cell phones and laptops.

An additional consequence of the arrangement in Figure 2 is that, when the alternator or other power source starts to deliver power to a battery in a discharged state, current will flow into the battery initially at an uncontrolled and potentially excessive rate, limited only by the capacity of the alternator, the small internal impedance of the battery and the minimal resistance of the charging circuit. As the battery becomes charged, the current naturally drops to the final "float charge" level. Figure 3 shows a typical charge profile with an alternator connected to the battery via a bus such as in Figure 2.

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Comparison of the typical charge profile using an alternator (Figure 3) with the required charge profile for Li-ion (Figure 1) illustrates the issue that needs to be overcome. In Figure 3 the initial charge current is a function of the alternator characteristics, which is in turn driven by the overall demands of the particular electrical system rather than the requirements of the battery. For example, the substantial equipment loads in a modern car may mandate use of a powerful alternator. Thus a typical mid-sized car may require a 175 Amp alternator and a 62 Amp-hour battery.

This does not present a problem in practice with PbAc cells since they have relatively high internal impedance which serves to limit the charge current; and they can in any event tolerate brief periods of high charge rate at low state of charge. However, this type of uncontrolled charging can readily exceed the maximum allowable charging rate of a Li-ion battery, with potentially serious consequences. For example, the recommended CC-phase current for a 60 Amp-hour Li-ion battery might be 20 Amps, so charging it routinely at 175 Amps will greatly exceed the maximum allowable fast-charge current, particularly if the battery is cold.

A further issue is that the safe functioning of the type of charging regime described in Figure 1 is dependent on the correct operation of the charging device. If alternator runaway occurs (an uncontrolled rise in alternator voltage caused by a component failure), both charge voltage and float charge current can become excessive. For example, a regulator failure or the loss of a ground path might cause the voltage of an alternator in a 12 volt system to rise from around 14 volts to around 17 volts.

In such a case, while this component failure may lead in a conventional installation to destructive venting of a PbAc battery, the consequences are not generally hazardous. Provided the battery box is ventilated, the chances of fire or explosion occurring are minimal. By contrast, such an event with an unprotected Li-ion battery circuit may have severe consequences, since the difference between a normal charge voltage and the onset of accelerated electrolyte breakdown can be as little as 0.2 volts per cell; a more substantial overvoltage for a significant period can lead to venting of inflammable electrolyte and even thermal runaway where exothermic breakdown of the cell produces oxygen and thus a self-sustaining conflagration. This clearly poses a significant risk of damage to the vehicle and injury to the occupants.

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A further issue with substituting batteries concerns the management of charging dependent upon the temperature. PbAc cells have a very wide allowable temperature range for charging and discharging, both ranges being substantially the same. This wider range means that in most applications, operating temperature limits do not have to be applied.

Li-ion cells typically have temperature limits for charging that are more restrictive than those for discharge. For example a battery may be usable as a power source down to temperatures of -20ºC, while charging might be prohibited below 0ºC.

In the case of a road vehicle, yacht or aircraft battery left in a cold environment overnight, for example in winter, the unit might be fully capable of cranking a starter motor in the morning while at the same time being below the manufacturer's minimum charging temperature. In order for a BMS to protect the battery, it must be able to inhibit charging while it is outside the permissible temperature range. If the battery is permanently connected to the bus bar as depicted in Figure 2, this cannot be achieved. The consequences may not be immediate, but there is a heightened risk of early cell failure and even thermal runaway.

Over-discharge can occasionally happen in the types of system described here. Car headlights may be left on overnight, or a boat owner may fail to turn off some small load, leaving it on for extended periods of time. PbAc cells generally survive occasional over-discharge satisfactorily, although with some types of PbAc cells, repeated deep discharge may shorten battery life. A fully discharged PbAc battery may freeze and crack its case but otherwise a fully discharged PbAc battery can normally simply be connected up to a power source, after which it will recover to normal operation. A familiar example is the use of jump leads to start a car with a discharged battery.

Again, Li-ion cells are much more sensitive in that a cell discharged to below about 2 volts may be permanently damaged. A cell within a battery that is discharged down to the point of voltage reversal will almost certainly be destroyed. For this reason, equipment powered by Li-ion batteries will in general require the battery to be isolated or recharged once a given level of discharge is reached.

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The above problem poses a challenge to the installation or retro-fitting of Li-ion batteries in applications where PbAc or Ni-Cad batteries are conventionally used. It has been known for Li-ion batteries sold as PbAc replacements simply to consist of a unit containing cells, connectors and terminal posts with no battery management system (BMS) and no way of disconnecting the battery if its limits are exceeded. Such a system is clearly a fire risk and will probably have a short life. If the cells were balanced before assembly and the battery were installed in a temperate environment, charged to a relatively low peak voltage and never seriously over-discharged, the system might last some time without mishap.

In general, proprietary drop-in replacement Li-ion battery packs will as a minimum incorporate a simple Li-ion battery management system, often within the battery casing. This typically will be configured to equalise the charge of all the individual cells in the battery within acceptable voltage limits, and may have an output to shut down an external charger.

In the type of application considered here, installing a BMS without additional components is of limited benefit. There is little the BMS can do other than attempt equalisation and it cannot protect the battery against excessive voltage, over discharge or float charge without the insertion of relays, contactors or power transistors to turn off power.

Some systems incorporate a heavy duty relay controlled by the BMS which can disconnect the battery if the BMS detects an error (Figure 4). This serves to protect the battery, for example in the event of alternator runaway or when the battery is outside the acceptable temperature range.

While this arrangement addresses some risks, there remain several difficulties. If the BMS opens the relay whilst a high current (potentially 100 amps or more) is flowing in the system, this may cause severe voltage spikes which can damage or destroy equipment connected to the system. The alternator and/or other connected equipment tends to rely on the battery acting as a large buffer to smooth out smaller but more frequent voltage spikes arising elsewhere in the system. Running the alternator with the battery disconnected can damage other sensitive electronic equipment such as Engine Control

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Units (ECUs). Incorporation of one or more large capacitors could be used to mitigate this but this adds to the cost and weight.

This approach is also not suitable for preventing high charge currents, since if the allowable peak charge current is set below the peak output of the alternator, it will trip whenever the alternator is operating at peak output, preventing the battery from being charged. Similarly, isolating the battery when it is fully charged to prevent float charging would mean that the battery would have to be offline, i.e. disconnected form the bus, for much of the time, which would not be acceptable in many applications.

A possible refinement is to permit the BMS to control the alternator output. In most practical configurations, however, the alternator is not just required to charge the battery. Interfering with the alternator output may compromise the operation of other electrical equipment. Furthermore, many modern alternators have internal regulation which means that implementing this configuration in an existing installation would require replacing the alternator as well as the battery.

Given the limitations of the solutions described above, another recognised approach is to use a supplementary PbAc battery in parallel with the Li-ion battery. This configuration can overcome some of the difficulties discussed above since it enables the BMS and an isolator to disconnect the Li-ion battery when fully charged so as to avoid float charging and also to prevent low temperature charging. The PbAc battery in parallel will act as a buffer which will largely eliminate the issues which would otherwise arise each time the Li-ion battery is disconnected. However, the need for a second battery adds back bulk and weight to the system, negating the gains which may have been a reason for preferring Li-ion batteries in the first place. It also adds complexity and another point of failure into the system. Furthermore, it adds to installation and maintenance costs. Effective control of charging current is also difficult in such an arrangement due to the differing requirements of the two battery technologies.

There is therefore a need for a solution which allows for the use of Li-ion type batteries without the problems described above. It is particularly desirable to provide a solution which can be used in existing installations without needing modification. The ability to be able to substitute a PbAc or other battery in an existing system without needing to modify

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the system is desirable. The present invention aims to solve or at least ameliorate some of those problems.

Therefore according to the present invention there is provided a battery connection system for connection to a rechargeable battery, the system including: a first connection for connection to said battery; a second connection; a first unidirectional current path arranged to allow current flow in only a first direction between the first connection and the second connection to provide a discharge path; a second unidirectional current path arranged to allow current flow in only a second direction, opposite to the first direction, between the first connection and the second connection to provide a charging path; and a current controller for controlling the current flow through said second unidirectional current path.

The use of separate charge and discharge current paths in combination restores full control to the charging process whilst providing the advantages of having the battery connected for supplying power to a bus. This arrangement allows charging to be positively terminated without taking the battery off line. This also allows charging to be terminated at a low current, avoiding damaging voltage spikes associated with interrupting a large current. Charging can be prevented if the cell temperatures are outside the permitted temperature range, while still enabling the battery to provide power.

The effective peak voltage at the battery terminals can be controlled in circumstances where the alternator rated output voltage exceeds allowable limits for the battery. In this way, the battery is effectively protected in the event of unexpected high voltages such as those caused by alternator runaway.

The charge current can be limited to suit the BMS requirements regardless of alternator output which allows constant current/constant voltage charge management of the required profile to optimise safety and battery life. The battery can still be safely isolated if it reaches a specified discharge voltage limit or if cell temperatures exceed the limits for discharge. The battery may be recharged using a simple proprietary PbAc charger which can safely be connected and left unattended. Similarly, the battery can also be recharged by connecting to other power sources including solar or wind generators provided their voltage and current outputs were adequate.

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The first unidirectional current path may include a power diode, a power transistor or other similar switching element to provide a unidirectional current flow, for preventing current flowing in a direction opposite to said first direction. This allows discharge current to flow between the first and second connections whilst preventing a charging current flowing back into the battery.

The second unidirectional current path may include a power diode, a power transistor or other similar switching element to provide a unidirectional current flow, for preventing current flowing in a direction opposite to said second direction. This allows a charging current to flow into the battery whilst preventing a discharge current flowing from the battery.

The second unidirectional current path preferably includes a power transistor controlled by said current controller, for controlling the current flow through said second unidirectional connection in said second direction. The second unidirectional current path may include one or more variable output DC to DC converters, controlled by said current controller, for controlling the current flow through said second unidirectional current path in said second direction. These allow the current to be controlled to control the charging of the battery independent of the voltage on the second connection, which may be connected to an alternator or other power source where the precise output voltage cannot or is not readily controlled.

The present invention may also provide a rechargeable power source including a battery connection system such as that described above in combination with a battery. These may be packaged in the same case or provided as separate elements. However, by providing them in a combined unit, a convenient drop-in replacement for existing PbAc systems can be provided with no modifications required to the rest of the electrical system.

Such a battery is preferably a Li-ion battery.

In the rechargeable power source, there is preferably provided a positive output of the rechargeable power source connected to the second connection of the battery connection system, with the first connection of the battery connection system connected to the positive terminal of the battery. The rechargeable power source is preferably also

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provided with a negative output connected to a negative terminal of the battery. In this arrangement, discharge current can flow from the battery into the first connection and then out of the second connection.

As an alternative, the rechargeable power source may be provided with a negative output connected to the second connection of the battery connection system, with the first connection of the battery connection system connected to the negative terminal of the battery. Such a rechargeable power source is preferably also provided with a positive output connected to a positive terminal of the battery. In this arrangement, discharge current can flow into the second connection and then out of the first connection and into the battery.

The rechargeable power source may be provided with a capacitor and preferably capacitor control means for selectively connecting the capacitor between the positive power connection and the negative power connection of the rechargeable power source.

The rechargeable power source may further comprise an alternative power source connected to a common power bus in parallel with the rechargeable power source. For example, an alternator may be provided connected to a mechanical power source or a solar or wind generator may provide a power source.

Such alternative power source may produce an unregulated voltage. This may not be ideal for charging batteries where careful control of charging is desirable, such as Li-ion batteries. However with the invention, the charging current can be controlled whilst still leaving the battery connected to a bus or other power providing connection.

The rechargeable power source may include one or more of the elements described above such as the battery and capacitor, which may be provided in a single unit. The unit may also include other elements such as a BMS, a charging module etc. in the same case, to provide the simple drop-in replacement mentioned above.

The current controller may be integrated with the BMS or may operate in conjunction with a separate BMS.

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In the above arrangements, the first connection is preferably connected to one of the battery terminals whilst the second connection is preferably connected to a bus or other load/recharging power source connection.

Specific examples of the present invention will now be described in more detail by reference to the following drawings in which:

Figure 1 shows a typical CC/CV charge profile for a Li-ion cell or battery;

Figure 2 shows a schematic layout of a typical low voltage DC bus system in a road vehicle;

Figure 3 shows a typical unregulated charge profile for a conventional cell or battery;

Figure 4 shows one arrangement for protecting a Li-ion battery application;

Figure 5 shows the layout of an embodiment according to the present invention;

Figure 6 shows an example of a charging module;

Figure 7 shows a schematic circuit layout of a bus based system using the charging system of the invention;

Figure 8 shows the layout of an alternative embodiment according to the present invention;

Figure 9 shows an example of an alternative charging module;

Figure 10 shows a further example of a charging module; and

Figure 11 shows a schematic circuit layout of a bus based system using an alternative charging system of the invention.

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The arrangement shown in Figure 5 has a modified structure compared to the prior art arrangement of Figure 2. Instead of a single wire connecting one of the battery terminals (the positive terminal in Figure 2) to the bus, the connection between the battery 500 and the bus is provided by two separate connections 503, 504, each providing a unidirectional current path. Current flows out of the battery 500 through one path 503 to the bus 102 to provide power the system when the alternator 104 or other power source is not supplying power. When the alternator is running or another source of power is available, current flows from the bus 102 to the battery 500 via the other current path 504 during charging.

The current flowing into the battery is modulated by a charging module 501 which controls the charging process. The charging module 501 is controlled by the BMS 502. The BMS is shown as a separate unit to the charging module 501 but the charging module and the BMS could be integrated into a single unit. Both units may also be integrated into a single unit along with the battery to provide a simple "drop-in" replacement for a PbAc battery or similar.

Figure 6 shows a simplified example of the charging module 501. The bus connection 504 is selectively switched to the battery connection under the control of a charge controller 601. The charge controller can control the voltage and current provided to the battery, for example by using PWM to control the connection. It may also disconnect the battery from the bus when charging is not required, for example then there is no external power source or the battery is fully charged.

The schematic circuit layout of a bus system using the invention is shown in Figure 7. The alternator 104 is connected to the bus 102 along with ancillary components 103 (103a, 103b, 103c). The diode symbols shown in Figure 7 represent the unidirectional paths to and from the battery to the bus. Whilst diodes may be used, other means or limiting the direction of flow of the current may be used, e.g. power transistors.

This configuration allows the charging module 501 to control key charge parameters including charging voltage, charging current, operating temperature and charge termination, so that the battery is provided with an appropriate charge profile such as that shown in Figure 1. This control is achieved without interfering with the functioning of the alternator or other power source.

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The "out" or "discharge" current path 503 allows current to flow from the battery to the bus should the voltage on the bus drop, e.g. if the alternator is no longer providing power. The connection 503 may be configured to also selectively block or regulate current out of the battery as well as into the battery. This may be desirable if the battery is at risk of being discharged more than desirable or if the temperature of the battery is outside the desirable operating range. This would generally be controlled by the BMS.

In this arrangement, the battery 500 is normally connected to the bus via connection 503 providing the benefits of a permanently connected battery but the battery can still be disconnected in extreme circumstances to prevent load current out of the battery, particularly where the battery is heavily discharged.

Adverse consequences can result from variation or ripple on the bus voltage. This may be positive or negative, i.e. with the voltage rising above and below the nominal bus voltage. With the arrangement of this embodiment, the negative component of the voltage ripple can be minimised. If at any instant the bus voltage drops, the battery which is connected via connection 503 is able to supply additional current to the bus to correct the voltage drop, irrespective and independent of whether the charging circuit has connected the bus to the battery at that point.

In a conventional system, positive ripple can also be controlled by directly connecting to the battery and using it to sink excess current. An increase in bus voltage will increase the current into the battery which will help to reduce the additional voltage on the bus. As noted above, it is not desirable to use Li-ion batteries in this way. Connecting a Li-ion battery to the bus in this way, without regulation can lead to large charging currents with undesirable consequences. In this arrangement, the unidirectional connection 503, would prevent current flowing from the bus to the battery and causing damage.

However, to absorb the positive part of any DC ripple, the charging module may be arranged to selectively connect a large capacitor 505 to the bus 102 when required. The capacitor would typically be pre-charged to a voltage close to or equal to the desired bus voltage and connected when the bus voltage rises above the desired voltage. The capacitor is pre-charged to avoid a large voltage differential when it is connected to the bus, which could lead to a large current and potential damage to the switching

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components or other components on the bus. When it is connected, the capacitor will then tend to limit a rise in voltage on the bus by absorbing current.

Alternatively, the charging module may be arranged to selectively connect a resistor to the bus 102 in order to sink excess current and restrain the bus voltage.

Figure 8 shows an alternative arrangement where the charging module 601 is put in the negative current path. The approach is logically identical to the arrangement of Figure 5 but the charging module 601 is placed between battery 500 and earth rather than between the bus 102 and the battery. With some types of switching device, this may slightly simplify the control electronics.

In this arrangement, the positive terminal of the battery 500 is connected directly to the bus 102. A unidirectional connection 703 is provided between the negative terminal and earth to provide a path for current flow when the battery is providing power to the system. The earth effectively provides the negative bus for the system. In a vehicle such as a car, the earth is provide by the metal chassis and body. This allows the body to be used as the return path so that only a single positive connection is needed to be provided to the ancillary device or alternator for operation.

When the battery is not required to power the system and an alternative power source is available, then the battery may be charged via the connection 704 to the charging module 601. The charging module 601 controls the current and voltage applied to the battery during charging to provide the desired charging profile, such as that set out in claim 1. The charging module 601 operates in a similar way to the charging unit 501.

There are a number of possible methods for implementing the approach illustrated in Figures 5 and 8. For example the charging module 501, 601 may use one or more electronic power switching devices, for example Field Effect Transistors ("FETs") or Insulated-Gate Bipolar Transistors ("IGBTs") or an array of such devices in order to modulate or completely shut off current and voltage. The device or devices will function in much the same way that a DC motor controller operates by pulse width modulation ("PWM").

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Figure 9 shows an example of a charging module which uses a MOSFET for controlling current and voltage. These devices are effectively very fast acting electronic switches. The charge controller 701 typically includes a microcontroller which controls the electronic switches to modulate current by switching them rapidly on and off hundreds or even thousands of times a second. The ratio of "on" time to "off" time governs the effective output. As shown in Figure 9, the charging module 601 is arranged between the battery and earth rather than between the bus bar and the battery. In this arrangement, the FETs or alternatively IGBTs are put in the negative current path. The example shown in Figure 9 is based on a MOSFET 703 as a switch or voltage controller. The charge controller 701 would govern the current flow by outputting a PWM control signal to the FET under the control 702 of the BMS. The ratio of on-time to off-time in the pulses would determine the current flow from the battery in order to set the correct charging current.

The complete installation would require additional components (freewheeling diodes, pull-down resistors, capacitors etc.) to prevent damage to components and ensure their proper operation. These have been omitted for clarity since they are standard requirements which do not have any bearing on the principle of operation of the solution described here.

Figure 9 shows an alternative arrangement for the charging module 501, in which the power from an engine-driven alternator could be used to drive a DC-DC converter. Figure 9 shows an overview of a charging module 501 including a DC-DC converter 903. The charging module shown assumes an arrangement similar to that shown in Figure 5 with the charging module provided between the bus and the battery. Figure 9 shows a typical implementation of the charging module 501, again incorporating a low voltage microcontroller 901 similar to that in the previous example, to control a DC-DC converter 903. The microcontroller 901 would trim the output of the DC-DC converter to control the current provided to the battery to maintain the chosen charge profile. The microcontroller 901 may be controlled by control signals 902 from the BMS.

The DC-DC converter may be a single unit or may be formed from an array of variable-output DC-DC converters. Some proprietary DC-DC converters can output hundreds of watts and permit voltage trimming above and below nominal, and/or output voltages higher than the input. Some of these converters can be used in parallel for higher power.

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The arrangements above make use of separate charge and discharge current paths in combination with a charging module and BMS. This allows full control of the charging process so that charging can be positively terminated without taking the battery off line. Also by terminating charging at a low current, the risk of damaging voltage spikes associated with interrupting a large current are avoided.

Also, as the charging can be controlled, charging can be prevented if the battery/cell temperatures are outside the permitted temperature range for charging. As noted above, whilst the temperature may be outside of an acceptable range for charging purposes, the temperature may be still within an acceptable range for discharge, allowing the battery to continue to supply power if needed and also provide the voltage regulation effect.

The effective peak voltage at the battery terminals can be controlled in circumstances where the alternator rated output voltage exceeds allowable/desirable limits for the battery. In this way, the battery is effectively protected in the event of unexpected high voltages such as those caused by alternator runaway.

The charge current can be limited to suit the BMS requirements regardless of alternator output. This allows CC/CV charge management with the required profile to optimise safety and battery life.

Once the battery has reached a specified discharge voltage, it can be safely isolated. Similarly, if cell temperatures exceed (or fall below) the limits for discharge the battery can be isolated. The system can be connected to a conventional battery charger of the type typically used for PbAc batteries. The charger would be connected to the bus to provide the source of power. However, the charging controller would then ensure that the correct charging profile was used to manage charging of the battery. This avoids the need for special Li-ion chargers where external charging of the battery is required. Again a conventional trickle charger designed for maintaining a PbAc battery can be used since the BMS would allow charging to take place until the Li-ion battery had reached the desired level of charge and then simply isolate the battery from the bus, although the battery would still be connected to the bus via the unidirectional connection 503, should it be required.

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The battery could also be recharged by connecting to other power sources including solar or wind generators provided their voltage and current outputs were adequate. Again, the regulation of the current and voltage provided by these sources is less critical as the charging is controlled by the charging module, as long as the sources were able to provide sufficient power.

In the arrangements described above, the BMS and charging modules are shown separately. However, the elements such as the cells, BMS, charging module, by-pass capacitors can be packaged in the same case, providing drop-in replacement in existing PbAc systems with no modifications required to the rest of the electrical system. Equally, the BMS and charging module may be provided separately so that they do not need to be replaced when the battery replaced.

The invention may also be embodied in a separate unit connected between the battery and the bus to allow a basic Li-ion battery to be used with one terminal connected to earth or the positive bus (as shown in figures 5 and 8 respectively) and a separate unit incorporating the two unidirectional connections provided between the other battery terminal and the positive bus and earth respectively.

Whilst in most applications, multiple cells are required to form a battery, the invention is still applicable to single cells and references to battery should be considered to be applicable to a cell and vice versa in this document.

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CLAIMS

1. A battery connection system for connection to a rechargeable battery, the system including:

a first connection for connection to said battery;

a second connection;

a first unidirectional current path arranged to allow current flow in only a first direction between the first connection and the second connection to provide a discharge path;

a second unidirectional current path arranged to allow current flow in only a second direction, opposite to the first direction, between the first connection and the second connection to provide a charging path; and

a current controller for controlling the current flow through said second unidirectional current path.

2. A battery connection system according to claim 1 wherein said first unidirectional current path includes at least one of a power diode and a power transistor, for preventing current flowing in a direction opposite to said first direction.

3. A battery connection system according to claim 1 or 2 wherein said second unidirectional current path includes at least one of a power diode and a power transistor, for preventing current flowing in a direction opposite to said second direction.

4. A battery connection system according to any preceding claim wherein said second unidirectional current path includes a power transistor controlled by said current controller, for controlling the current flow through said second unidirectional connection.

5. A battery connection system according to any preceding claim wherein said second unidirectional current path includes one or more variable output DC to DC converters, controlled by said current controller, for controlling the current flow through said second unidirectional current path.

6. A rechargeable power source including a battery connection system according to any one of the preceding claims and further comprising a battery.

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7. A rechargeable power source according to claim 6 wherein said battery is a Lithium ion battery.

8. A rechargeable power source according to claim 6 or 7, further comprising:

a positive output connected to said second connection of the battery connection system, wherein said first connection of the battery connection system is connected to a positive terminal of said battery; and

a negative output connected to a negative terminal of said battery.

9. A rechargeable power source according to claim 6 or 7, further comprising:

a negative output connected to said second connection of the battery connection system, wherein said first connection of the battery connection system is connected to a negative terminal of said battery; and

a positive output connected to a positive terminal of said battery.

10. A rechargeable power source according to any one of claims 6 to 9, further comprising a capacitor and capacitor control means for selectively connecting the capacitor between said positive power connection and said negative power connection of said rechargeable power source.

11. A rechargeable power source according to any one of claims 6 to 10 further comprising an alternative power source connected to a common power bus in parallel with said rechargeable power source.

12. A rechargeable power source according to claim 11 wherein said alternative power source is a mechanically powered alternator.

13. A rechargeable power source according to claim 11 wherein said alternative power source produces an unregulated voltage.

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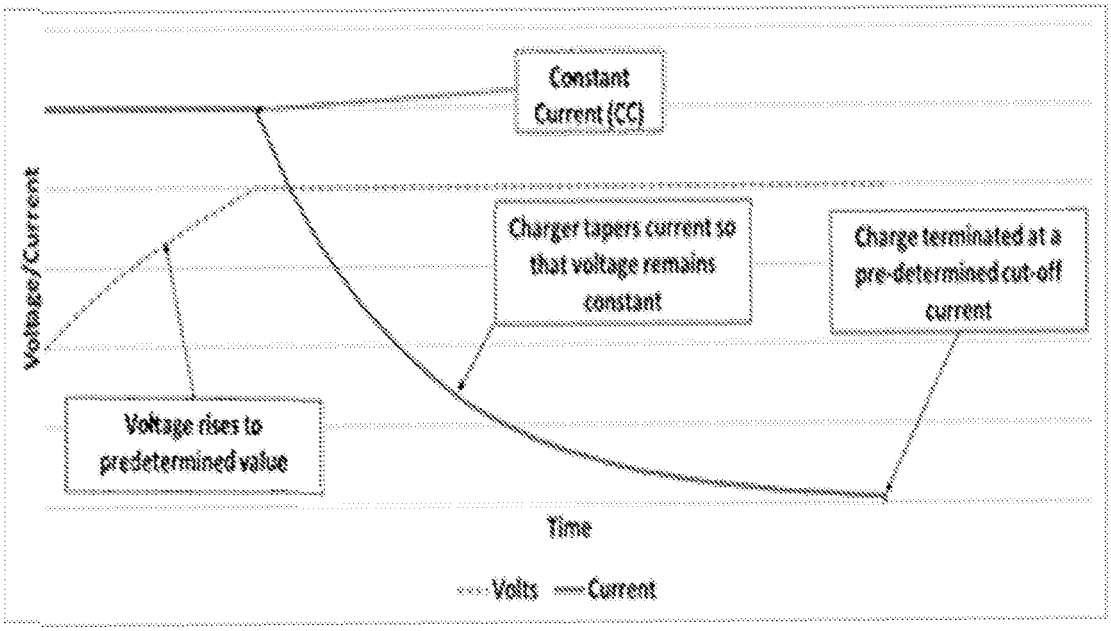


Figure 1

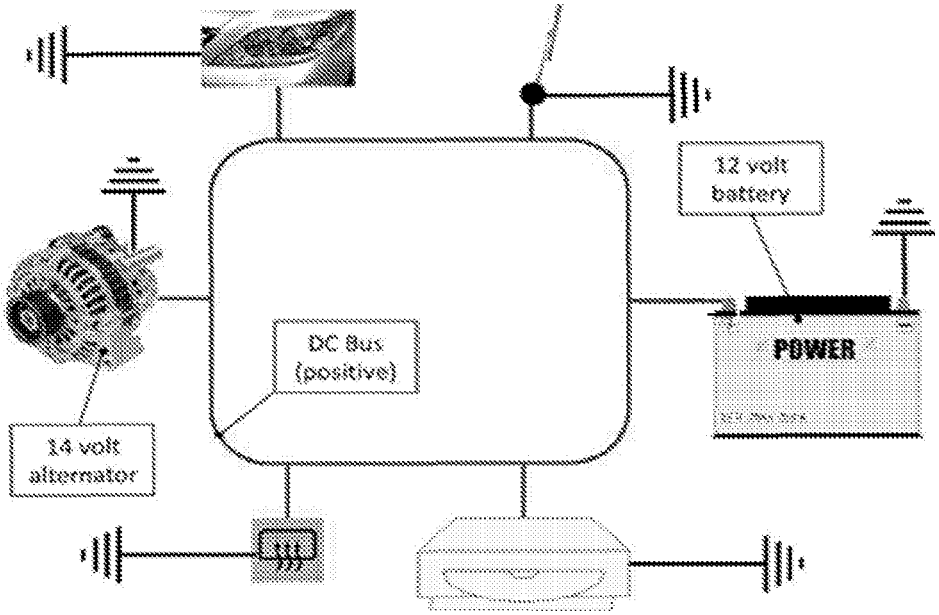


Figure 2

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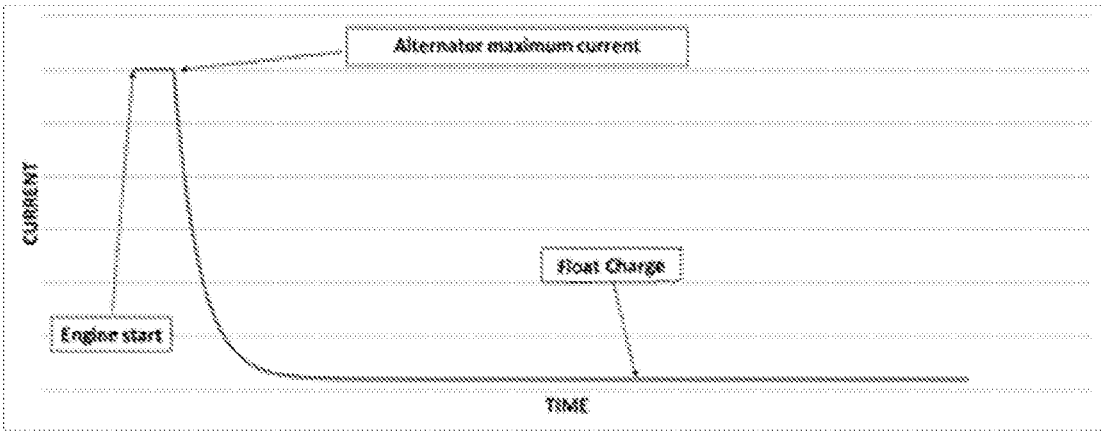


Figure 3

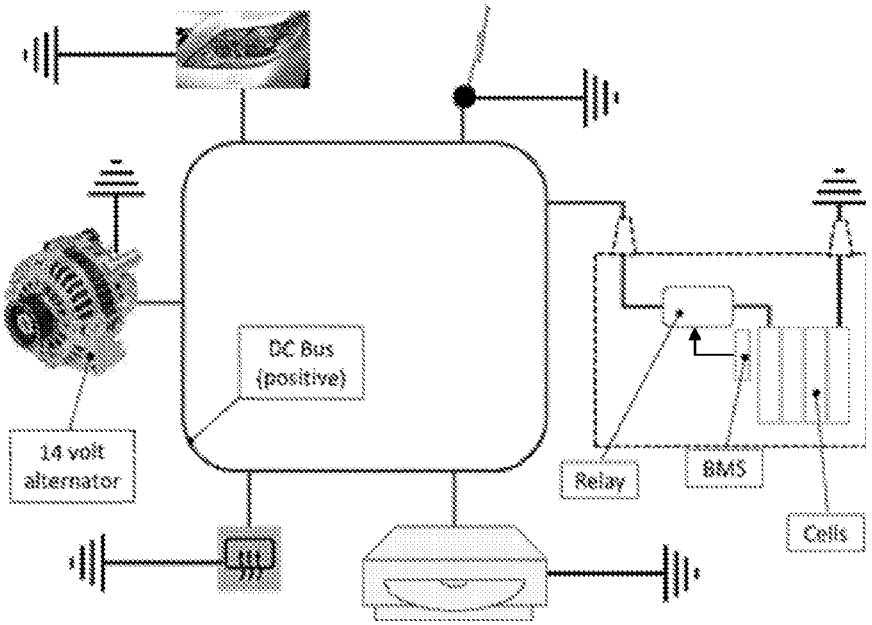


Figure 4

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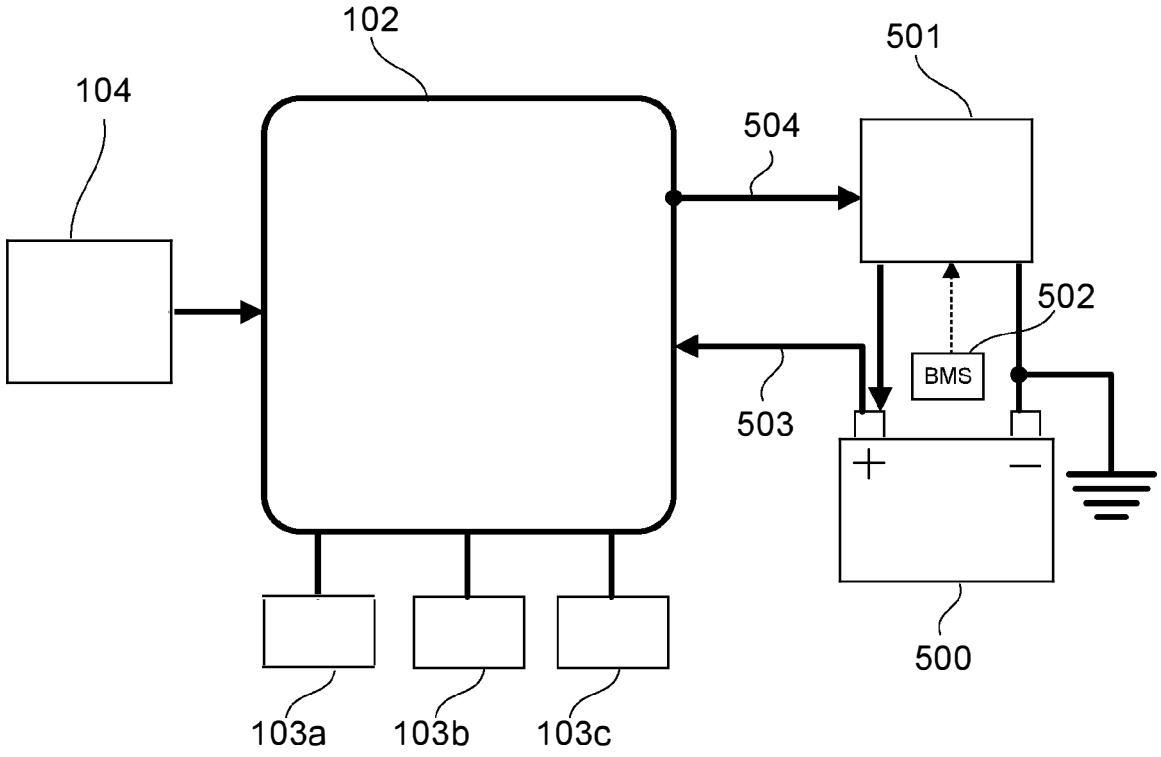


Figure 5

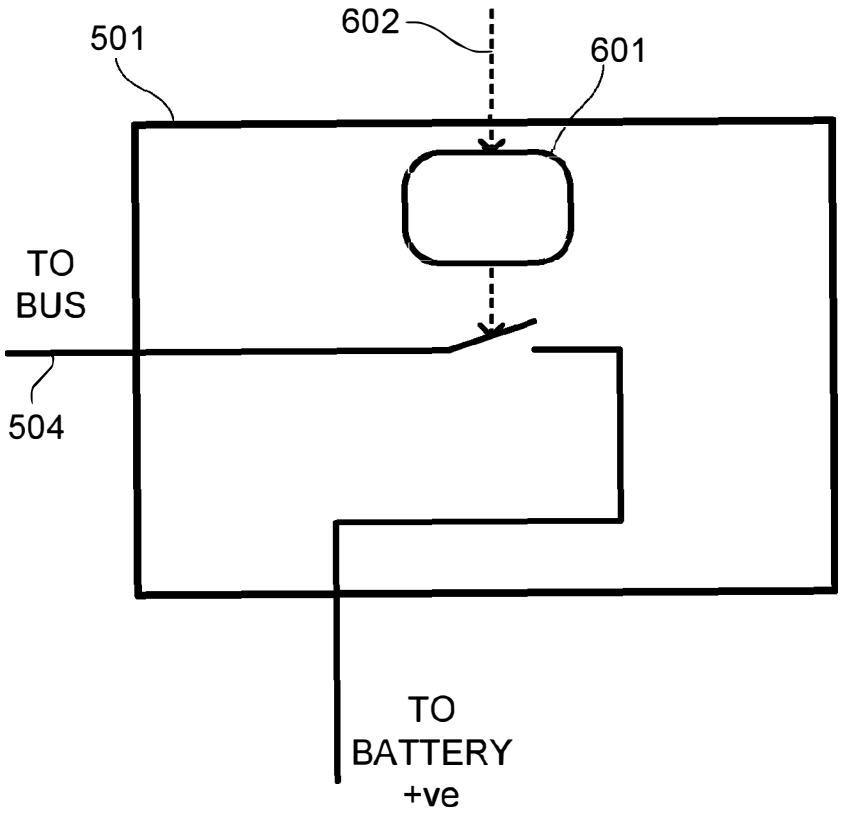


Figure 6

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Petitioner ADC (IPR2024-00577)

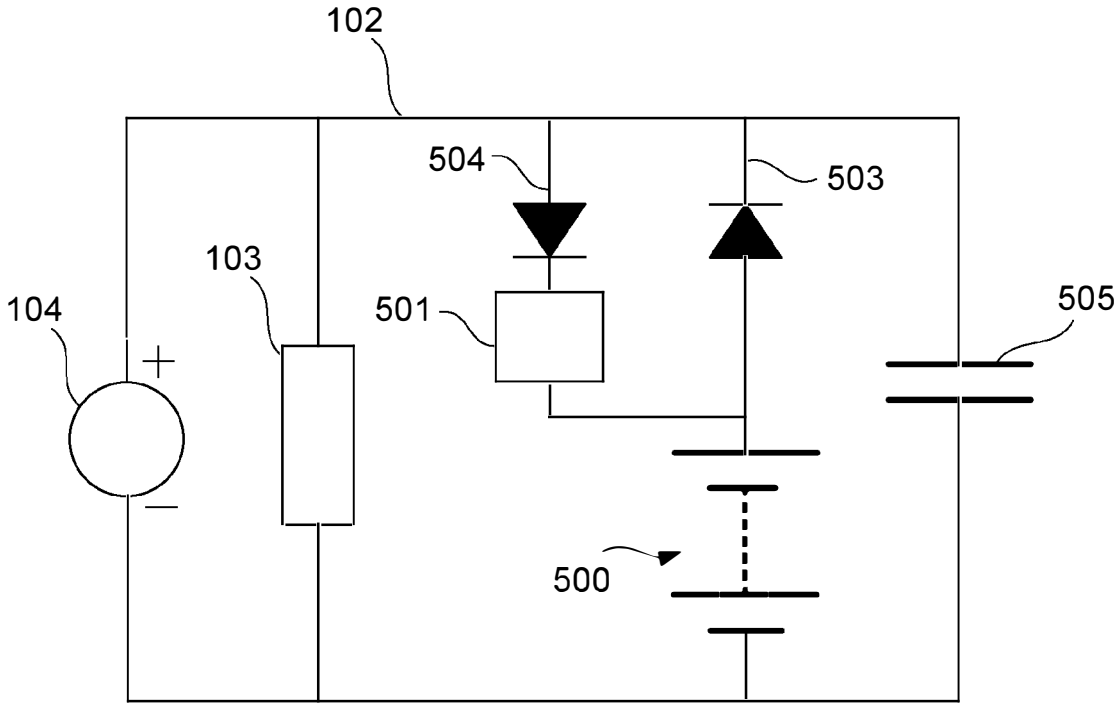


Figure 7

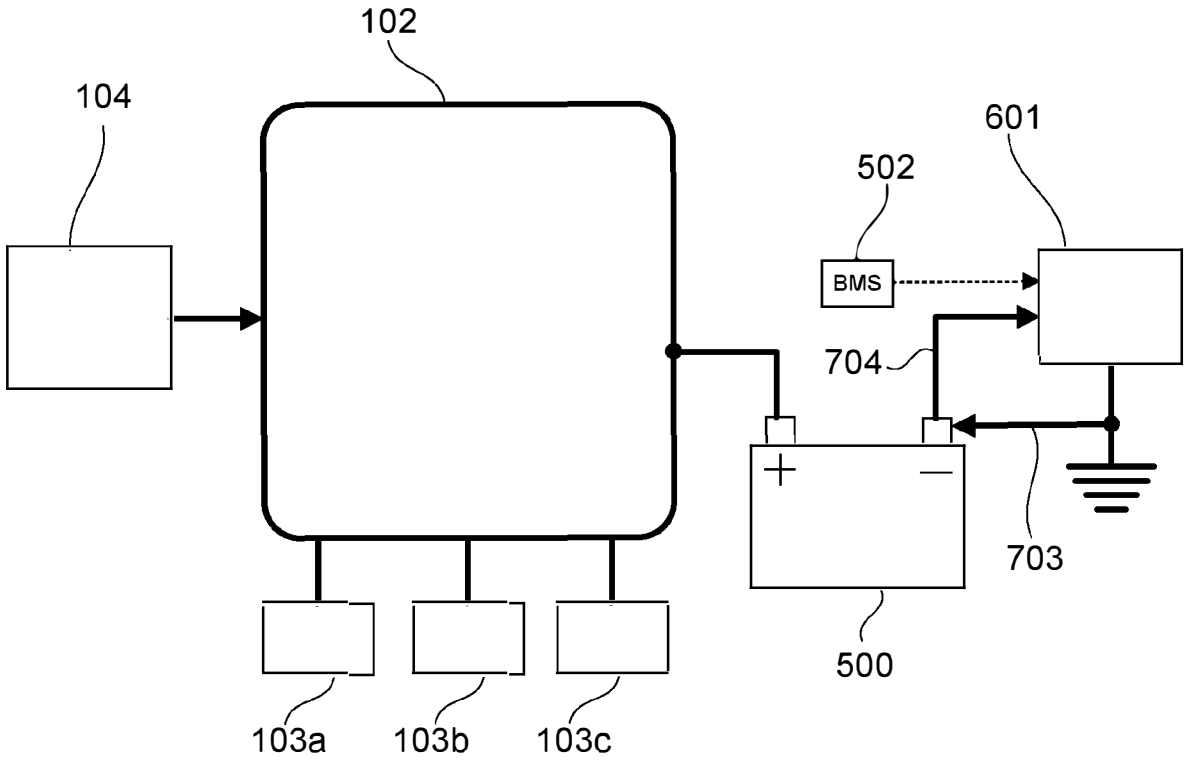


Figure 8

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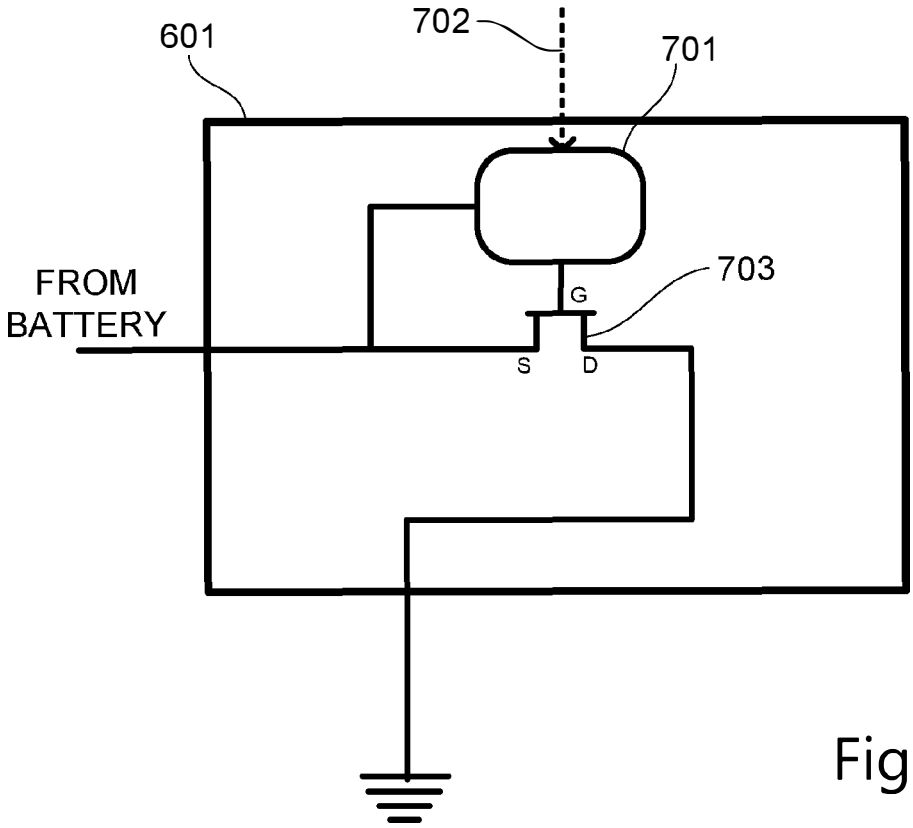


Figure 9

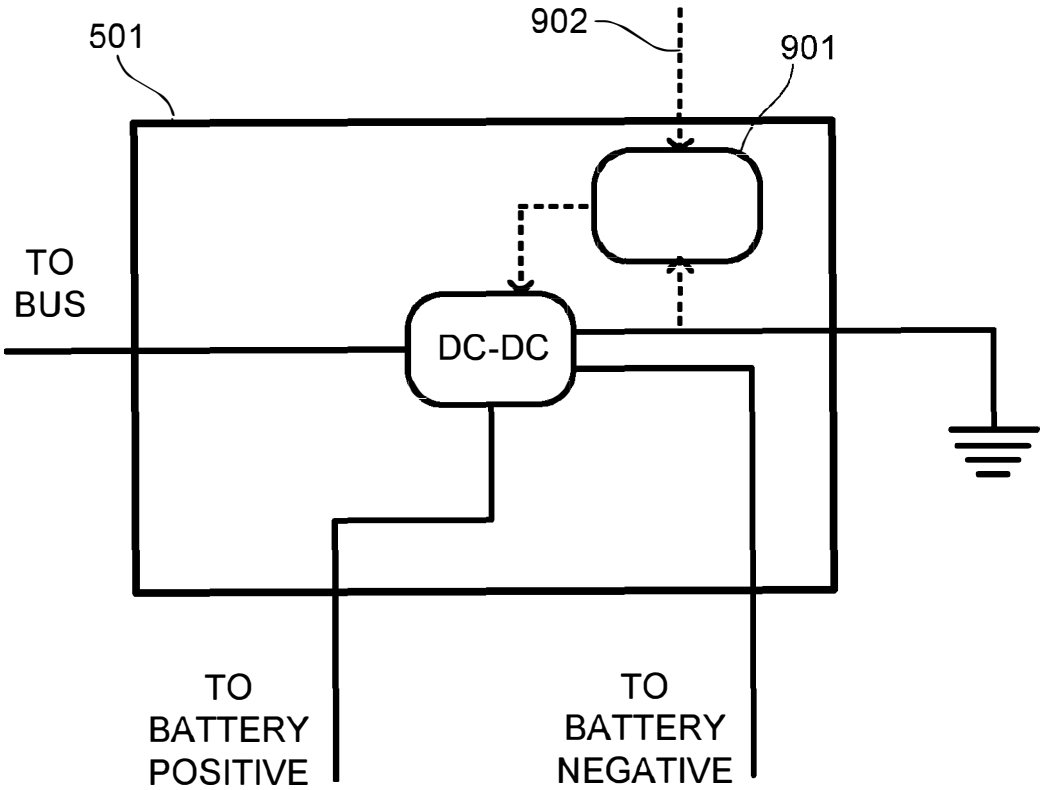


Figure 10

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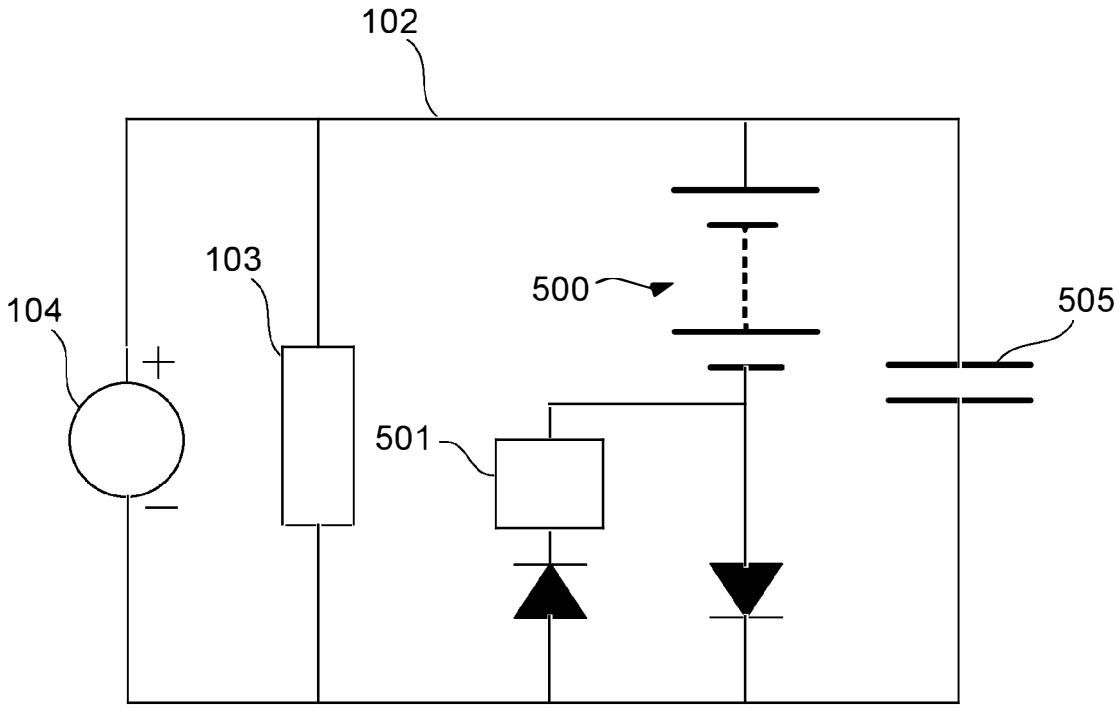


Figure 11

EXHIBIT 1002
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INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2018/052111

A. CLASSIFICATION OF SUBJECT MATTER
INV. H02J7/14 H02J7/00 H02J7/34
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)
H02J

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)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	EP 2 605 364 A2 (SAMSUNG SDI CO LTD [KR]) 19 June 2013 (2013-06-19) paragraphs [0033], [0037], [0041], [0051], [0054], [0056], [0057], [0060]; claim 1; figures 1, 4, 5	1-9, 11-13 10
X	US 5 789 900 A (HASEGAWA HIROYUKI [JP] ET AL) 4 August 1998 (1998-08-04) column 4, line 1 - line 2; figure 10	1-4,6-9
Y	US 8 203 810 B2 (BRYAN LYLE STANLEY [US]; COWAN JOHN STEVEN [US]; TYCO ELECTRONICS CORP) 19 June 2012 (2012-06-19) figure 1	10

☐ 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 2018	06/09/2018

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	Sulic, Tomislav

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Form PCT/ISA/210 (second sheet) (April 2005)

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2018/052111

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2605364 A2	19-06-2013	CN 103165946 A	19-06-2013
		EP 2605364 A2	19-06-2013
		KR 20130069527 A	26-06-2013
		US 2013154371 A1	20-06-2013
US 5789900 A	04-08-1998	NONE	
US 8203810 B2	19-06-2012	CA 2647732 A1	11-10-2007
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		US 2007230229 A1	04-10-2007
		WO 2007114929 A2	11-10-2007

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Espacenet

CN204966731U Multi -functional output terminal of charger heavy current

Applicants: PRIME ELECTRIC (SHENZHEN) CO LTD

Inventors: SHEN XIAOLONG

Classifications:
IPC ***H01R11/12; H01R11/22; H01R4/02; H01R4/20;***

Priorities: CN201520652164U 2015-08-26

Application: CN204966731U·2015-08-26

Publication: CN204966731U·2016-01-13

Published as: CN204966731U

Multi -functional output terminal of charger heavy current

Abstract

The utility model provides a multi -functional output terminal of charger heavy current can give big electricity charging utensils family, provides the selection of plugging into of two kinds of batteries: with line ear snap -on to battery terminal, remove with the provisional battery terminal of plugging into of pliers when using during stationary use. The problem of " line ear + pliers " dual - purpose combination under the condition of heavy current, the line to tong arm binding site seriously generate heat and the pressure drop big is solved. Thereby avoid scalding one's hand, charging voltage is low and a series of problems such as vicious circle of " generate heat - end of a thread oxidation - pressure drop increase - generate heat the aggravation ".

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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

(10)授权公告号 CN 204966731 U
(45)授权公告日 2016.01.13

(21)申请号 201520652164.2

(22)申请日 2015.08.26

(73)专利权人 雅德电业(深圳)有限公司
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(72)发明人 中小龙

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代理人 罗志强

(51)Int.Cl.
H01R 11/12(2006.01)
H01R 11/22(2006.01)
H01R 4/02(2006.01)
H01R 4/20(2006.01)

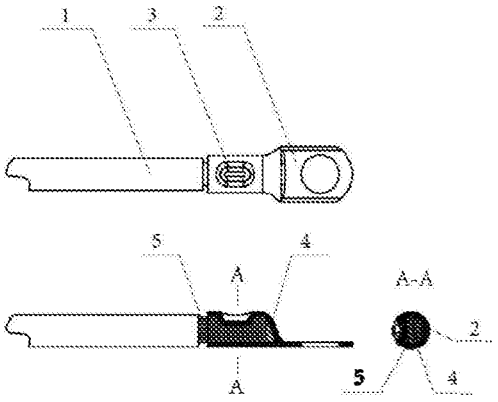
权利要求书1页 说明书3页 附图3页

(54)实用新型名称

一种充电器大电流多功能输出端子

(57)摘要

本实用新型提供了一种充电器大电流多功能输出端子，可以给大电流充电器用户，提供两种电池接驳选择：固定使用时用线耳直接固定到电池端子，移动使用时用钳子临时性接驳电池端子。解决了“线耳 钳子”两用组合在大电流的情况下，线到钳臂结合部位严重发热及压降大问题。从而避免烫手、充电电压低以及“发热－线头氧化－压降增大－发热加剧”的恶性循环等一系列的问题。



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1. 一种充电器大电流多功能输出端子，其特征在于：包括有可以直接固接在电池端子上的线耳结构和可以临时性接驳线耳机构的钳子结构，

所述线耳结构包括有输出线 (1) 及其末端铜丝 (5) 和线耳 (2)，所述末端铜丝固接于线耳 (2) 尾部线管内，所述末端铜丝 (5) 上覆盖有锡膏；

所述钳子结构包括有钳臂 (9)、钳子塑胶外壳 (11) 和设置在钳臂 (9) 末端用于临时性固定线耳结构的线耳连接结构。

2. 根据权利要求 1 所述的一种充电器大电流多功能输出端子，其特征还在于：所述铜丝 (5) 伸入线耳 (2) 尾部线管的固接方式为在线管上冲压出冲压口 (3)。

3. 根据权利要求 1 所述的一种充电器大电流多功能输出端子，其特征还在于：所述线耳连接结构包括有黄铜螺母 (6) 和塑胶压线扣 (14)。

4. 根据权利要求 3 所述的一种充电器大电流多功能输出端子，其特征还在于：所述黄铜螺母 (6) 通过铆压的方式植入钳臂 (9) 末端，并在螺母于钳臂表面接触边缘点焊。

5. 根据权利要求 3 所述的一种充电器大电流多功能输出端子，其特征还在于：所述黄铜螺母 (6) 为非倒角平面螺母。

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一种充电器大电流多功能输出端子

技术领域

[0001] 本实用新型涉及一种充电器大电流多功能输出端子，特别是一种可以固定固定使用和移动使用的充电器大电流多功能输出端子。

背景技术

[0002] 目前市面上也有“线耳 + 钳子”两用组合，但由于输出线头到钳臂结合部位内阻大，只能用到小电流 (<15Amp) 的充电器上。如果用于大电流充电器，电流一大，将会导致发热烫手、充电电压低，长时间使用出现“发热 - 线头氧化 - 压降增大 - 发热加剧”的恶性循环，导致接触不良，甚至火灾等严重后果。所以在一些大电流 (15-80A) 的充电器上，要么直接用线耳，要么直接用钳子。

[0003] 为什么传统输出线头到钳臂结合部位内阻大？传统的做法是直接冲压，由于铜丝是圆柱形，冲压后，铜丝与铜丝之间会有大量的虚位，铜丝与线管内壁有大量虚位，铜丝如果有散乱，内部虚位更会成倍增加，这种虚位会导致整体接触面减少，线束中心铜丝与周围铜丝接触不好，线束表面铜丝与线管内壁接触不好，因此整体结构的接触电阻就会很大，大电流的情况下，就会发热严重。而铜丝之间的虚位，给空气进入结构内部提供了有利条件，在发热情况下，很容易导致铜丝和线管内壁氧化，氧化会导致接触电阻的增大，实测经常出现几兆欧甚至更大电阻，这样的结果是加剧发热，恶性循环，最终接触不良，甚至出现火灾。可见传统结构，不但发热大，也非常不稳定。

实用新型内容

[0004] 本实用新型要解决的技术问题在于，针对现有技术的上述缺陷，提供针对现有技术中的不足，本实用新型要解决的技术问题在于提供了一种充电器大电流多功能输出端子。

[0005] 本实用新型解决其技术问题所采用的技术方案是：

[0006] 提供一种充电器大电流多功能输出端子，包括有可以直接固接在电池端子上的线耳结构和可以临时性接驳线耳机构的钳子结构，所述线耳结构包括有输出线及其末端铜丝和线耳，所述末端铜丝浸上低温锡膏后，伸入线耳尾部线管固接，并对所述尾部线管进行局部加热；所述钳子结构包括有钳臂、钳子塑胶外壳和设置在钳末端用于临时性固定线耳结构的线耳连接结构。

[0007] 优选的，铜丝伸入线耳尾部线管的固接方式为在线管上冲压出冲压口，目的是锁紧铜丝与线耳，避免意外分离。

[0008] 优选的，线耳连接结构包括有黄铜螺母和塑胶压线扣，用来固定线耳，使线耳子与钳子固定成一个整体，使用时随时可以拆卸收藏。

[0009] 优选的，黄铜螺母通过铆压的方式植入钳臂末端，并在螺母于钳臂表面接触边缘点焊，这种“铆压 + 点焊”的结构方式，为螺母与钳臂提供了充分的接触和可靠的强度，避免操作扭力和热应力导致螺母与钳臂出现松动和接触不好现象。

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[0010] 优选的，黄铜螺母为非倒角平面螺母，为线耳的安装提供了足够的接触面，尽可能的减少了接触电阻。

[0011] 一种充电器大电流多功能输出端子，本实用新型的有益效果是：通过有效减低线耳于铜线之间的电阻，进一步降低了大电流充电时产生的发热量，从而为大电流充电提供了固定充电和移动充电两种可供客户自由选择的充电方式，提高了大电流充电的安全性，方便客户使用，以及避免了烫手、充电电压低以及“发热－线头氧化－压降增大－发热加剧”的恶性循环等一系列的问题。

附图说明

[0012] 下面将结合附图及实施例对本实用新型作进一步说明：

[0013] 图 1 大电流充电器输出线通过线耳直接连接电池电极端示意图

[0014] 图 2 大电流充电器输出线通过“线耳＋钳子”连接电池电极端示意图

[0015] 图 3 线耳与输出线连接处结构示意图

[0016] 图 4 钳臂与螺母连接处结构示意图

[0017] 图 5 线耳与钳子连接装配示意图

[0018] 图 6 线耳与钳子装配后的成品示意图

[0019] 图中，1. 充电器 DC 输出线 2. 铜线耳 3. 线耳冲压口 4. 焊接锡料 5. 输出线末端铜丝 6. 平面黄铜螺母 7. 螺母焊接点 8. 螺母铆压结构 9. 钳臂 10. 塑胶压线扣 11. PC 钳子塑胶外壳 12. 螺钉 13. 弹簧垫圈 14. 输出线固定扣

具体实施方式

[0020] 下面结合附图对本实用新型的具体实施方式进一步详细说明。

[0021] 图 1 是大电流充电器输出线通过线耳直接连接电池电极端示意图，也就是固定充电时的状态示意图。

[0022] 图 2 大电流充电器输出线通过“线耳＋钳子”连接电池电极端示意图，也就是移动充电时的状态示意图，插拔简单随时可以收好。

[0023] 图 3 实施例中，充电器输出线 1 的末端铜丝 5 浸上熔点 150℃低温锡膏后，伸入线耳 2 尾部的线管中，并在线管上冲压出冲压口 3，锁紧铜丝与线耳。然后用红外局部加热装置，对线管进行加热到 160℃左右，让焊锡充分熔接铜丝和线管内壁。以少量的低温锡膏做填充，不但封堵了空气进入，也将铜丝线管连成了一体，巧妙地解决了铜丝散乱，铜丝与线管内部接触不良等问题。

[0024] 图 4 实施例中，6.5mm 厚 M8 的黄铜螺母 6 通过铆压的方式，植入到钳臂 9 的末端，并在螺母和钳臂的接触边缘用点焊加固。这种“铆压＋点焊”的结构方式，为螺母与钳臂提供了充分的接触和可靠的强度，避免操作扭力和热应力导致螺母与钳臂出现松动和接触不好现象。而且所使用的螺母为 M8 大螺母的六角平面，为与线耳的安装提供了足够的接触面。

[0025] 图 5 实施例中，线耳 (2) 与 M8 螺母 (6)，通过 M8 螺钉 (12) 和 M8 弹簧垫片 (13) 锁定到一块，然后将塑胶压线扣 (14) 压入钳臂 (2) 的对应位置，就可以将充电输出线 (1) 固定，完成线耳和钳子的连接，使他们成为“线耳＋钳子”的可移动的整体，方便客户选用。

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[0026] 本实用新型可以给大电流充电器（15-80A）用户，提供两种电池接驳选择：固定使用时用线耳直接固定到电池端子，移动使用时用钳子临时性接驳电池端子。解决了“线耳+钳子”两用组合在大电流的情况下，线到钳臂结合部位严重发热及压降大问题。从而避免烫手、充电电压低以及“发热－线头氧化－压降增大－发热加剧”的恶性循环等一系列的问题，保证了大电流充电的安全性，提高了电能的利用率。

[0027] 如上所述，仅为本实用新型治具具体实施方式，不能以此为限定本实用新型具体实施范围，凡根据本实用新型权利要求及说明内容所作的变化与修改，皆在本实用新型的保护范围内。

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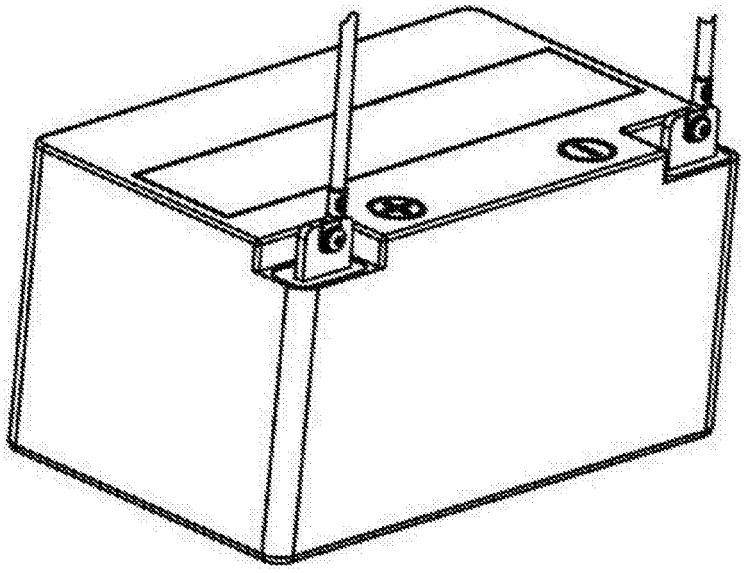


图 1

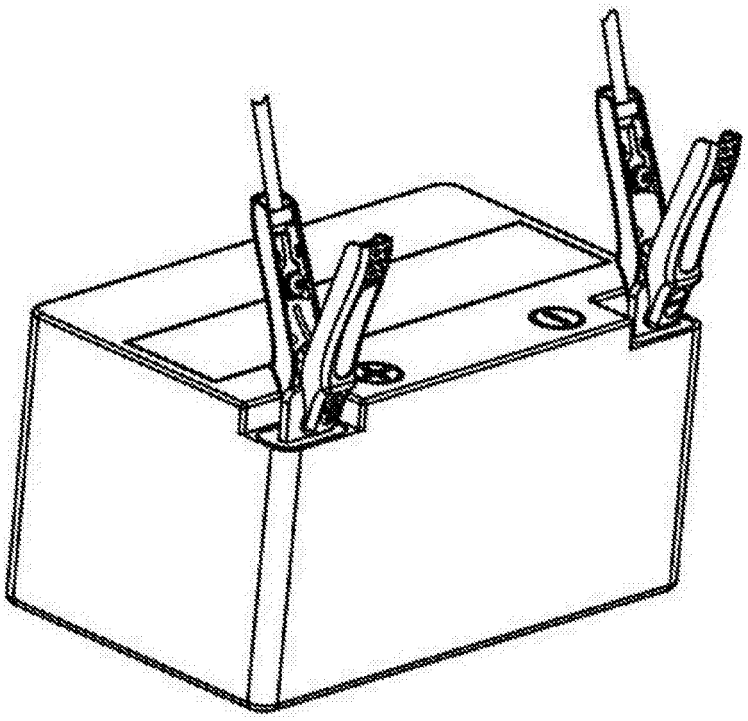


图 2

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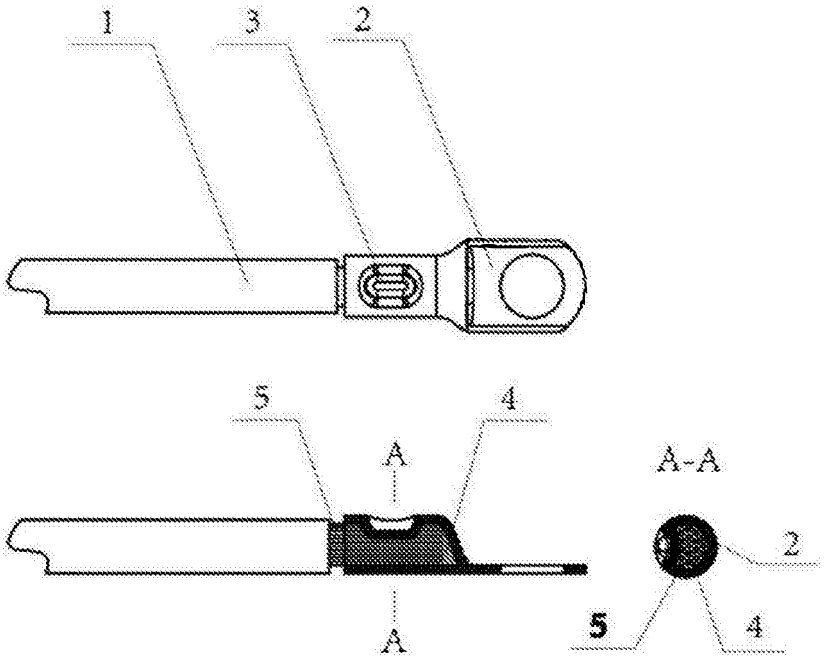


图 3

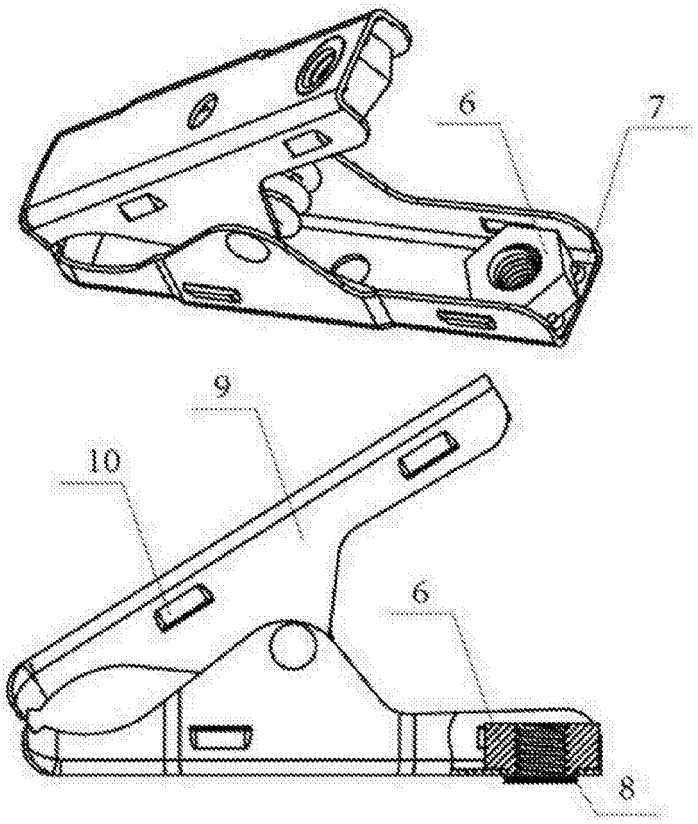


图 4

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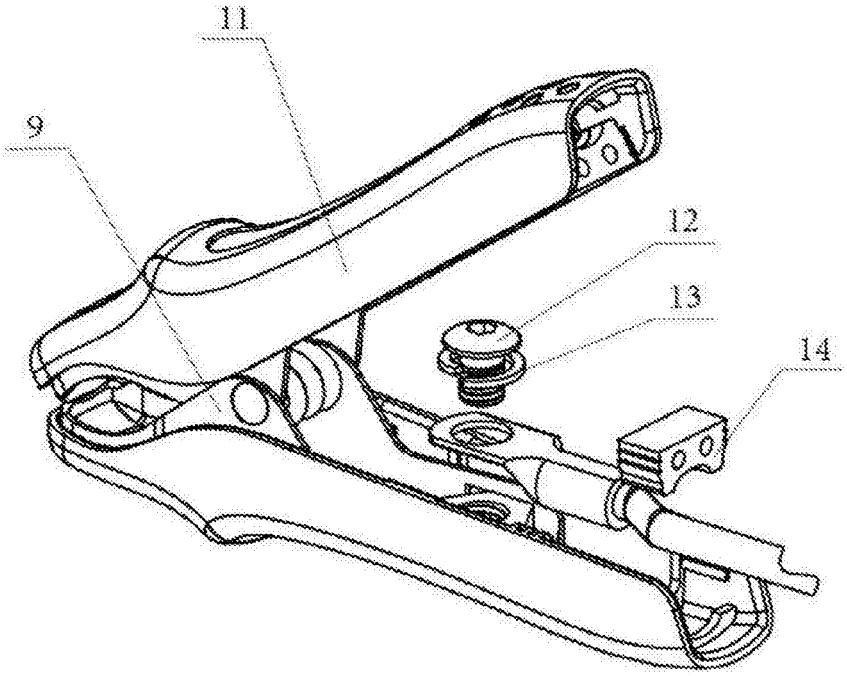


图 5

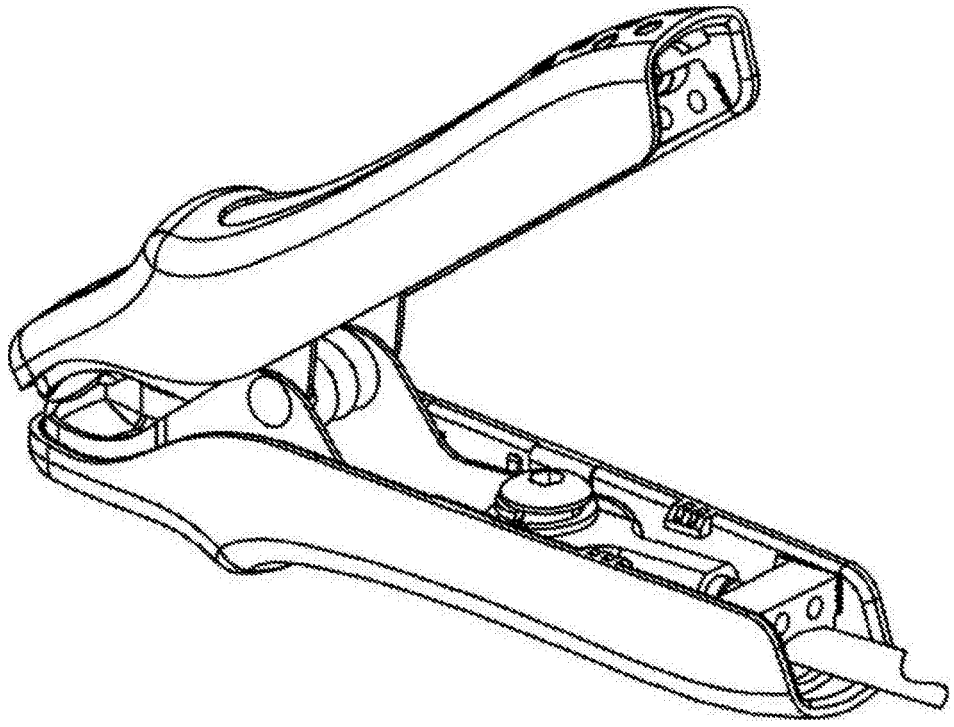


图 6

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(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 105 980 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
30.09.2009 Bulletin 2009/40

(21) Application number: **09156099.5**

(22) Date of filing: **25.03.2009**

(51) Int Cl.:
H01M 2/10 *(2006.01)* ***H01M 2/22*** *(2006.01)*
H01M 10/04 *(2006.01)* ***H01M 10/48*** *(2006.01)*

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA RS

(30) Priority: **28.03.2008 KR 20080028992**

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(54) Lithium rechargeable battery

(57) A lithium rechargeable battery including: a bare cell including an electrode assembly disposed in a pouch, the electrode assembly including two electrodes, a separator, and first and second electrode tabs that extend from the electrodes, through a first side of the bare cell; a protecting circuit board electrically connected to the first and second electrode tabs; a first lead plate connected to the protecting circuit board and the first electrode tab, and a second lead plate connected to the protecting circuit board and the second electrode tab. The protecting circuit board is provided on a second side of the bare cell, which is adjacent to the first side. The first and second lead plates are bent to extend along the first and second sides of the pouch.

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Description

[0001] Aspects of the present invention relate to a lithium rechargeable battery, and more particularly, to a lithium rechargeable battery having a battery pack with an optimized structure.

[0002] In general, lithium rechargeable batteries can be classified as a cylindrical battery, a polygonal battery, and a pouch-type battery, in accordance with the shape of a case in which an electrode assembly and an electrolyte are accommodated. In a pouch-type battery, the electrode assembly is accommodated in a pouch, to form a bare cell, and the electrode assembly is connected to a protecting circuit board, to form a battery pack.

[0003] In the above-described pouch-type battery, in the electrode assembly, electrode tabs drawn from two electrodes are electrically connected to the protecting circuit board, via a lead plate. The protecting circuit board faces a surface from which the electrode tabs extend from the bare cell.

[0004] When the specification of an electrical device varies, or when the size of the protecting circuit board changes, the protecting circuit board can be provided on a surface from which the electrode tabs are not drawn. In such a case, since the electrode tabs are further separated from the protecting circuit board, the length of the lead plate increases. Therefore, the longer lead plate increases internal resistance of the battery.

[0005] As described above, in a lithium rechargeable battery, the structure of the lead plate has a large influence on optimizing the structure of the battery pack.

SUMMARY OF THE INVENTION

[0006] An aspect of the present invention is to provide a lithium rechargeable battery having an improved electrical connection between a bare cell and a protecting circuit board.

[0007] Another aspect of the present invention is to provide a lithium rechargeable battery having a minimized internal resistance, due to the structure of an electrical connection between a bare cell and a protecting circuit board.

[0008] According to the present invention, there is provided a lithium rechargeable battery comprising a bare cell comprising, an electrode assembly comprising first and second electrodes and a separator disposed therebetween, a pouch in which the electrode assembly is housed, and first and second electrode tabs extending from the first and second electrodes, through a first side of the bare cell. The battery further comprises a protecting circuit board electrically connected to the first and second electrode tabs, disposed on a second side of the bare cell; a first lead plate connected to the protecting circuit board and the first electrode tab; and a second lead plate connected to the protecting circuit board and the second electrode tab, wherein the first lead plate and the second lead plate are bent at an intersection of the first and second sides of the bare cell, so as to extend along the first and second sides of the bare cell.

[0009] In other words, there is provided a lithium rechargeable battery comprising: a bare cell comprising an electrode assembly including two electrodes and a separator, and a pouch in which the electrode assembly is accommodated; a protecting circuit board electrically connected to a first electrode tab and a second electrode tab, which extend from the two electrodes of the electrode assembly; and first and second lead plates to connect the protecting circuit board to the first and second electrode tabs. The protecting circuit board is provided on a surface adjacent to a surface from which the first and second electrode tabs project from the bare cell. The first and second lead plates are bent from the protecting circuit board, toward the surface from which the first and second electrode tabs project.

[0010] The first lead plate and the second lead plate may be perpendicular to a direction in which the first electrode tab and the second electrode tab extend. The first and second electrode tabs may be bent to respectively face the first and second lead plates

[0011] The first lead plate and the second lead plate may intersect the first electrode tab and the second electrode tab.

[0012] The first lead plate and the second lead plate can be in the same plane, i.e. the first and second lead plates extend in the same plane, across the first side of the bare cell.

[0013] The first lead plate and the second lead plate may be separated from each other. Insulating members are provided on surfaces of the first lead plate and the second lead plate. The insulating members can be insulating tapes. The insulating tapes can be formed of polyimide.

[0014] The first lead plate and the second lead plate can be disposed in parallel planes.

[0015] The first lead plate and the second lead plate can have the same width as a side surface of the bare cell. Insulating members are provided on the surfaces of the first lead plate and the second lead plate. The insulating members are insulating tapes. The insulating tapes are formed of polyimide.

[0016] An attachment sheet can be interposed between the first lead plate and the second lead plate, to attach the first lead plate to the second lead plate.

[0017] The first lead plate and the second lead plate can comprise connection tabs that are connected to the first electrode tab and the second electrode tab. The connection tabs extend perpendicularly from sides of each of the first lead plate and the second lead plate. The connection tabs are extend from sides of the first lead plate and the second plate, in the same direction as a direction in which the first electrode tab and the second electrode tab extend.

[0018] The connection tabs may have the same area as the electrode tabs. The connection tabs comprise wings that extend in a widthwise direction, so that the

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area of the connection tabs can be larger than the electrode tabs.

[0019] The lead plates may be provided on the different surfaces of the bare cell, and are bent to be in the same plane, so that the structure of the battery pack is optimized.

[0020] The lead plates may extend in parallel planes, so that the internal resistance of the battery is minimized.

[0021] Additional aspects and/or advantages of the invention are subject matter of the dependent claims or may be learned form the description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] These and/or other aspects and advantages of the invention will become apparent, and more readily appreciated, from the following description of the exemplary embodiments, taken in conjunction with the accompanying drawings, of which:

FIG. 1 is an exploded perspective view of a lithium rechargeable battery, according to an exemplary embodiment of the present invention;

FIGS. 2A and 2B illustrate the lithium rechargeable battery of FIG. 1, as assembled;

FIG. 3 is an exploded perspective view of a lithium rechargeable battery, according to another exemplary embodiment of the present invention;

FIGS. 4A and 4B illustrate the lithium rechargeable battery of FIG. 3, as assembled;

FIG. 5 illustrates the enlargement of part V of FIG. 4B; and

FIG. 6 is an exploded perspective view of a lithium rechargeable battery, according to another exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0023] Reference will now be made in detail to the exemplary embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout. The exemplary embodiments are described below, in order to explain the aspects of the present invention, by referring to the figures.

[0024] FIG. 1 is an exploded perspective view of a lithium rechargeable battery 100, according to an exemplary embodiment of the present invention. FIGS. 2A and 2B illustrate the lithium rechargeable battery 100, as assembled.

[0025] Referring to FIGS. 1, 2A, and 2B the lithium rechargeable battery 100 includes a bare cell 110, a protecting circuit board 120 connected to the bare cell 110, and a lead plate 130 to connect the bare cell 110 to the protecting circuit board 120. The protecting circuit board 120 is provided on a second surface of the bare cell 110, which is adjacent to a first surface from which the electrode tabs 116 and 117 extend. The protecting circuit board 120 protects the battery 100 from over charges and over discharges. The lead plate 130 is bent and extends from the first side to the second side.

[0026] The bare cell 110 includes an electrode assembly 114, including a positive electrode plate 111, a negative electrode plate 112, and a separator 113 interposed therebetween. The bare cell 110 includes a pouch-type case 115 (hereinafter, referred to as a pouch) that accommodates an electrolyte and the electrode assembly 114. The bare cell 110 is a rectangular prism. The bare cell 110 includes a first short side 110a, a second short side 110c that faces the first short side 110a, a first long side 110b, a second long side 110d that faces the first long side 110b, a first main side 110e, and a second main side 110f that faces the first main side 110e.

[0027] The first electrode tab 116 is attached to the positive electrode plate 111, and the second electrode tab 117 is attached to the negative electrode plate 112. The first electrode tab 116 and the second electrode tab 117 extend out of the bare cell 110, through the first short side 110a.

[0028] The protecting circuit board 120 is provided on the first long side 110b. However, the present invention is not limited to the above. The protecting circuit board 120 can be provided on the second long side 110d, for example.

[0029] The lead plate 130 includes a first lead plate 131 and a second lead plate 132. One end of the first lead plate 131 is connected to the protecting circuit board 120, and the other end of the first lead plate 131 is connected to the first electrode tab 116. The first lead plate 131 is bent at the edge between the first short side 110a and the first long side 110b. The first lead plate 131 extends along the first short side 110a. The first lead plate 131 extends to the first electrode tab 116.

[0030] One end of the second lead plate 132 is connected to the protecting circuit board 120, and the other end of the second lead plate 132 is connected to the second electrode tab 117. The second lead plate 132 is bent at the edge between the first short side 110a and the first long side 110b. The second lead plate 132 extends along the first short side 110a. The second lead plate 132 extends to the second electrode tab 117.

[0031] The first lead plate 131 and the second lead plate 132 extend in parallel across the first short side 110a. The first lead plate 131 and the second lead plate 132 are connected to the protecting circuit board 120. Since the first lead plate 131 is connected to the first electrode tab 116 and the second lead plate 132 is connected to the second electrode tab 117, the first lead plate 131, and the second lead plate 132 are separated from each other.

[0032] Insulating tapes 140 are attached to opposing surfaces of the first lead plate 131 and the second lead plate 132. The insulating tapes 140 are generally formed of polyimide. However, the material of the insulating tapes 140 is not limited to polyimide.

[0033] The first lead plate 131 includes a first connec-

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tion tab 133, and the second lead plate 132 includes a second connection tab 134. The first connection tab 133 extends from one side of the first lead plate 131, at a position corresponding to the first electrode tab 116. The second connection tab 134 extends from one side of the second lead plate 132, at a position corresponding to the second electrode tab 117.

[0034] The first connection tab 133 and the second connection tab 134 are bent perpendicularly from the sides of the first lead plate 131 and the second lead plate 132. The first connection tab 133 and the second connection tab 134 extend in parallel, away from the first short side 110a.

[0035] The first connection tab 133 and the second connection tab 134 can have the same width as the first electrode tab 116 and the second electrode tab 117. The width of the first connection tab 133 and the second connection tab 134 can be larger than the width of the first electrode tab 116 and the second electrode tab 117. Therefore, assembly dispersion can be reduced, due to the positions of the first electrode tab 116 and the second electrode tab 117.

[0036] Referring to FIG. 2A, ends of the first lead plate 131 and the second lead plate 132 are welded to the protecting circuit board 120, so that the first lead plate 131 and the second lead plate 132 are electrically connected to the protecting circuit board 120. The first lead plate 131 and the second lead plate 132 are bent at the edge between the first long side 110b and the first short side 110a, so as to extend to the first electrode tab 116 and the second electrode tab 117.

[0037] The first connection tab 133 and the second connection tab 134 extend in parallel with the first electrode tab 116 and the second electrode tab 117. The first electrode tab 116 and the first connection tab 133 are electrically connected to each other, by welding, for example. The second electrode tab 117 and the second connection tab 134 are electrically connected to each other, by welding, for example.

[0038] As illustrated in FIG. 2B, when the battery 100 is assembled, the first electrode tab 116 and the first connection tab 133 are folded toward the first lead plate 131. The second electrode tab 117 and the second connection tab 134 are folded toward the second lead plate 132. In this way, the bare cell 110 and the protecting circuit board 120 are connected to each other.

[0039] FIG. 3 is an exploded perspective view of a lithium rechargeable battery 200, according to another exemplary embodiment of the present invention. FIGS. 4A and 4B illustrate the lithium rechargeable battery 200, as assembled. FIG. 5 illustrates an enlargement of part V of FIG. 4B.

[0040] Referring to FIGS. 3 to 5, the lithium rechargeable battery 200 includes a bare cell 110, a protecting circuit board 120 connected to the bare cell 110, and a lead plate 230 connected to the bare cell 110 and the protecting circuit board 120. In the lithium rechargeable battery 200, the structure of the lead plate 230 is different from the structure of the lead plate 130 in the lithium rechargeable battery 100. Therefore, the lead plate 230 will mainly be described, and a description of similar elements is omitted.

[0041] In the lithium rechargeable battery 200, the lead plate 230 includes a first lead plate 231 and a second lead plate 232. The first lead plate 231 and the second lead plate 232 respectively extend from the first electrode tab 116 and the second electrode tab 117, and overlap one another along the first short side 110a of the bare cell 110. The first lead plate 231 and the second lead plate 232 are connected to the protecting circuit board 120. The first lead plate 231 and the second lead plate 232 are separated from each other.

[0042] Since the first lead plate 231 and the second lead plate 232 overlap, the widths of the first lead plate 231 and the second lead plate 232 can be as large as the width of the first short side 110a. Since the areas of the first lead plate 231 and the second lead plate 232 can be increased, due to the overlap, current flow can be increased, and the internal resistance of the battery 200 is reduced.

[0043] Insulating tapes 240 are attached to opposing surfaces of the first lead plate 231 and the second lead plate 232, to insulate the first and second lead plates 231 and 231. The insulating tapes 240 can be formed of polyimide. However, the material of the insulating tapes 240 is not limited to polyimide.

[0044] An attachment sheet 250 can be interposed between the first lead plate 231 and the second lead plate 232, to attach the first lead plate 231 to the second lead plate 232. The first lead plate 231 includes a first connection tab 233 that is connected to the first electrode tab 116. The second lead plate 232 includes a second connection tab 234 that is connected to the second electrode tab 117.

[0045] The first connection tab 233 extends from one side of the first lead plate 131, adjacent to the first electrode tab 116. The second connection tab 234 extends from one side of the second lead plate 232, adjacent to the second electrode tab 117.

[0046] The first connection tab 233 and the second connection tab 234 are bent perpendicularly from the sides of the first lead plate 231 and the second lead plate 232. The first connection tab 233 and the second connection tab 234 extend in parallel, away from the first short side 110a. The first connection tab 233 and the second connection tab 234 have larger widths as the first electrode tab 116 and the second electrode tab 117.

[0047] Referring to FIG. 4A, ends of the first lead plate 231 and the second lead plate 232 are welded to the protecting circuit board 120, so that the first lead plate 231 and the second lead plate 232 are electrically connected to the protecting circuit board 120. The first lead plate 231 and the second lead plate 232 are bent at the edge between the first long side 110b and the first short side 110a, so as to extend across the first short side 110a.

[0048] The first connection tab 233 and the second

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connection tab 234 extend in parallel with the first electrode tab 116 and the second electrode tab 117. The first electrode tab 116 and the first connection tab 233 are electrically connected to each other, by welding, for example. The second electrode tab 117 and the second connection tab 234 are electrically connected to each other, by welding, for example.

[0049] As illustrated in FIG. 4B, when the battery 200 is assembled, the first electrode tab 116 and the first connection tab 233 are folded toward the first lead plate 231, and the second electrode tab 117 and the second connection tab 234 are folded toward the second lead plate 232. In this way, the bare cell 110 and the protecting circuit board 120 are connected to each other.

[0050] FIG. 6 is an exploded perspective view of a lithium rechargeable battery 300, according to a still another exemplary embodiment of the present invention. Referring to FIG. 6, the lithium rechargeable battery 300 includes a bare cell 110, a protecting circuit board 120 connected to the bare cell 110, and a lead plate 330 connected to the bare cell 110 and the protecting circuit board 120.

[0051] In the lithium rechargeable battery 300, the a first connection tab 333 and a second connection tab 334 of the lead plate 330 are different from the first connection tab 233 and the second connection tab 234 of the lithium rechargeable battery 200. Therefore, the lithium rechargeable battery 300 will be described with respect to the first connection tab 333 and the second connection tab 334 of the lead plate 330, and a description of similar elements is omitted.

[0052] The battery 300 includes a wing 333a that extends from the first connection tab 333, and a wing 334a that extends from the second connection tab 334. The area of the first connection tab 333 and the second connection tab 334 is increased by the wings 333a and 334a. Therefore, the first and second connection tabs 333 and 334 do not need to extend to the first and second electrode tabs 116 117.

Claims

1. A lithium rechargeable battery (100, 200, 300) comprising:

   a bare cell (110) comprising,

   an electrode assembly (114) comprising first and second electrodes and a separator (113) disposed therebetween,
   a pouch (115) in which the electrode assembly (114) is housed, and
   first and second electrode tabs (116, 117) extending from the first and second electrodes, through a first side of the bare cell (110);

   a protecting circuit board (120) electrically connected to the first and second electrode tabs (116, 117), disposed on a second side of the bare cell (110);
   a first lead plate (131, 231, 331) connected to the protecting circuit board (120) and the first electrode tab (116); and
   a second lead plate (132, 232, 332) connected to the protecting circuit board (120) and the second electrode tab (117),
   wherein the first lead plate (131, 231, 331) and the second lead plate (132, 232, 332) are bent at an intersection of the first and second sides of the bare cell (110), so as to extend along the first and second sides of the bare cell (110).

2. The lithium rechargeable battery of claim 1, wherein the first and second lead plates (131, 231, 331, 132, 232, 332) are separated from each other.

3. The lithium rechargeable battery of claims 1 or 2, wherein the first lead plate (231, 331) and the second lead plate (232, 332) overlap each other along the first side of the bare cell (110).

4. The lithium rechargeable battery of claim 3, wherein the first lead plate (231, 331) and the second lead plate (232, 332) have the same width as the first side of the bare cell (110).

5. The lithium rechargeable battery of claims 3 or 4, further comprising at least one insulating member to insulate the first lead plate (231, 331) and the second lead plate (232, 332) from each other.

6. The lithium rechargeable battery of claim 5, wherein the insulating member includes insulating tapes (240).

7. The lithium rechargeable battery of claim 6, wherein the insulating tapes (240) consist of or comprise polyimide.

8. The lithium rechargeable battery of any of claims 3 through 7, further comprising an attachment sheet (250) to attach the first lead plate (231) to the second lead plate (232).

9. The lithium rechargeable battery of any of the preceding claims, wherein:

   the first lead plate (131, 231, 331) comprises a first connection tab (133, 233, 333) that is connected to the first electrode tab (116); and
   the second lead plate comprises (132, 232, 332) a second connection tab (134, 234, 334) that is connected to the second electrode tab (117).

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10. The lithium rechargeable battery of claim 9, wherein the first and second connection tabs (133, 233, 333, 134, 234, 334) respectively extend from edges of the first and second electrode tabs (116, 117) and are perpendicular to the first side of the bare cell (110).

11. The lithium rechargeable battery of claims 9 or 10, wherein the first and second connection tabs (133, 233, 333, 134, 234, 334) extend from sides of the first and second lead plates (131, 231, 331, 132, 232, 332), which face the first and second electrode tabs (116, 117) respectively.

12. The lithium rechargeable battery of any of claims 9 through 11, wherein the first and second connection tabs (133, 233, 333, 134, 234, 334) have a width which is larger than the width of the first and second electrode tabs (116, 117).

13. The lithium rechargeable battery of any of claims 9 through 12, wherein the first and second connection tabs (333, 334) comprise wings (333a, 334a) that extend therefrom, along the first side of the bare cell (110).

14. The lithium rechargeable battery of any of claims 9 through 13, wherein the first and second connection tabs (133, 233, 333, 134, 234, 334) and the first and second electrode tabs (116, 117) are bent to face the first side of the bare cell (110).

15. The lithium rechargeable battery of any of the preceding claims, wherein:

the bare cell (110) is a rectangular prism comprising the first side, an opposing third side, the second side, an opposing fourth side, and first and second main sides that are connected to opposing edges of the first, second, third, and fourth sides.

16. The lithium rechargeable battery of claim 15, wherein the first and third sides are shorter than the second and fourth sides.

Amended claims in accordance with Rule 137(2) EPC.

1. A lithium rechargeable battery (100, 200, 300) comprising:

a bare cell (110) comprising,
an electrode assembly (114) comprising first and second electrodes and a separator (113) disposed therebetween,
a pouch (115) in which the electrode assembly (114) is housed, and
first and second electrode tabs (116, 117) extending from the first and second electrodes, through a first side of the bare cell (110);
a protecting circuit board (120) electrically connected to the first and second electrode tabs (116, 117), disposed on a second side of the bare cell (110);
a first lead plate (231, 331) connected to the protecting circuit board (120) and the first electrode tab (116); and
a second lead plate (232, 332) connected to the protecting circuit board (120) and the second electrode tab (117),

wherein the first lead plate (231, 331) and the second lead plate (232, 332) are bent at an intersection of the first and second sides of the bare cell (110), so as to extend along the first and second sides of the bare cell (110),
wherein the first and second lead plates (231, 331, 232, 332) are separated from each other and overlap each other along the first side of the bare cell (110).

2. The lithium rechargeable battery of claim 1, wherein the first lead plate (231, 331) and the second lead plate (232, 332) have the same width as the first side of the bare cell (110).

3. The lithium rechargeable battery of claims 1 or 2, further comprising at least one insulating member to insulate the first lead plate (231, 331) and the second lead plate (232, 332) from each other.

4. The lithium rechargeable battery of claim 3, wherein the insulating member includes insulating tapes (240).

5. The lithium rechargeable battery of claim 4, wherein the insulating tapes (240) consist of or comprise polyimide.

6. The lithium rechargeable battery of any of claims 1 through 5, further comprising an attachment sheet (250) to attach the first lead plate (231) to the second lead plate (232).

7. The lithium rechargeable battery of any of the preceding claims, wherein:

the first lead plate (231, 331) comprises a first connection tab (233, 333) that is connected to the first electrode tab (116); and
the second lead plate comprises (232, 332) a second connection tab (234, 334) that is connected to the second electrode tab (117).

8. The lithium rechargeable battery of claim 7, wherein the first and second connection tabs (233, 333,

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234, 334) respectively extend from edges of the first and second electrode tabs (116, 117) and are perpendicular to the first side of the bare cell (110).

9. The lithium rechargeable battery of claims 7 or 8, wherein the first and second connection tabs (233, 333, 234, 334) extend from sides of the first and second lead plates (231, 331, 232, 332), which face the first and second electrode tabs (116, 117) respectively.

10. The lithium rechargeable battery of any of claims 7 through 9, wherein the first and second connection tabs (233, 333, 234, 334) have a width which is larger than the width of the first and second electrode tabs (116, 117).

11. The lithium rechargeable battery of any of claims 7 through 10, wherein the first and second connection tabs (333, 334) comprise wings (333a, 334a) that extend therefrom, along the first side of the bare cell (110).

12. The lithium rechargeable battery of any of claims 7 through 11, wherein the first and second connection tabs (233, 333, 234, 334) and the first and second electrode tabs (116, 117) are bent to face the first side of the bare cell (110).

13. The lithium rechargeable battery of any of the preceding claims, wherein:

the bare cell (110) is a rectangular prism comprising the first side, an opposing third side, the second side, an opposing fourth side, and first and second main sides that are connected to opposing edges of the first, second, third, and fourth sides.

14. The lithium rechargeable battery of claim 13, wherein the first and third sides are shorter than the second and fourth sides.

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FIG. 1

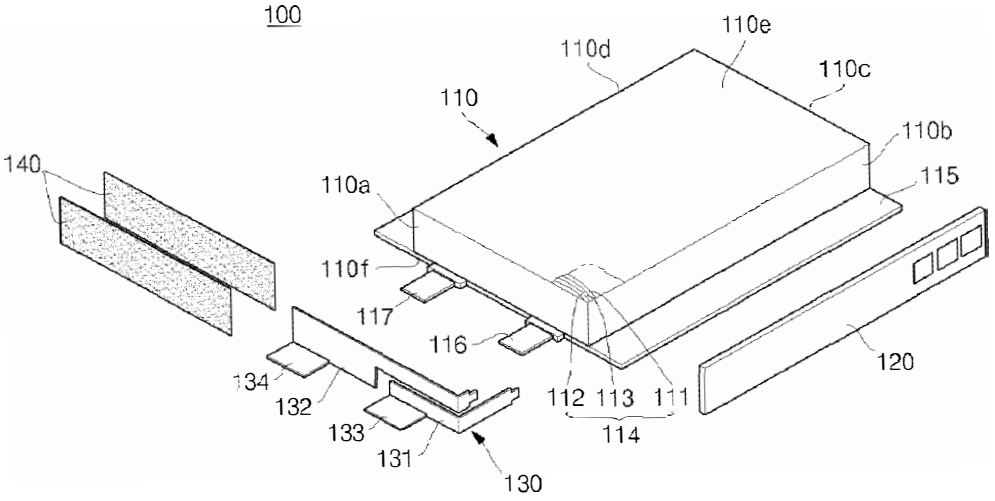

100
110e
110d
110c
110
110b
140
115
110a
110f
117
116
120
134
132
112 113 111
133
114
131
130

FIG. 2A

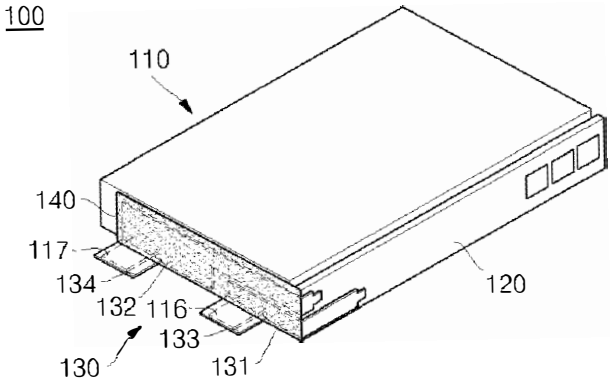

100
110
140
117
134
132
116
133
120
130
131

FIG. 2B

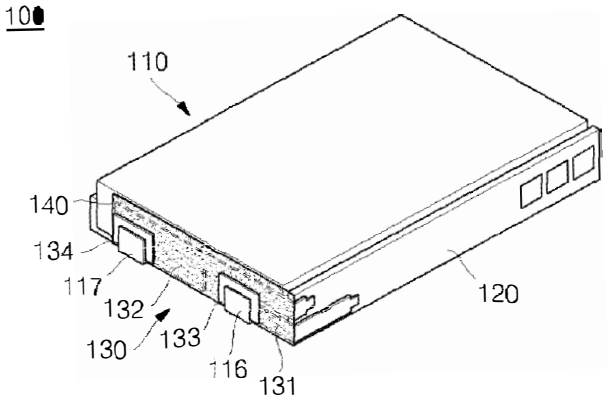
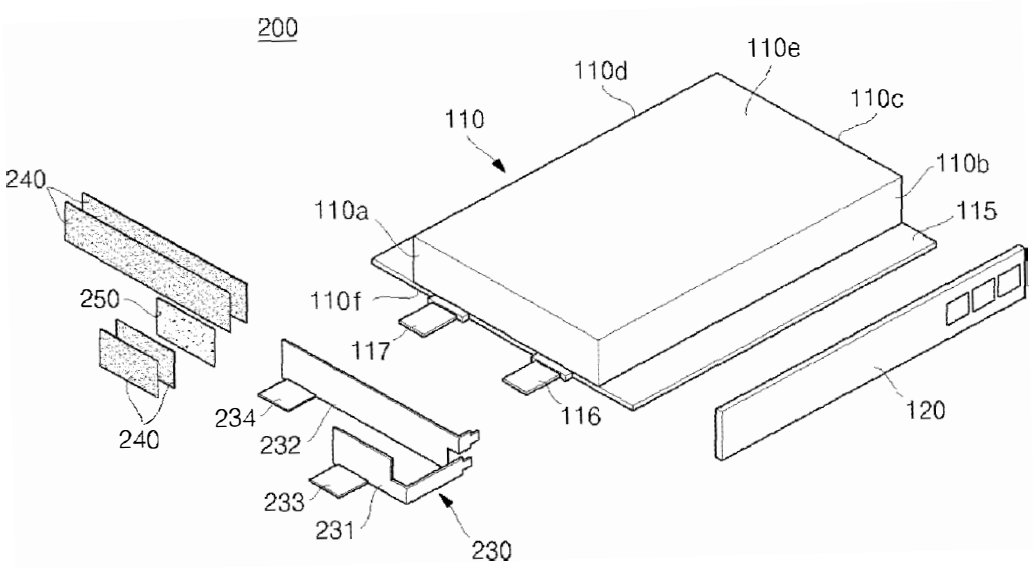


FIG. 3



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FIG. 4A

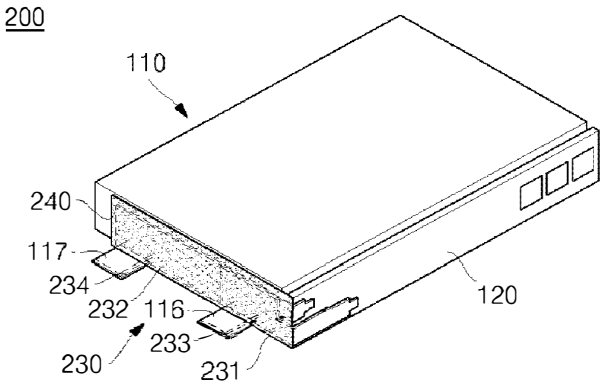


FIG. 4B

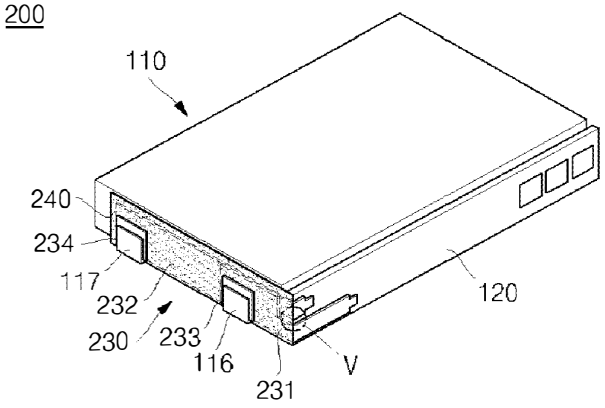


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FIG. 5

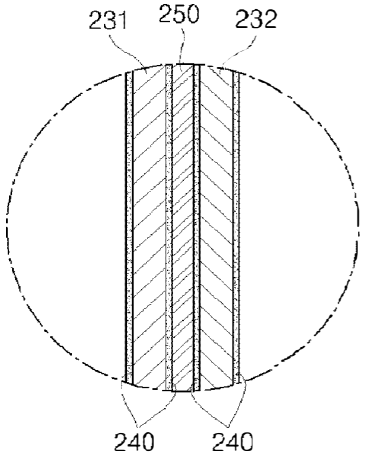
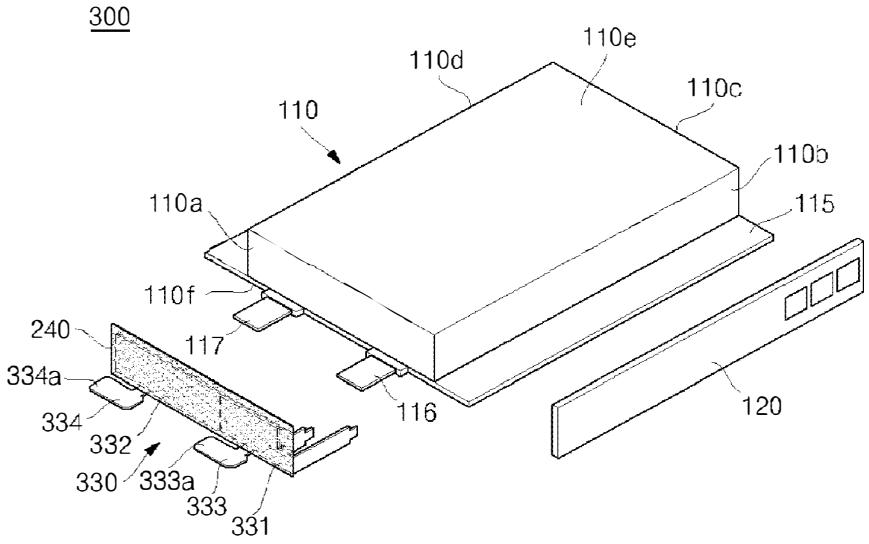


FIG. 6



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Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 09 15 6099

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	KR 100 770 106 B1 (SAMSUNG SDI CO LTD [KR]) 24 October 2007 (2007-10-24) * abstract * -----	1-16	INV. H01M2/10 H01M2/22 H01M10/04
X	JP 2006 164558 A (SANYO ELECTRIC CO) 22 June 2006 (2006-06-22) * abstract * -----	1-16	H01M10/48

TECHNICAL FIELDS SEARCHED (IPC)

H01M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 May 2009	Cappadonia, Marcella

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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EPO FORM 1503 03.82 (P04C01)

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 09 15 6099

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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06-05-2009

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

Espacenet

CN103035874A Battery

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Classifications:
IPC ***H01M10/04; H01M2/34; H01M4/70;***

CPC **H01M10/0525 (KR); H01M2/043 (EP,KR,US); H01M2/307 (EP,KR,US); H01M2/34 (KR); H01M2/348 (EP,KR,US);** H01M10/0525 (EP,US); H01M2200/103 (KR); Y02E60/10 (EP); Y02T10/70 (KR,US);

Priorities: US201161540692P 2011-09-29; US201213343948A 2012-01-05

Application: CN103035874A·2012-06-08

Publication: CN103035874A·2013-04-10

Published as: CN103035874A;**CN103035874B; EP2575189A1; EP2575189B1; JP2013077546A; JP6249593B2; KR101683214B1; KR20130035163A; US2013084471A1; US8940420B2**

Battery

Abstract

A battery includes an electrode assembly including a first electrode and a second electrode, a first electrode terminal, and a first current collecting member electrically connecting the first electrode terminal and a first electrode uncoated region of the first electrode. The first current collecting member includes a first terminal connection region, a side plate extending downwardly from the first terminal connection region towards the first electrode uncoated region, a first current collecting piece extending from the side plate, the first current collecting piece being in contact with the first electrode uncoated region, and a fuse between the side plate and the first current collecting piece.

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(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 103035874 A
(43)申请公布日 2013.04.10

(21)申请号 201210188861.8

(22)申请日 2012.06.08

(30)优先权数据
61/540,692 2011.09.29 US
13/343,948 2012.01.05 US

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(51)Int.Cl.
H01M 2/34(2006.01)
H01M 4/70(2006.01)
H01M 10/04(2006.01)

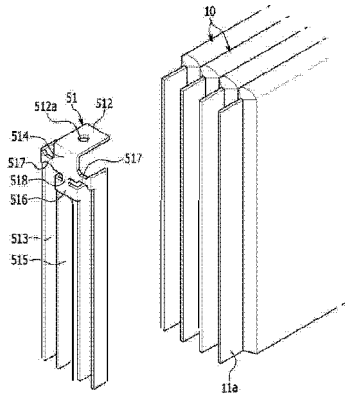
权利要求书 2 页 说明书 9 页 附图 9 页

(54)发明名称

电池

(57)摘要

一种电池，包括：包括第一电极和第二电极的电极组件；第一电极端子；和将所述第一电极端子和所述第一电极的第一电极未涂覆区域电连接的第一集流构件。所述第一集流构件包括：第一端子连接区域；从所述第一端子连接区域朝向所述第一电极未涂覆区域向下延伸的侧板；从所述侧板延伸的第一集流片，所述第一集流片与所述第一电极未涂覆区域接触；和在所述侧板和所述第一集流片之间的熔断体。



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1. 一种电池，包括：

包括第一电极和第二电极的电极组件；

第一电极端子；和

将所述第一电极端子和所述第二电极的第二电极未涂覆区域电连接的第二集流构件，所述第一集流构件包括：

第一端子连接区域；

从所述第一端子连接区域朝向所述第一电极未涂覆区域向下延伸的侧板；

从所述侧板延伸的第一集流片，所述第一集流片与所述第一电极未涂覆区域接触；和

在所述侧板和所述第一集流片之间的熔断体。

2. 如权利要求 1 所述的电池，其中所述第一端子连接区域、所述侧板、所述第一集流片和所述熔断体由相同的材料形成。

3. 如权利要求 2 所述的电池，其中所述第一端子连接区域、所述侧板、所述第一集流片和所述熔断体彼此形成整体。

4. 如权利要求 2 所述的电池，其中所述熔断体具有比所述侧板和所述第一集流片的相邻部分小的截面积。

5. 如权利要求 1 所述的电池，其中至少两个第一集流片从所述侧板延伸。

6. 如权利要求 1 所述的电池，所述电极组件包括多个电极组件，所述第一集流片包括对应的多个第一集流片，所述熔断体包括分别在所述侧板与所述多个第一集流片中的两个第一集流片之间的第一熔断体区域和第二熔断体区域。

7. 如权利要求 6 所述的电池，其中所述第一熔断体区域和所述第二熔断体区域在所述侧板和所述两个第一集流片之间横向地延伸。

8. 如权利要求 7 所述的电池，进一步包括从所述侧板竖向地延伸的第三熔断体区域，所述第三熔断体区域在所述侧板和除所述两个第一集流片之外的第一集流片之间。

9. 如权利要求 8 所述的电池，其中所述第三熔断体区域接触在除所述两个第一集流片之外的第一集流片之间横向延伸的连接区域。

10. 如权利要求 7 所述的电池，进一步包括将所述两个第一集流片分别与相邻的第一集流片连接的连接区域。

11. 如权利要求 7 所述的电池，进一步包括：

从所述侧板竖向延伸的连接区域；和

从所述连接区域横向延伸的第三熔断体区域，所述第三熔断体区域在所述连接区域与第三个第一集流片之间。

12. 如权利要求 11 所述的电池，进一步包括：

在与所述第三熔断体区域相反的一侧上从所述连接区域横向延伸的第四熔断体区域，所述第四熔断体区域在所述连接区域和第四个第一集流片之间。

13. 如权利要求 6 所述的电池，其中所述多个第一集流片为两个集流片。

14. 如权利要求 5 所述的电池，其中所述熔断体包括在每个集流片和所述侧板之间的电路径中的熔断体区域。

15. 如权利要求 1 所述的电池，进一步包括连接到所述第一电极端子的短路构件。

16. 如权利要求 1 所述的电池，其中所述第一集流片被焊接到所述第一电极未涂覆区

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域。

17. 如权利要求 1 所述的电池，进一步包括由电绝缘材料制成并且至少部分围绕所述熔断体的阻断构件。

18. 如权利要求 17 所述的电池，其中所述阻断构件包括在所述熔断体的与所述第一电极未涂覆区域相反的一侧上的基部区域，以及在所述第一端子连接区域和所述第一集流片之间的突出部。

19. 如权利要求 1 所述的电池，进一步包括：

第二电极端子；

将所述第二电极端子和所述第二电极的第二电极未涂覆区域电连接的第二集流构件；和

在所述电极组件的横向侧上并且被电连接到所述第二电极的安全构件。

20. 如权利要求 19 所述的电池，其中每个安全构件包括：

导电板；

将所述导电板和所述电极组件分开的绝缘区域；和

将所述导电板与所述第二电极电连接的电极连接区域，其中所述电极连接区域被焊接到所述第二电极。

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电池

技术领域

[0001] 所描述的技术大体上涉及一种电池，更具体地涉及一种包括具有改进结构的集流构件的可再充电电池。

背景技术

[0002] 与不能被再充电的一次电池不同，可再充电电池能被再充电和放电。小容量可再充电电池被用于诸如移动电话、膝上电脑和便携式摄像机等的小型可携式电子设备，而大容量可再充电电池被用作用于混合动力车辆等的马达驱动电源。

[0003] 近来，已经开发出使用具有高能量密度的非水电解质的高输出可再充电电池。大容量电池模块可包括多个串联连接的高输出可再充电电池。这种可再充电电池可具有圆柱形形状、有角形状等。大容量电池模块可被用于要求大量电力的应用，例如驱动诸如电动车辆等设备的马达。

[0004] 当过电流在具有由诸如金属等材料制成的壳体的可再充电电池内流动时，可再充电电池的温度增加并且可能着火。此外，当由于可再充电电池内的电解质因过电流分解而使可再充电电池的内部压力增加时，可再充电电池可能爆炸。

[0005] 在该背景部分中公开的上述信息仅用于增强对所描述的技术的背景的理解，并且因此其可能包含不构成在本国对本领域普通技术人员已知的现有技术的信息。

发明内容

[0006] 所描述的技术努力提供一种具有改进的稳定性的可再充电电池。

[0007] 实施例致力于一种电池，包括：包括第一电极和第二电极的电极组件；第一电极端子；和将所述第一电极端子和所述第一电极的第一电极未涂覆区域电连接的第一集流构件。所述第一集流构件可包括：第一端子连接区域；从所述第一端子连接区域朝向所述第一电极未涂覆区域向下延伸的侧板；从所述侧板延伸的第一集流片，所述第一集流片与所述第一电极未涂覆区域接触；和在所述侧板和所述第一集流片之间的熔断体。

[0008] 所述第一端子连接区域、所述侧板、所述第一集流片和所述熔断体可由相同的材料形成。

[0009] 所述第一端子连接区域、所述侧板、所述第一集流片和所述熔断体可彼此形成整体。

[0010] 所述熔断体可具有比所述侧板和所述第一集流片的相邻部分的截面积小的截面积。

[0011] 至少两个第一集流片可从所述侧板延伸。

[0012] 所述电极组件可包括多个电极组件，所述第一集流片可包括对应的多个第一集流片。所述熔断体可包括分别在所述侧板与所述多个第一集流片中的两个第一集流片之间的第一熔断体区域和第二熔断体区域。

[0013] 所述第一熔断体区域和所述第二熔断体区域可在所述侧板和所述两个第一集流

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片之间横向地延伸。

[0014] 所述电池可进一步包括从所述侧板竖直地延伸的第三熔断体区域，所述第三熔断体区域在所述侧板和除所述两个第一集流片之外的第一集流片之间。

[0015] 所述第三熔断体区域可接触在除所述两个第一集流片之外的第一集流片之间横向延伸的连接区域。

[0016] 所述电池可包括将所述两个第一集流片分别与相邻的第一集流片连接的连接区域。

[0017] 所述电池可包括：从所述侧板竖直延伸的连接区域；和从所述连接区域横向延伸的第三熔断体区域，所述第三熔断体区域在所述连接区域与第三个第一集流片之间。

[0018] 所述电池可包括：在与所述第三熔断体区域相反的一侧上从所述连接区域横向延伸的第四熔断体区域，所述第四熔断体区域在所述连接区域和第四个第一集流片之间。

[0019] 所述熔断体可包括在每个集流片和所述侧板之间的电路径中的熔断体区域。

[0020] 所述多个第一集流片可为两个集流片。

[0021] 所述电池可包括连接到所述第一电极端子的短路构件。

[0022] 所述第一集流片可被焊接到所述第一电极未涂覆区域。

[0023] 阻断构件可由电绝缘材料制成并且至少部分地围绕所述熔断体。

[0024] 所述阻断构件可包括在所述熔断体的与所述第一电极未涂覆区域相反的一侧上的基部区域，以及在所述第一端子连接区域和所述第一集流片之间的突出部。

[0025] 所述电池可包括：第二电极端子；将所述第二电极端子和所述第二电极的第二电极未涂覆区域电连接的第二集流构件；和在所述电极组件的横向侧上并且被电连接到所述第二电极的安全构件。

[0026] 每个安全构件可包括：导电板；将所述导电板和所述电极组件分开的绝缘区域；和将所述导电板与所述第二电极电连接的电极连接区域，其中所述电极连接区域被焊接到所述第二电极。

附图说明

[0027] 通过参照附图详细描述各示例性实施例，各特征对于本领域普通技术人员将变得明显，其中：

[0028] 图 1 描绘出根据第一实施例的可再充电电池的透视图。

[0029] 图 2 描绘出沿图 1 的线 II-II 截取的剖视图。

[0030] 图 3 描绘出根据第一实施例的可再充电电池的局部分解透视图。

[0031] 图 4 描绘出根据第二实施例的可再充电电池的剖视图。

[0032] 图 5 描绘出根据第二实施例的可再充电电池的集流构件的透视图。

[0033] 图 6 描绘出根据第三实施例的可再充电电池的集流构件的透视图。

[0034] 图 7 描绘出根据第四实施例的可再充电电池的集流构件的透视图。

[0035] 图 8 描绘出根据第五实施例的可再充电电池的剖视图。

[0036] 图 9 描绘出根据第六实施例的可再充电电池的局部分解透视图。

[0037] 图 10 描绘出示出根据第六实施例的可再充电电池的构造的示意图。

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具体实施方式

[0038] 现在将参照附图详细描述各示例性实施例，使得各示例性实施例能够易于被本领域技术人员执行。本领域技术人员将认识到，所描述的各实施例可以以各种不同的方式被修改，均不脱离本发明精神或范围。相似的附图标记在整个说明书中指代相似的元件。

[0039] 图 1 描绘出根据第一实施例的可再充电电池的透视图。图 2 描绘出沿图 1 的线 II-II 截取的剖视图。

[0040] 参见图 1 和图 2，根据第一示例性实施例的可再充电电池 101 可包括：通过卷绕正电极 11 和负电极 12 以及介于它们之间的隔板 13 而形成的电极组件 10；将电极组件 10 容纳在其中的壳体 30；和联接到壳体 30 的开口的盖组件 20。

[0041] 在第一示例性实施例中，例如，可再充电电池 101 为方形的锂离子可再充电电池。然而，本实施例不限于此，本实施例可应用于各种类型的电池，例如锂聚合物电池、圆柱形电池等。

[0042] 正电极 11 和负电极 12 可分别包括形成为涂覆有活性物质的薄金属箔的集电体的涂覆区域和没有涂覆活性物质的未涂覆区域 11a 和 12a。

[0043] 正电极未涂覆区域 11a 可沿正电极 11 的长度方向形成在正电极 11 的一个横向端处，负电极未涂覆区域 12a 可沿负电极 12 的长度方向形成在负电极 12 的另一个横向端处。正电极 11 和负电极 12 可与作为绝缘体且介于它们之间的隔板 13 一起被卷绕。

[0044] 然而，各实施例不限于此。例如，电极组件 10 可具有这样的结构：被配置为多个片的正电极和负电极被交替堆叠，而隔板介于它们之间。

[0045] 壳体 30 可具有基本长方体形状，并且在其一侧可具有开口。盖组件 20 可包括覆盖壳体 30 的开口的盖板 25、从盖板 25 向外伸出并且与正电极 11 电连接的正电极端子 21、从盖板 25 向外伸出并且与负电极 12 电连接的负电极端子 22 以及带有形成为在预定内部压力下破裂的凹痕的排气构件 27。

[0046] 盖板 25 可被形成为薄板，并且可包括形成在其一侧处的电解质注入孔。用于密封电解质注入孔的密封塞 23 可被固定地安装在盖板 25 上。

[0047] 正电极端子 21 可以以贯穿的方式被安装在盖板 25 上。位于上侧的第一垫圈 24 和位于盖板 25 和正电极端子 21 之间的下方第二垫圈 26 将盖板 25 与正电极端子 21 绝缘。

[0048] 正电极端子 21 可具有圆柱形状。螺母 29 可被安装在正电极端子 21 上以在上侧支撑正电极端子 21。螺纹可形成在正电极端子 21 的外周上，以允许螺母 29 被紧固到正电极端子 21。

[0049] 正电极端子 21 可以经由集流构件 51 与正电极未涂覆区域 11a 电连接。支撑正电极端子 21 的端子法兰和集流构件 51 形成在正电极端子 21 的下端。

[0050] 负电极端子 22 可以以贯穿的方式被安装在盖板 25 上。位于上侧的第一垫圈 24 和位于盖板 25 和负电极端子 22 之间的下方第二垫圈 26 将盖板 25 与负电极端子 22 绝缘。

[0051] 负电极端子 22 可具有圆柱形状。螺母 29 可被安装在负电极端子 22 上以在上侧支撑负电极端子 22。螺纹可形成在负电极端子 22 的外周上，以允许螺母 29 被紧固到负电极端子 22。

[0052] 负电极端子 22 经由集流构件 52 与负电极未涂覆区域 12a 电连接。支撑负电极端子 22 的端子法兰和集流构件 52 可以形成在负电极端子 22 的下端。

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[0053] 图 3 描绘出根据第一实施例的可再充电电池的局部分解透视图。

[0054] 集流构件 51 可包括端子连接区域 512、被形成为从端子连接区域 512 弯曲的侧板 514、固定到正电极未涂覆区域 11a 的集流片 513 和 515 以及形成在侧板 514 与集流片 513 和 515 之间并且具有与周围区域相比小的截面积的熔断体区域 517 和 518，端子连接区域 512、侧板 514、集流片 513 和 515 以及熔断体区域 517 和 518 由相同材料形成且彼此形成整体。

[0055] 除了熔断体区域 517 和 518 之外，安装在负电极端子 22 处的集流构件 52 被配置为具有与集流构件 51 的结构相同的结构，因此其说明将不再重复。

[0056] 端子连接区域 512 可具有四边形板状形状，并且可包括形成在其中心处的孔 512a，正电极端子 21 插入该孔 512a 中。端子连接区域 512 可通过焊接被连接到正电极端子 21 的下部。侧板 514 可以以直角从端子连接区域 512 朝向壳体 30 的底部弯曲，从而被设置为与壳体 30 的侧面平行。

[0057] 两个集流片 513 可被连接到侧板 514 的两个横向端。集流片 513 可具有长四边形板的形状，并且可通过焊接被连接到正电极未涂覆区域 11a（即，与正电极未涂覆区域 11a 接触）。

[0058] 具有比其它部分小的截面积的熔断体区域 517 可形成在集流片 513 和侧板 514 之间。根据本实施例，熔断体区域 517 被形成为具有比周围区域小的宽度。因此，当过电流流过集流构件 51 时，熔断体区域 517 可被熔化以切断集流片 513 和侧板 514 之间的电连接。然而，本实施例不意味着限于此。例如，实现熔断体具有比周围区域小的截面积的任何方式可被使用，例如熔断体区域 517 可具有比周围区域小的厚度。

[0059] 连接区域 516 形成在侧板 514 的下部，并且具有比其它部分小的截面积的熔断体区域 518 形成在连接区域 516 和侧板 514 之间且与连接区域 516 接触。集流片 515 形成在连接区域 516 的两个横向端处并且通过焊接被连接到正电极未涂覆区域 11a。

[0060] 当熔断体区域 518 具有比周围区域小的宽度并且过电流流过集流构件 51 时，熔断体区域 518 被熔化以切断侧板 514 和连接区域 516 之间的电连接。

[0061] 以此方式，根据本实施例，因为多个熔断体区域 517 形成为被连接到侧板 514，因此当过电流流动时，与相应的集流片 513 的电连接能够被切断。此外，因为熔断体区域 518 形成在侧板 514 和连接区域 516 之间，侧板 514 和连接区域 516 之间的电连接能够被切断。另外，电极组件和集流片的数量不限于此，也可以分别为一个或多个。

[0062] 当多个电极组件 10 被插入地安装并且在壳体 30 内彼此并联连接时，如果各个电极组件没有被阻断，则高容量电流将持续在电极组件 10 之间流动，导致危险的状况。在此情况下，持续的电流流动将增加壳体 30 内的内部压力，从而可能导致爆炸或着火。

[0063] 然而，根据本实施例，当连接到侧板 514 的集流片 513 和 515 被分别阻断时，存储在电极组件 10 中的电流量被分散，从而增强了稳定性。

[0064] 图 4 描绘出根据第二实施例的可再充电电池的剖视图。图 5 描绘出根据第二实施例的可再充电电池的集流构件的透视图。

[0065] 除了集流构件 61 的结构之外，根据第二实施例的可再充电电池 102 被配置为具有与上述第一实施例的结构相同的结构，因此对相同结构的说明将不再重复。

[0066] 参见图 4 和图 5，根据第二实施例的可再充电电池 102 可包括电极组件 10、正电极

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端子 21、负电极端子 22、将正电极端子 21 与电极组件 10 电连接的集流构件 61 以及将负电极端子 22 与电极组件 10 电连接的集流构件 62。

[0067] 集流构件 61 可包括被固定到正电极端子 21 的端子连接区域 612、被形成为从端子连接区域 612 弯曲的侧板 614、连接到侧板 614 的下部的两个连接区域 616 以及连接到连接区域 616 的两个横向端并且被附接到正电极未涂覆区域 11a 的集流片 615。具有比周围区域小的截面积的熔断体区域 617 可形成在侧板 614 与连接区域 616 之间。

[0068] 除了熔断体区域 617 之外，集流构件 62 可被配置为具有与集流构件 61 的结构相同的结构，因此其描述将不再重复。

[0069] 端子连接区域 612 可具有四边形板状形状，并且可包括在其中心处的孔 612a，正电极端子 21 插入该孔 612a 中。端子连接区域 612 可通过焊接被连接到正电极端子 21 的下部。侧板 614 可以以直角从端子连接区域 612 朝向壳体 30 的底部弯曲，从而被设置为与壳体 30 的侧面平行。

[0070] 两个连接区域 616 可以被分开地连接到侧板 614 的下端部。具有比其它部分小的截面积的熔断体区域 617 可形成在连接区域 616 与侧板 614 之间。集流片 615 可形成在每个连接区域 616 的两个横向端处，并且通过焊接被连接到正电极未涂覆区域 11a。

[0071] 根据本实施例，熔断体区域 617 具有比周围区域小的宽度。因此，当过电流流过集流构件 61 时，熔断体区域 617 可被熔化，以切断连接区域 616 与侧板 614 之间的电连接。然而，本实施例并不意味着限于此，例如，熔断体区域 617 可具有比周围区域小的厚度。

[0072] 当多个电极组件 10 被插入地安装并且在壳体 30 内并联连接时，如果各个电极组件不被阻断，则高容量电流将持续在电极组件 10 之间且在电极组件 10 中流动，这可导致危险的状况。在此情况下，持续的电流流动将增加壳体 30 内的内部压力，从而可导致爆炸或着火。

[0073] 然而，根据本实施例，当连接到侧板 614 的连接区域 616 被分别阻断时，存储在电极组件 10 中的电流量被分散，从而增强稳定性。

[0074] 阻断构件 67 可被插入地安装在熔断体区域 617 的每一个上。阻断构件 67 可由诸如聚合物等具有电绝缘特性的材料制成。阻断构件 67 可包括在熔断体区域 617 的与正电极未涂覆区域相反的一侧上的基部区域 671、从基部区域 671 的两个横向端伸出并在端子连接区域 612 和集流片 615 之间的突出部 672 和在突出部 672 的前端并且向内伸出的止挡突出部 673。突出部 672 被插入形成在熔断体区域 617 上的凹进中，而止挡突出部 673 接触熔断体区域 617，从而支撑阻断构件 67。

[0075] 基部区域 671 可定位在壳体 30 和集流构件 61 之间，以将集流构件 61 和壳体 30 绝缘。当熔断体区域 617 被熔化时，突出部 672 支撑使得熔化的部分被分开。因此，在熔断体区域 617 被熔化之后，能够防止分开的部分恢复接触。

[0076] 当熔断体区域 617 被熔化时，如果分开的部分足够接近，可能在分开的部分处引发火星等，并且可再充电电池 102 可能着火。然而，根据本实施例，因为阻断构件 67 被安装，熔断体区域 617 的分开的部分之间的间隙可被稳定地保持。

[0077] 图 6 描绘了根据第三实施例的可再充电电池的集流构件的透视图。

[0078] 参见图 6，除了集流构件的结构之外，根据第三实施例的可再充电电池被配置为具有与第一实施例的结构相同的结构，因此对相同结构的说明将不再重复。

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[0079] 根据第三实施例的集流构件64可包括固定到正电极端子21的端子连接区域642、被形成为从端子连接区域642弯曲的侧板644、连接到侧板644的两个横向端的两个连接区域646以及形成在连接区域646的下部并且被附接到正电极未涂覆区域11a的集流片643。具有比周围区域小的截面积的熔断体区域647可形成在侧板644和连接区域646之间。

[0080] 端子连接区域642可具有四边形板状形状，并且可包括在其中心处的孔642a，正电极端子21插入孔642a中。端子连接区域642可通过焊接被连接到正电极端子21的下部。侧板644可以以直角从端子连接区域642朝向壳体30的底部弯曲，从而被设置为与壳体30的侧面平行。

[0081] 连接区域646可与侧板644的两个横向端连接。集流片643可形成在连接区域646的下部，并且被附接到正电极未涂覆区域11a。分支区域648可从连接区域646的横向端伸出。集流片645可被连接到分支区域648。

[0082] 每一个具有比其它部分小的截面积的熔断体区域647可被形成在连接区域646和侧板644之间。根据本实施例，熔断体区域647具有比周围区域小的宽度。因此，当过电流流过集流构件64时，熔断体区域647可被熔化以切断连接区域646与侧板644之间的电连接。然而，本实施例并不意味着限于此，例如，熔断体区域647可具有比周围区域小的厚度。

[0083] 当多个电极组件10被插入地安装并且在壳体30内并联连接时，如果各个电极组件不被阻断，则高容量电流可持续在多个电极组件10之间并在多个电极组件10中流动，这可导致危险的状况。在此情况下，持续的电流流动将增加壳体30内的内部压力，从而可能导致爆炸或着火。

[0084] 然而，根据本实施例，当连接到侧板644的连接区域646被分别阻断时，存储在电极组件10中的电流量被分散，从而增强稳定性。

[0085] 图7描绘了根据第四实施例的可再充电电池的集流构件的透视图。

[0086] 参见图7，除了电极组件的数量之外，根据第四实施例的可再充电电池被配置为具有与第一实施例的结构相同的结构，因此对相同结构的说明将不再重复。

[0087] 根据第四实施例的可再充电电池的集流构件65可包括固定到正电极端子21的端子连接区域652、被形成为从端子连接区域652弯曲的侧板654、连接到侧板654的两个横向端的集流片655以及在侧板654和集流片655之间的熔断体区域657。

[0088] 端子连接区域652可具有四边形板状形状，并且可包括在其中心处的孔652a，正电极端子21插入孔652a中。端子连接区域652可通过焊接被连接到正电极端子21的下部。侧板654可以以直角从端子连接区域652朝向壳体30的底部弯曲，从而被设置为与壳体30的侧面平行。

[0089] 具有比其它部分小的截面积的熔断体区域657可被形成在侧板654的两个横向端处。根据本实施例，熔断体区域657被形成为具有比周围区域小的宽度。因此，当过电流流过集流构件65时，熔断体区域657可被熔化以切断集流片655与侧板654之间的电连接。然而，本实施例并不意味着限于此，例如，熔断体区域657可被形成为具有比周围区域小的厚度。

[0090] 集流片655可形成在每个熔断体区域657的一个横向端处，并且通过焊接被连接到正电极未涂覆区域11a。

[0091] 当两个电极组件10被插入地安装并且在壳体30内并联连接时，如果各个电极组

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件不被阻断，则高容量电流可持续在电极组件 10 之间流动，这可导致危险的状况。在此情况下，持续的电流流动将增加壳体 30 内的内部压力，从而可能导致爆炸或着火。

[0092] 然而，根据本实施例，当连接到侧板 654 的集流片 655 被分别阻断时，存储在电极组件 10 中的电流量被分散，从而增强稳定性。

[0093] 图 8 描绘了根据第五实施例的可再充电电池的剖视图。

[0094] 参见图 8，根据第五示例性实施例的可再充电电池 103 可包括：通过卷绕正电极 11 和负电极 12 以及介于它们之间的隔板 13 而形成的电极组件 10；将电极组件 10 容纳在其中的壳体 30；和联接到壳体 30 的开口的盖组件 120。电极组件 10 被配置为具有与上述第一实施例的结构相同的结构。

[0095] 壳体 30 可具有基本长方体形状，并且在其一侧具有开口。盖组件 120 可包括覆盖壳体 30 的开口的盖板 125、从盖板 125 向外伸出并且与正电极 11 电连接的正电极端子 121 以及从盖板 125 向外伸出并且与负电极 12 电连接的负电极端子 122。

[0096] 正电极端子 121 可经由集流构件 51 与正电极未涂覆区域 11a 电连接。集流构件 51 可被配置为具有与根据第一实施例的集流构件的结构相同的结构。

[0097] 在正电极端子 121 和盖板 125 之间，垫圈 143 可被插入地定位在正电极端子 121 贯穿的孔中。下绝缘构件 147 可被安装在盖板 125 下方，以将正电极端子 121 和集流构件 51 的插入下绝缘构件 147 中的部分与盖板 125 的绝缘。

[0098] 短路接线片 131 可被电连接到正电极端子 121，例如短路接线片 131 被安装在盖板 125 上。上绝缘构件 137 可安装在短路接线片 131 和盖板 125 之间以将短路接线片 131 和盖板 125 电绝缘。短路接线片 131 可经由螺母 129 与正电极端子 121 电连接。上绝缘构件 137 可被安装以覆盖短路接线片 131 的横向端，并且可在与形成在盖板 125 上的短路孔 135 对应的部分处具有孔。

[0099] 负电极端子 122 可贯穿盖板 125。盖板 125 和负电极端子 122 之间的连接板 141 将负电极端子 122 和盖板 125 电连接。因此，盖板 125 和壳体 30 带负电。在负电极端子 122 和盖板 125 之间，垫圈 142 可被插入地定位在负电极端子 122 贯穿的孔中。

[0100] 盖组件 120 可包括能够将正电极 11 和负电极 12 短路的短路构件 134。短路孔 135 可形成在盖板 125 中，并且短路构件 134 可被设置在短路孔 135 处位于上绝缘构件 137 与盖板 125 之间。短路构件 134 可被配置为反转板，包括形成在其边缘处并且被固定到盖板 125 的边缘部分 134a 和形成在边缘部分 134a 的内侧呈弧形形状凸出的弧形部分 134b。

[0101] 以此方式，短路构件 134 被连接到与负电极 12 电连接的盖板 125。当可再充电电池 103 的内部压力增加时，短路构件 134 变形以被连接到与正电极 11 电连接的短路接线片 131。

[0102] 当短路构件 134 被电连接到短路接线片 131 时，大电流瞬时流过集流构件 51。此时，熔断体区域 517 和 518 被熔化以切断正电极端子 121 和电极组件 10 之间的电连接以及电极组件 10 之间的电连接。

[0103] 以此方式，通过应用短路构件 134 和包括多个熔断体区域 517、518 的集流构件，当可再充电电池 103 的内部压力增加时能够容易地中断（或切断）电流，由此进一步增加稳定性。

[0104] 图 9 描绘出第六实施例的可再充电电池的局部分解透视图。图 10 描绘出示出根

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据第六实施例的可再充电电池的构造的示意图。

[0105] 参见图 9 和图 10，根据第六实施例的可再充电电池 104 被配置为具有与第一实施例的结构相同的结构，因此相同结构的说明将不再重复。

[0106] 集流构件 66 可通过焊接被连接到正电极未涂覆区域 11a。集流构件 68 可通过焊接被连接到负电极未涂覆区域 12a。

[0107] 集流构件 66 将正电极 11 与正电极端子 21 电连接。集流构件 68 将负电极 12 与负电极端子 22 电连接。

[0108] 集流构件 66 可包括固定到正电极端子 21 的端子连接区域 662、从端子连接区域 662 弯曲的侧板 664、固定到正电极未涂覆区域 11a 的集流片 663 以及在侧板 664 和集流片 663 之间并且具有比周围区域小的截面积的熔断体区域 667。

[0109] 除了熔断体区域 667 和 668 之外，安装在负电极端子 22 处的集流构件 68 被配置为具有与集流构件 66 的结构相同的结构，因此对其的描述将不再重复。

[0110] 端子连接区域 662 可具有四边形板状形状，并且可包括在其中心处的孔 662a，正电极端子 21 插入孔 662a 中。端子连接区域 662 可通过焊接被连接到正电极端子 21 的下部。侧板 664 可以以直角从端子连接区域 662 朝向壳体 30 的底部弯曲，从而被设置为与壳体 30 的侧面平行。

[0111] 两个集流片 663 可被连接到侧板 664 的两个横向端处。具有比其它部分小的截面积的熔断体区域 667 可被形成在集流片 663 和侧板 664 之间。

[0112] 根据本实施例，熔断体区域 667 被形成为具有比周围区域小的宽度。因此，当过电流流过集流构件 66 时，熔断体区域 667 可被熔化以切断集流片 663 与侧板 664 之间的电连接。然而，本实施例并不意味着限于此，例如，熔断体区域 667 可被形成为具有比周围区域小的厚度。

[0113] 连接区域 666 可形成在侧板 664 的下部，并且集流片 665 可形成在连接区域 666 的两个横向端处，并且通过焊接被连接到正电极未涂覆区域 11a。具有比其它部分小的截面积的熔断体区域 668 可被形成在连接区域 666 和集流片 665 之间。

[0114] 熔断体区域 668 被形成为具有比周围区域小的宽度。因此，当过电流流过集流构件 66 时，熔断体区域 668 被熔化，以切断连接区域 666 和集流片 665 之间的电连接。

[0115] 以此方式，根据本实施例，因为多个熔断体区域 667 形成为与侧板 664 连接，当过电流流动时，与各个集流片 663 的电连接能够被切断。另外，因为多个熔断体区域 668 形成为与连接区域 666 连接，当过电流流动时，与各个集流片 665 的电连接能够被切断。

[0116] 与负电极 12 电连接的安全构件 70 可分别被安装在电极组件 10 中设置在两个横向侧处的电极组件 10 上。安全构件 70 可通过焊接被连接到电极组件 10 中设置在两个横向侧处的电极组件 10 的负电极未涂覆区域 12a。安全构件 70 可包括金属板 71 和附接到金属板 71 的绝缘膜 73。

[0117] 与负电极未涂覆区域 12a 电连接的电极连接区域 72 被连接到金属板 71 的一个横向端。金属板 71 通过焊接在电极连接区域 72 处与负电极未涂覆区域 12a 连接，并且由与负电极未涂覆区域 12a 的材料相同的材料制成，从而易于被焊接到负电极未涂覆区域 12a。根据本实施例的金属板 71 由例如铜（Cu）或铜合金制成。

[0118] 绝缘膜 73 可安装在金属板 71 的与电极组件 10 的平坦前表面相对的部分上。绝

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缘膜 73 用于防止电极组件 10 和金属板 71 电连接。绝缘膜 73 可由不与电解质反应的材料制成，例如聚合物材料。

[0119] 电极连接区域 72 在被设置为与负电极未涂覆区域 12a 平行的状态下可通过焊接被固定到负电极未涂覆区域 12a。因此，电极连接区域 72 用于防止负电极未涂覆区域 12a 由于外部冲击或震动而摇晃。

[0120] 当集流构件 68 通过焊接被连接到负电极未涂覆区域 12a 时，如果负电极未涂覆区域 12a 由于外部冲击或震动而摇晃，则负电极未涂覆区域 12a 与集流构件 68 之间的接触恶化。然而，在本实施例中，因为电极连接区域 72 支撑负电极未涂覆区域 12a，由于外部冲击或震动等导致的负电极未涂覆区域 12a 与集流构件 68 之间的接触恶化可被减小或防止。

[0121] 如图 10 所示，当例如钉子、螺丝锥等导电外物 80 穿透到可再充电电池 104 中时，如果正电极 11 和负电极 12 经由导电外物 80 短路，则大量的热将在可再充电电池 104 中产生，这可导致可再充电电池爆炸或着火。然而，在本实施例中，因为安全构件 70 被安装，安全构件 70 和正电极 11 短路，从而释放带电流。当与负电极 12 电连接的金属板 71 与正电极 11 短路时，与正电极 11 和负电极 12 短路的情况相比产生非常小量的热。

[0122] 以此方式，根据本实施例，当外物从外部穿透潜在地导致短路时，电流被释放以减小或消除着火的可能，因此增强了可再充电电池 104 的稳定性。

[0123] 此外，当短路发生因此过电流流动时，形成在集流构件 66 处的熔断体区域 667 和 668 被熔化以切断正电极端子 21 和电极组件 10 之间的电连接以及电极组件之间的电连接。因此，可再充电电池 104 的稳定性能够被进一步增强。根据实施例，当过电流流动时，电极组件被电切断，因此改进了可再充电电池的稳定性。

[0124] 在这里已经公开了各示例实施例，尽管采用了特定术语，但这些术语仅以一般和描述的意义被使用和理解而不是为了限制的目的。在一些情况下，对于本领域普通技术人员明显的是，在递交本申请时，除非特别指出之外，结合特定实施例描述的特征、特点和 / 或元件可单独使用或可与结合其它实施例描述的特征、特点和 / 或元件组合使用。因此，本领域技术人员将理解，不脱离所附权利要求中所提出的本发明的精神和范围的情况下可以进行各种形式上和细节上的改变。

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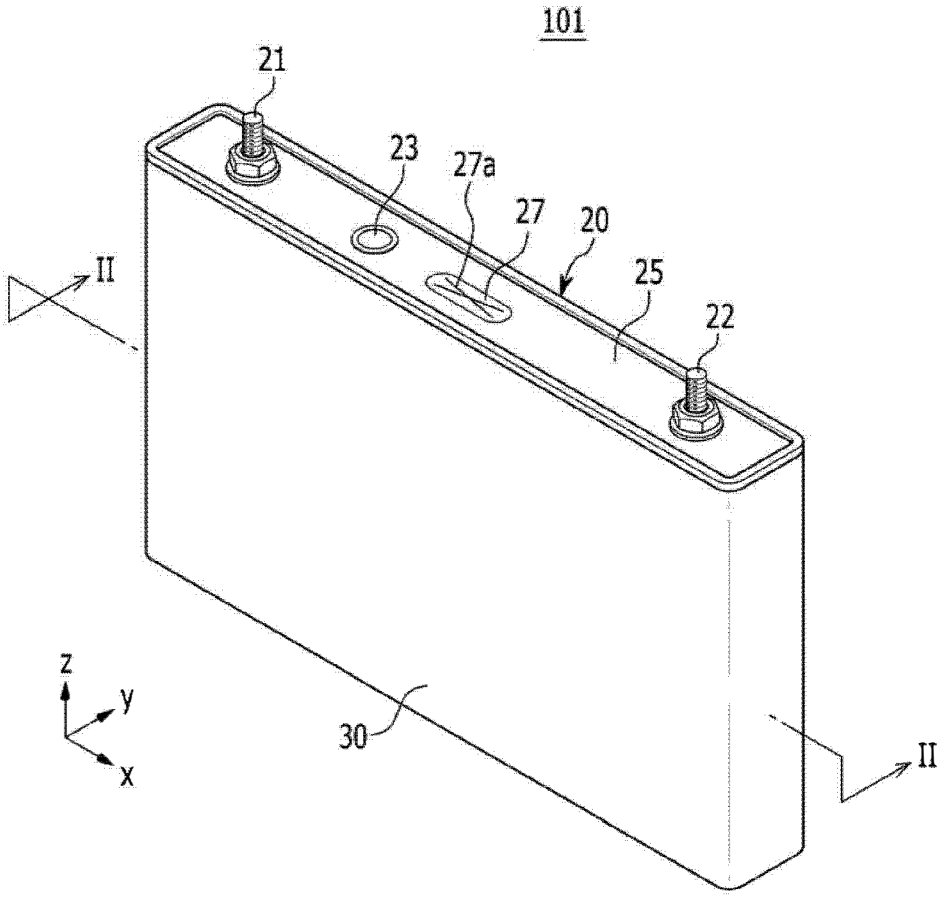


图 1

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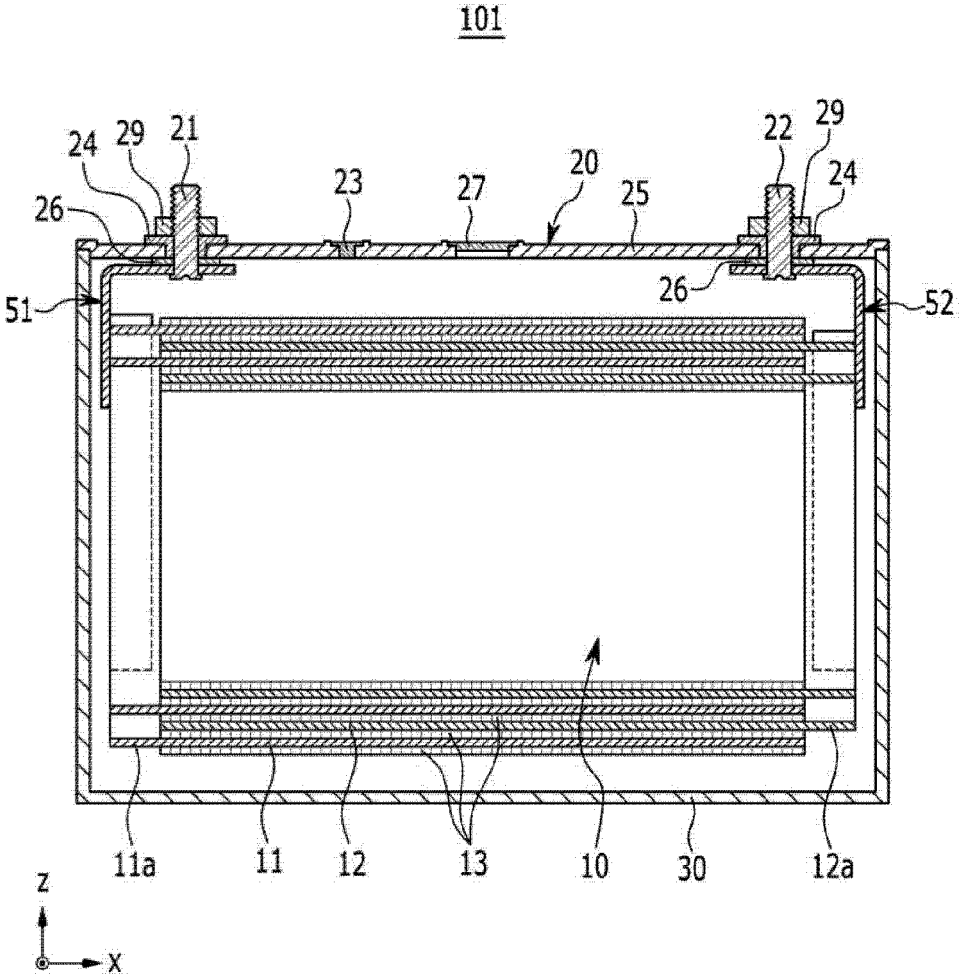


图 2

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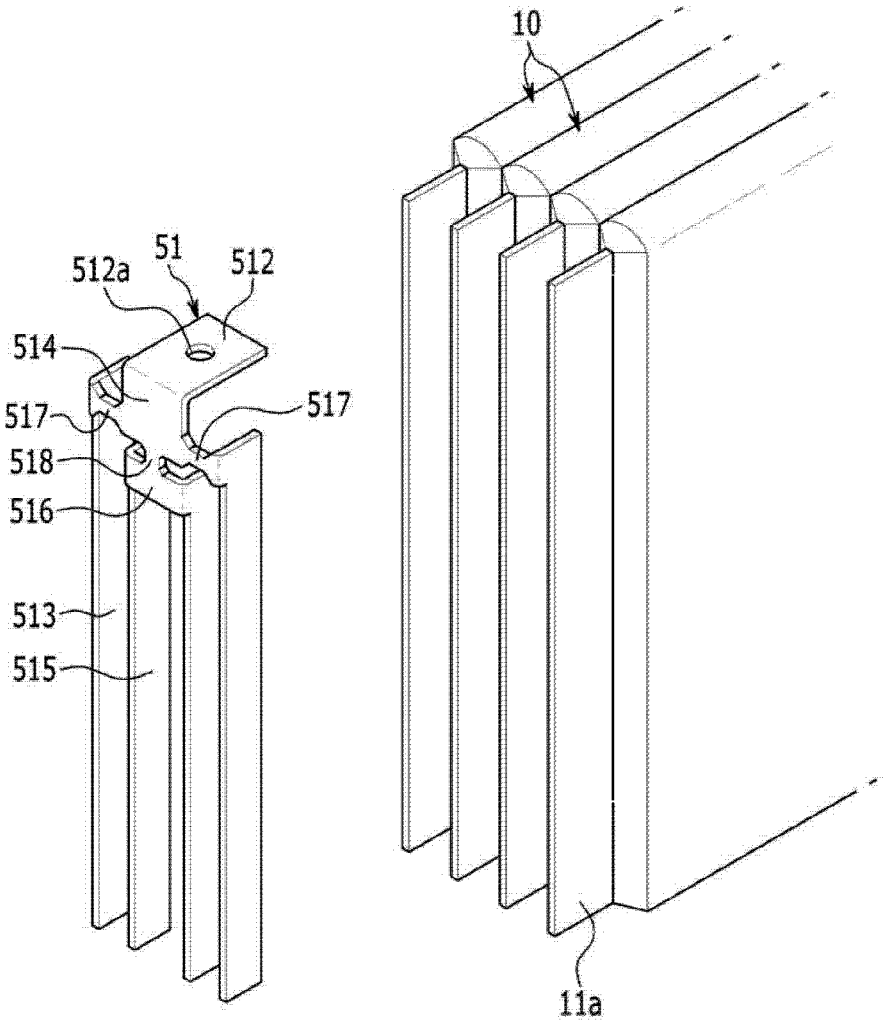


图 3

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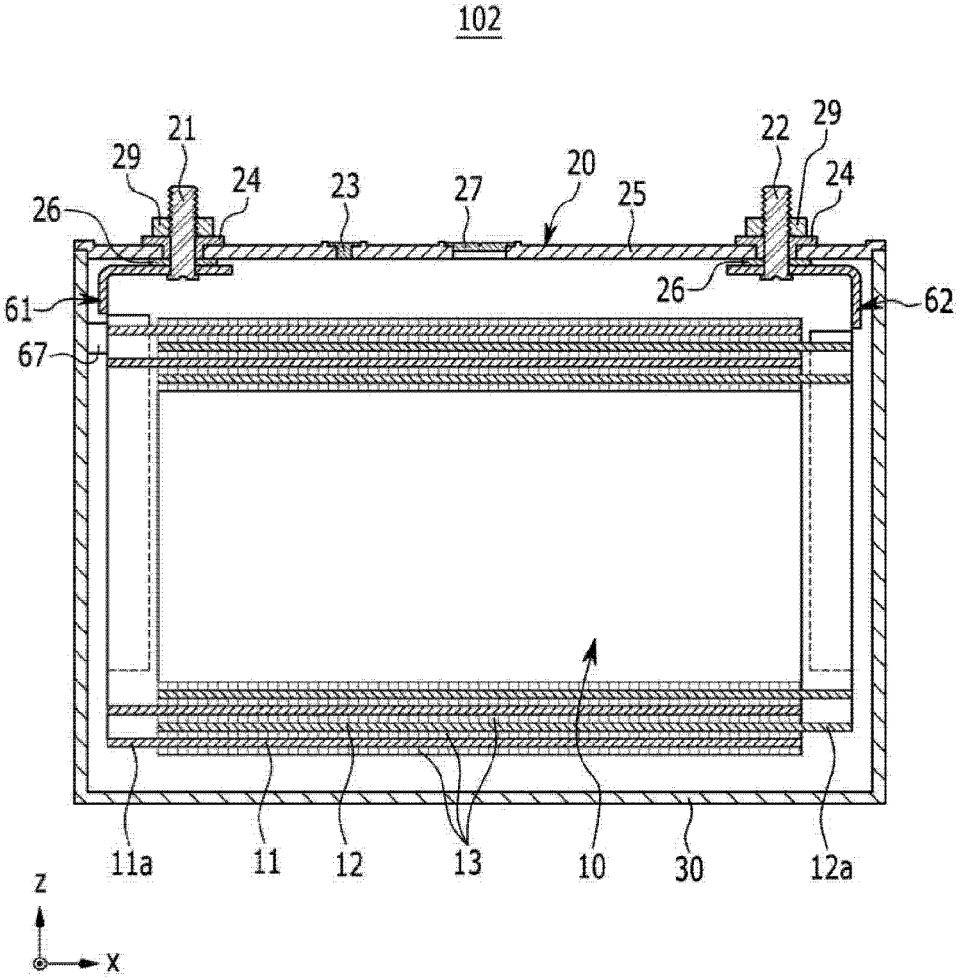


图 4

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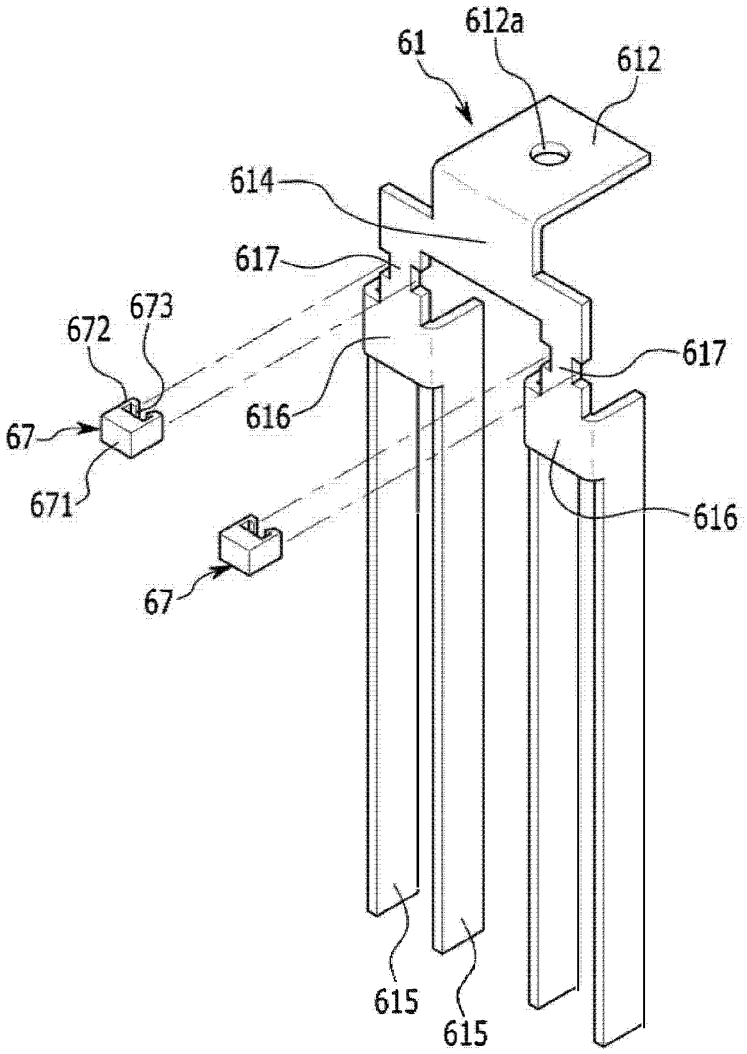


图 5

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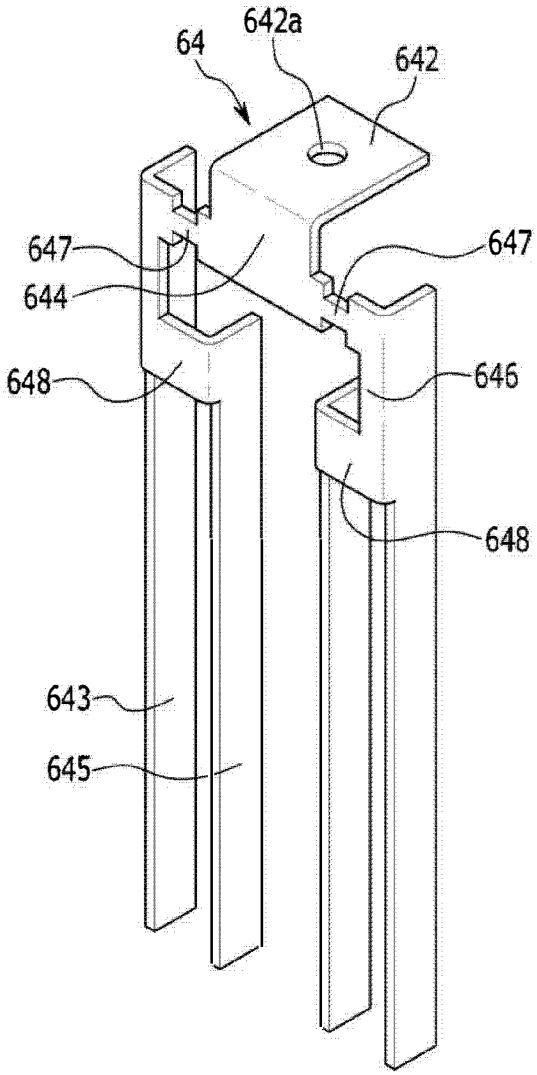


图 6

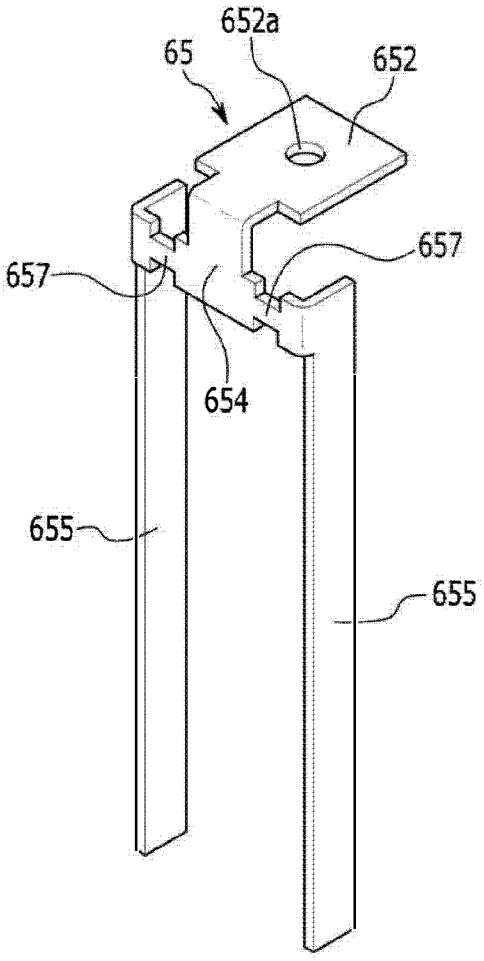


图 7

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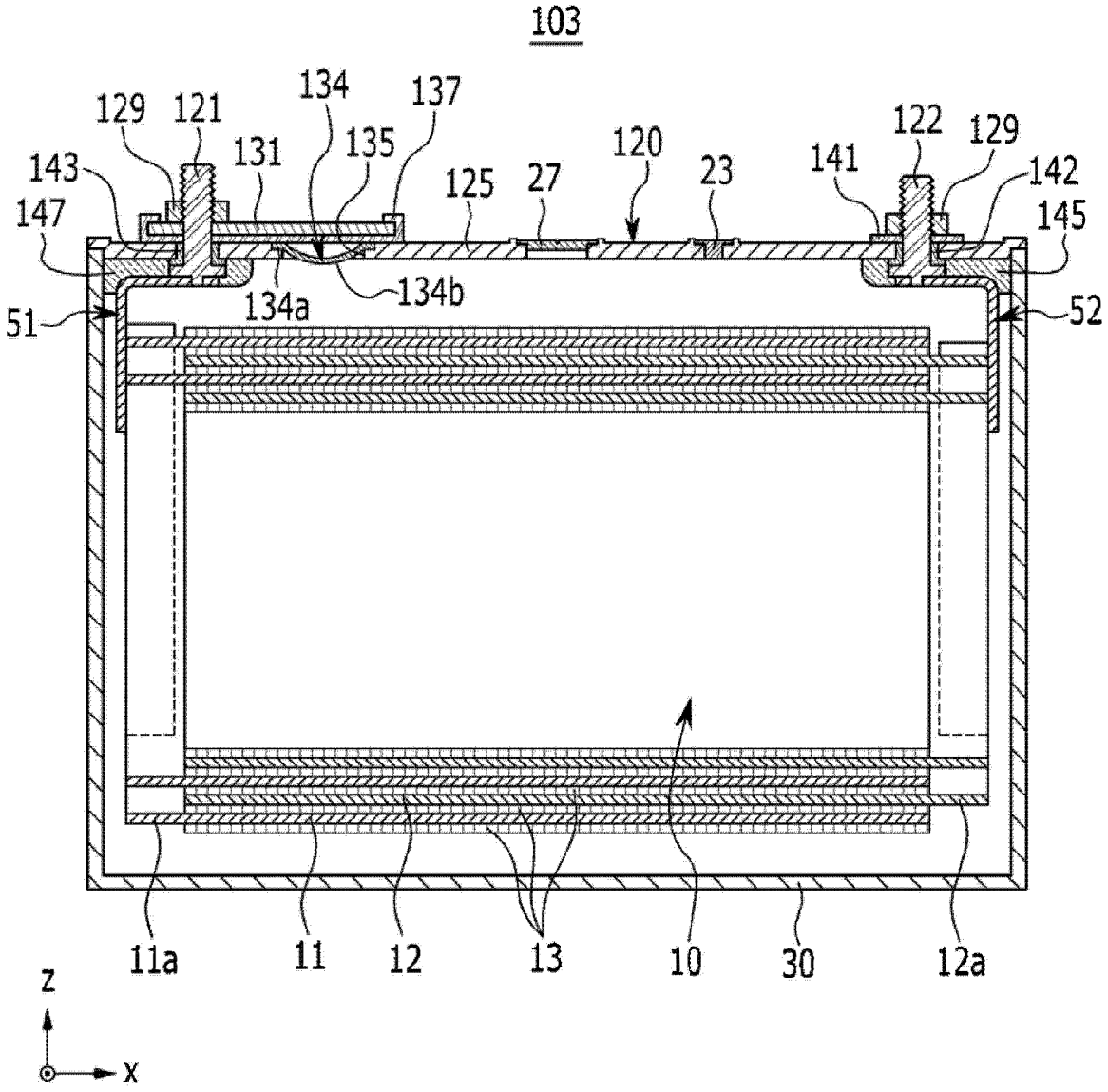


图 8

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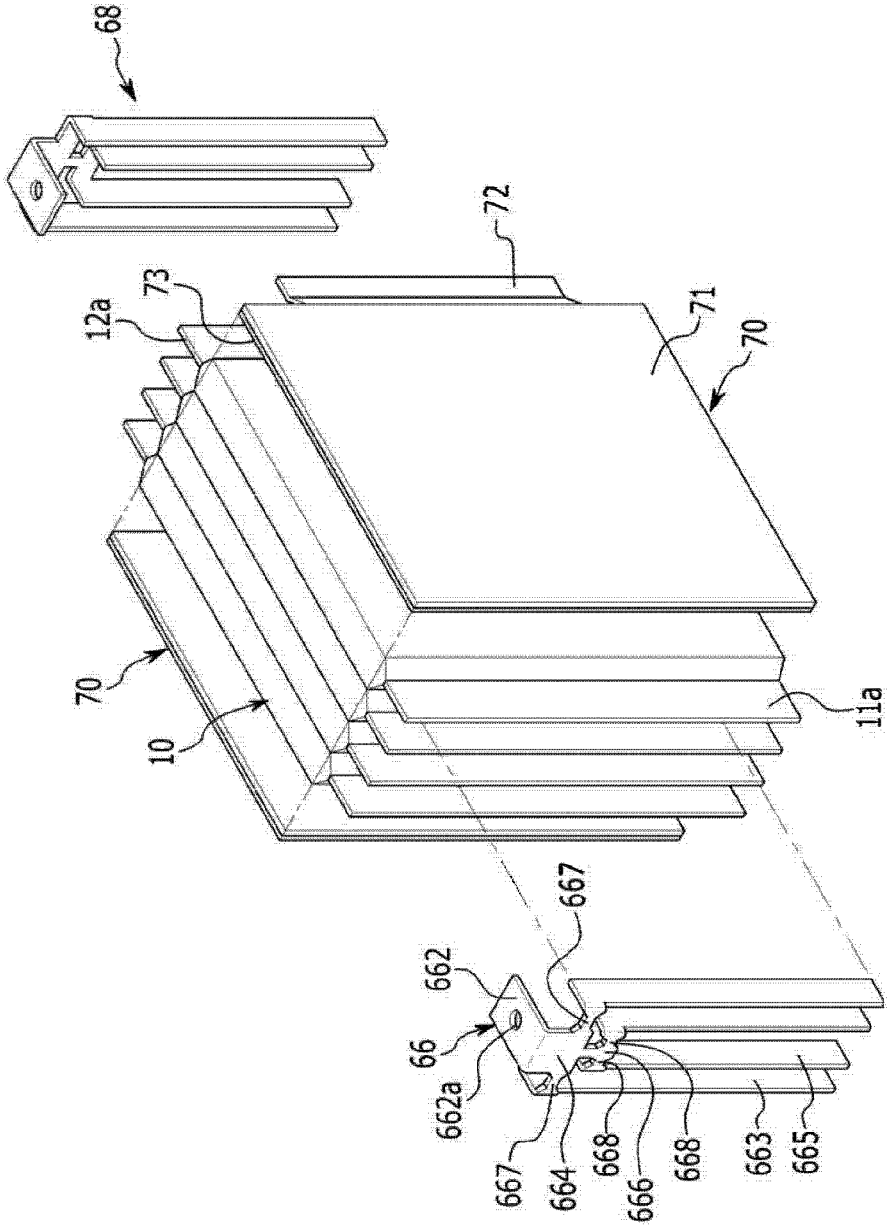


图 9

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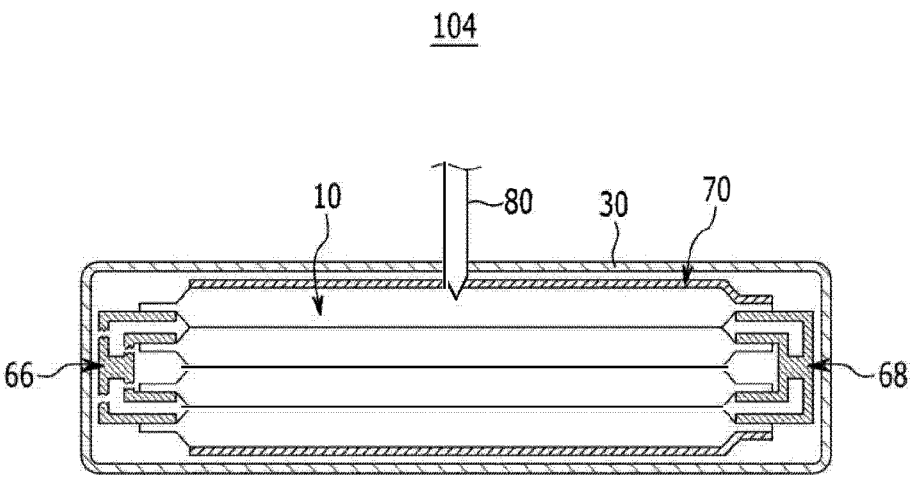


图 10

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PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/450,422	Filing Date 06/24/2019	☐ To be Mailed

ENTITY: ☐ LARGE ☑ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $50 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $230 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	06/23/2022	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 54	Minus	** 48	= 6		x $50 =	300
	Independent (37 CFR 1.16(h))	* 6	Minus	*** 5	= 1		x $240 =	240
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	540

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	SLIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/SHARON M WEST/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
16/450,422	06/23/2022 03:17:41 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 #	60736192	AUTHORIZED BY	William Klima
CUSTOMER #	20230	FILING DATE	06/24/2019
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Jonathan Lewis Nook

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
DA / 220585	E20226MF18000113	Lisa Elliott

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
2202	EACH CLAIM IN EXCESS OF 20	50.00	6	300.00
2201	EACH INDEPENDENT CLAIM IN EXCESS OF THREE	240.00	1	240.00
			TOTAL AMOUNT:	$540.00

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

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)

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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.

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APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
16/450,422	**06/23/2022 03:17:41 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 #	60736192	FILING DATE	06/24/2019
CUSTOMER #	20230	FIRST NAMED INVENTOR	Jonathan Lewis Nook
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	William Klima

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
2022-06-23 - RNFOA - 16450422 - 054985-000055-US-05.pdf	20	Preliminary Amendment	169 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
2022-06-23 - RNFOA - 16450422 - 054985-000055-US-05.pdf	1ADED4A206CF05E1A116775A6CE1999DE6BFF9DCB15AA1F6D83ABFA6F1CC420FC6423C46B6D882739•1B9DBA00A7A69433 11678483FC4804FE96C2A414C9B0417

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
NOOK et al.
Appl. No.: 16/450,422
Filing Date: June 24, 2019
Exam: DIAO
Art Unit: 2859
Conf.: 1008
Title: **PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION AND JUMPER CABLE DEVICE THEREOF**

AMENDMENT AND RESPONSE

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22315

Dear Commissioner:

This paper is submitted after filing a Request for Continued Examination (RCE) dated June 10, 2022.

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Amendments to the claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Currently amended) A jump starting apparatus configured for boosting or charging a depleted or discharged battery having a positive polarity battery terminal and a negative polarity battery terminal, the jump starting apparatus comprising:

a power supply;

a positive polarity battery terminal connector configured for connecting the jump starting apparatus to the positive polarity battery terminal of the depleted or discharged battery;

a negative polarity battery terminal connector configured for connecting the jump starting apparatus to the negative polarity battery terminal of the depleted or discharged battery;

a power switch or circuit configured to turn on power from the power supply to the positive and negative polarity battery terminal connectors;

a control system or circuit connected to and controlling the power switch, the control system or circuit configured to detect whether the positive and negative polarity battery terminal connectors have a ~~proper or improper~~ correct polarity connection with the positive and negative polarity battery terminals of the depleted or discharged battery prior to turning on the power switch or circuit;

a USB input ~~charge~~ circuit connected to the power supply, the USB input ~~charge~~ circuit comprising a DC/DC converter, the USB input ~~charge~~ circuit configured for

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converting power from a USB ~~charger~~ power source to increase ~~charge~~ power voltage ~~for charging~~ to the power supply; and

a USB input connector connected to the USB input ~~charge~~ circuit, the USB input connector configured for connecting to the USB ~~charger~~ power source and providing ~~charging~~ power input from the USB ~~charger~~ power source through the USB input connector and the USB input ~~charge~~ circuit to the power supply.

2. (Previously presented) The apparatus of claim 1, wherein the power supply comprises a lithium ion battery.

3. (Previously presented) The apparatus of claim 2, wherein the lithium ion battery comprises a battery pack of multiple lithium ion batteries.

4. (Previously presented) The apparatus of claim 1, wherein the power switch comprises one or more FETs.

5. (Currently amended) The apparatus of claim 1, wherein the control system or circuit is configured ~~for detecting~~ to detect a presence of the depleted or discharged battery connected between the positive and negative polarity battery terminal connectors and ~~detecting a proper~~ to detect the correct polarity connection of the ~~positive and negative polarity terminals with the~~ positive and negative polarity battery terminal connectors of the jump starting device with the positive and negative battery terminals of the depleted or discharged battery.

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6. (Previously presented) The apparatus of claim 1, further comprising a plurality of power diodes coupled between the positive and negative battery terminal connectors and the power supply to prevent back-charging of the power supply from an electrical system connected to the positive and negative battery terminal connectors.

7. (Previously presented) The apparatus of claim 1, further comprising a temperature sensor configured to detect temperature of the power supply and to provide a temperature signal to a microcontroller.

8. (Previously presented) The apparatus of claim 1, further comprising a voltage measurement circuit configured to measure output voltage of the power supply and to provide a voltage measurement signal to a microcontroller.

9. (Previously presented) The apparatus of claim 1, further comprising a voltage regulator configured to convert output voltage of the power supply to a voltage level appropriate to provide operating power to internal components of the jump starting apparatus.

10. (Previously presented) The apparatus of claim 1, further comprising a USB output port configured to provide charging power from the power supply to a USB-chargeable device.

11. (Cancelled)

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12. (Original) The apparatus of claim 1, further comprising a flashlight circuit configured to provide a source of light to a user.

13. (Previously presented) The apparatus of claim 12, wherein the source of light is at least one LED.

14. (Previously presented) The apparatus of claim 13, wherein the control system or circuit is configured to control the at least one LED to provide a visual alarm indicating an emergency situation.

15. (Previously presented) The apparatus of claim 1, further comprising a plurality of visual indicators configured to display remaining capacity status of the power supply.

16. (Previously presented) The apparatus of claim 15, wherein the plurality of visual indicators comprises a plurality of LEDs providing output light of different colors.

17. (Previously presented) The apparatus of claim 1, further comprising a visual indicator configured to warn a user when the depleted or discharged battery is connected to the jump starting apparatus with reverse polarity.

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18. (Previously presented) The apparatus of claim 1, further comprising separate visual indicators configured to display a power on status of the jump starting apparatus, and a jump start boost power status of power supplied to an output device.

19. (Currently amended) The apparatus of claim 1, further comprising a manual override switch configured to activate a manual override mode to enable a user to connect jump start power to ~~an output port~~ the depleted or discharged vehicle battery when [[the]] a vehicle battery isolation sensor is unable to detect presence of [[a]] the vehicle battery.

20. (Previously presented) The apparatus of claim 19, wherein the control system or circuit is configured to detect actuation of the manual override switch for at least a predetermined period of time before activation of the manual override mode.

21. (Previously presented) The apparatus of claim 1, further comprising a jumper cable device, the jumper cable device comprising a plug configured to plug into an output port of the jump starting apparatus, a pair of battery cables integrated with the plug at one end of the pair of cables, and the positive and negative battery terminal connectors connected to an opposite end of the pair of battery cables.

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22. (Previously presented) The apparatus of claim 21, wherein the jumper cable device further comprises a pair of ring terminals configured to respectively connect the pair of cables at the opposite end to the respective positive and negative battery terminals of the depleted or discharged battery, or connect to respective positive and negative battery clamps.

23. (Previously presented) The apparatus of claim 21, wherein the output port and the plug are dimensioned so that the plug will fit into the output port only in one specific orientation.

24.-28. (Cancelled)

29. (Currently amended) A jump starting apparatus for boosting or charging a depleted or discharged battery having a positive polarity battery terminal and a negative polarity battery terminal, the jump starting apparatus comprising:

a power supply;

a positive polarity battery terminal connector configured for connecting the jump starting apparatus to the positive polarity terminal of the depleted or discharged battery;

a negative polarity battery terminal connector configured for connecting the jump starting apparatus to the negative polarity terminal of the depleted or discharged battery;

a battery presence sensor or circuit connected in circuit with the positive polarity battery terminal connector and the negative polarity battery terminal connector;

a reverse polarity sensor or circuit connected in circuit with the positive polarity

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battery terminal connector and the negative polarity terminal connector;

a power switch or circuit connected or connectable in circuit with the power supply and the positive and negative polarity battery terminal connectors;

a microcontroller configured to receive input signals provided by the battery presence sensor or circuit and the reverse polarity sensor or circuit, the microcontroller configured to provide an output signal to control the power switch,

a USB input ~~charge~~ circuit connected to the power supply, the USB input ~~charge~~ circuit configured for converting power from a USB ~~charger~~ power source to increase ~~charge~~ power voltage ~~for charging~~ to the power supply; and

a USB input connector connected to the USB input ~~charge~~ circuit, the USB input connector configured for connecting to the USB ~~charger~~ power source and providing ~~charge~~ power input from the USB ~~charger~~ power source through the USB input connector and the USB input ~~charge~~ circuit to the power supply.

30. (Currently amended) A jump starting device for boosting or charging a depleted or discharged battery having a positive polarity battery terminal and a negative polarity battery terminal, the jump starter device comprising:

a power supply;

a positive battery terminal connector for connecting the jump starter device to the positive battery terminal of the depleted or discharged battery;

a negative battery terminal connector for connecting the jump starter device to the negative battery terminal of the depleted or discharged battery;

a power switch or circuit connected in circuit with the power supply and the

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positive and negative battery terminal connectors, the power switch configured to turn power on or off from the power supply to the depleted or discharged battery when the positive and negative battery terminal connectors are properly connected to the positive and negative battery connectors;

a power switch control system or circuit connected to and controlling the power switch, the power switch control system or circuit configured to detect presence of the depleted or discharged battery when connected between the positive and negative battery terminal connectors and to detect polarity of the depleted or discharged battery when connected between the positive and negative battery terminal connectors;

a USB input ~~charge~~ circuit connected to the power supply, the USB input ~~charge~~ circuit configured for converting power from a USB ~~charger~~ power source to increase ~~charge~~ power voltage ~~for charging~~ to the power supply; and

a USB input connector configured for connecting to the USB ~~charger~~ power source and providing ~~charge~~ power input from the USB ~~charger~~ power source through the USB input connector ~~an~~ and the USB input ~~charge~~ circuit to the power supply.

31. (Previously presented) The device according to claim 30, wherein the power switch control system or circuit does not switch on the power supply to connect the power supply to the depleted or discharged battery when the power switch control system or circuit detects either that (i) the depleted or discharged battery is absent or not connected between the positive and negative battery connectors, and (ii) the depleted or discharged battery is not connected with a proper polarity between the positive and negative battery terminal connectors.

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32. (Previously presented) The device according to claim 30, wherein the power switch control system or circuit is configured to detect presence of the depleted or discharged battery when connected between the positive and negative battery connectors and to detect polarity of the depleted or discharged battery when connected between the positive and negative battery connectors prior to turning power on from the power supply to the depleted or discharged battery.

33. (Previously presented) The device according to claim 30, wherein the power switch control system or circuit comprises a microcontroller configured for providing an output controlling the power switch.

34. (Previously presented) The device according to claim 33, wherein the microcontroller receives input from one or more sensors configured to detect presence of the depleted or discharged battery when connected between the positive and negative battery connectors and to detect polarity of the depleted or discharged battery when connected between the positive and negative battery connectors.

35. (Previously presented) The device according to claim 34, wherein the one or more sensors includes one sensor configured to detect presence of the depleted or discharged battery when connected between the positive and negative battery terminal connectors, and another sensor configured to detect polarity of the depleted or discharged battery when connected between the positive and negative battery terminal connectors.

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36. (Previously presented) The device according to claim 35, wherein the one or more sensors comprises one or more sensing circuits.

37. (Previously presented) The device according to claim 33, wherein the microcontroller is configured to turn on the power switch to provide power from the power supply to the depleted or discharged battery only when the depleted or discharged battery is determined by the microcontroller to be present and properly or improperly connected to the jump starting apparatus.

38. (Currently amended) A jump starting device for boosting or charging a depleted or discharged battery having a positive polarity battery terminal and a negative polarity battery terminal, the jump starter device comprising:

a power ~~source~~ supply;

a positive battery terminal connector for connecting the jump starter device to the positive battery terminal of the depleted or discharged battery;

a negative battery terminal connector for connecting the jump starter device to the negative battery terminal of the depleted or discharged battery;

a power switch or circuit connected in circuit with the power ~~source~~ supply and the positive and negative battery terminal connectors, the power switch configured to turn power on or off from the power supply to the depleted or discharged battery when connected to the positive and negative battery terminal connectors;

a power switch control system or circuit connected to and controlling the power switch, the power switch control system or circuit configured to detect presence of the

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depleted or discharged battery when connected between the positive and negative battery terminal connectors and to detect proper or improper polarity of the depleted or discharged battery when connected between the positive and negative battery terminal connectors;

a USB input ~~charge~~ circuit connected to the power supply, the USB input ~~charge~~ circuit configured for converting power from a USB ~~charger~~ power source to increase ~~charge~~ power voltage ~~for charging~~ to the power supply; and

a USB input connector connected to the USB input ~~charge~~ circuit, the USB input connector configured for connecting to the USB ~~charger~~ power source, and providing ~~charge~~ power input from the USB ~~charger~~ power source through the USB input connector and the USB input ~~charge~~ circuit to the power ~~source~~ supply.

39. (Currently amended) The apparatus according to claim 38, ~~further comprising a DC-DC converter connected to~~ wherein the USB input ~~charge~~ circuit comprises a DC-DC converter.

40. (Currently amended) The apparatus according to claim [[1]] 39, wherein the DC-DC converter is configured for up-converting the input voltage received by the USB input connector.

41. (Currently amended) The apparatus according to claim 40, wherein the input voltage is about 5V that is up-converted to ~~12.4 VDC~~ at least 11.1 VDC for ~~charging~~ powering the power supply.

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42. (Previously presented) The apparatus according to claim 39, wherein the USB input charge circuit is configured to turn on and off the DC-DC converter by an output of the control system or circuit comprising a microcontroller.

43. (Currently amended) The apparatus according to claim 1, further comprising a USB output circuit ~~connected to~~ connecting the power supply to ~~provide a USB output port~~ a USB output connector for charging portable electronic devices from the power supply~~, and a USB output connector connected to the USB output circuit~~.

44. (Currently amended) The apparatus according to claim 43, ~~further comprising a~~ wherein the USB output ~~control~~ circuit is connected to a microcontroller, the USB output ~~control~~ circuit is configured to allow the USB output ~~port~~ circuit to be turned on and off by software control to prevent the ~~internal lithium battery~~ power supply from getting too low in capacity.

45. (Currently amended) The apparatus according to claim 43, wherein the USB output ~~connector~~ circuit includes a voltage divider ~~for enabling charge~~ to enable charging of certain electronic devices.

46. (Previously presented) The apparatus according to claim 1, including an operation indicator LED to provide visual indication of the power supply capacity status.

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47. (Previously presented) The apparatus according to claim 1, including an operation indicator LED to provide visual indication of the switch activation status indicating power is being provided to the depleted or discharged battery.

48. (Previously presented) The apparatus according to claim 1, wherein the proper or improper connection with the positive and negative polarity battery terminal connectors of the depleted or discharged battery prior to turning on the power switch or circuit is a proper or improper polarity connection.

49. (Previously presented) The apparatus according to claim 1, wherein the control system or circuit comprises one or more sensors connected to a microprocessor for determining whether the depleted or discharged battery is present and connected between the positive and negative polarity battery terminal connectors.

50. (Previously presented) The apparatus according to claim 1, wherein the control system or circuit comprises one or more sensors connected to a microprocessor for determining whether the depleted or discharged battery is properly or improperly connected to the positive and negative polarity battery terminal connectors.

51. (Previously presented) The apparatus according to claim 1, wherein the control system or circuit comprises one or more sensors connected to a microprocessor for determining whether the depleted or discharged battery is present and connected between the positive and negative polarity battery terminal connectors and determining

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whether the depleted or discharged battery is properly or improperly connected to the positive and negative polarity battery terminal connectors.

52. (Currently amended) The apparatus according to claim 1, wherein the DC-DC converter can be turned on and off by ~~the USB input charge circuit~~ a microprocessor.

53. (Currently amended) A jump starting apparatus configured for boosting or charging a depleted or discharged battery having a positive polarity battery terminal and a negative polarity battery terminal, the jump starting apparatus comprising:

a power supply;

a positive polarity battery terminal connector configured for connecting the jump starting apparatus to the positive polarity battery terminal of the depleted or discharged battery;

a negative polarity battery terminal connector configured for connecting the jump starting apparatus to the negative polarity battery terminal of the depleted or discharged battery;

a power switch or circuit configured to turn on power from the power supply to the positive and negative polarity battery terminal connectors;

a control system or circuit connected to and controlling the power switch, the control system or circuit comprising a microcontroller, the control system or circuit configured to detect whether the positive and negative polarity battery terminal connectors have a proper or improper connection with the positive and negative polarity battery terminals of the depleted or discharged battery prior to turning on the power

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switch;

a USB input connector configured for removably connecting to ~~an external~~ a USB ~~charger~~ power source and providing ~~charge~~ power input from the USB ~~charger through~~ power source to the USB input connector ~~to the power supply~~; and

a USB input ~~charge~~ circuit connecting the USB input connector to the power supply, the USB input ~~charge~~ circuit comprising a DC/DC converter, the USB input charge circuit configured for converting power from the ~~external~~ USB ~~charger~~ power source to ~~charge~~ to increase power voltage ~~and current for charging~~ to the power supply,

wherein the DC-DC converter can be turned on and off by an output [[of]] from the microcontroller.

54. (Currently amended) The apparatus according to claim 53, wherein the DC-DC converter can be turned on and off via the ~~USB input charge circuit~~ the control system or circuit by the output from the microcontroller.

55. (New) The apparatus according to claim 1, wherein the jump starting apparatus is configured to prevent an incorrect polarity connection of the positive and negative battery terminal connectors of the jump starting apparatus with the positive and negative polarity battery terminals of the depleted or discharged battery.

56. (New) The apparatus according to claim 1, wherein the jump starting apparatus is configured to prevent an incorrect polarity connection of the positive and negative battery terminal connectors of the jump starting apparatus with the positive and negative polarity

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battery terminals of the depleted or discharged battery prior to turning on the power switch or circuit.

57. (New) The apparatus according to claim 1, wherein the jump starting apparatus is configured to prevent an incorrect polarity connection of the positive and negative battery terminal connectors of the jump starting apparatus with the positive and negative polarity battery terminals of the depleted or discharged battery when turning on the power switch or circuit.

58. (New) The apparatus according to claim 1, wherein the jump starting apparatus is configured to prevent an incorrect polarity connection of the positive and negative battery terminal connectors of the jump starting apparatus with the positive and negative polarity battery terminals of the depleted or discharged battery by turning on the power switch only when the depleted or discharged battery is connected with correct polarity to the jump starting apparatus.

59. (New) The apparatus according to claim 1, wherein the jump starting apparatus is configured to prevent an incorrect polarity connection of the positive and negative battery terminal connectors of the jump starting apparatus with the positive and negative polarity battery terminals of the depleted or discharged battery by the jump starting device supplying power to the depleted or discharged battery only when or while connected with correct polarity to the jump starting apparatus.

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60. (New) A jump starting apparatus configured for boosting or charging a depleted or discharged battery having a positive polarity battery terminal and a negative polarity battery terminal, the jump starting apparatus comprising:

a power supply;

a positive polarity battery terminal connector configured for connecting the jump starting apparatus to the positive polarity battery terminal of the depleted or discharged battery;

a negative polarity battery terminal connector configured for connecting the jump starting apparatus to the negative polarity battery terminal of the depleted or discharged battery;

a power switch or circuit configured to turn on power from the power supply to the positive and negative polarity battery terminal connectors;

a control system or circuit connected to and controlling the power switch, the control system or circuit configured to detect whether the positive and negative polarity battery terminal connectors have a correct polarity connection with the positive and negative polarity battery terminals of the depleted or discharged battery and prevent an incorrect polarity connection with the positive and negative polarity battery terminals of the depleted or discharged battery prior to turning on the power switch or circuit;

a USB input connector; and

a USB input circuit connecting the USB input connector to the power supply, the USB input circuit comprising a DC/DC converter for up-converting the voltage from the USB input connector to the power supply.

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Remarks

Claims 1-10, 12-23, and 29-54 are pending prior to entry of the above amendments.

Claims 11 and 24-28 have previously been cancelled without prejudice or disclaimer of the subject matter contained therein.

Claims 1, 5, 19, 29, 30, 38-41, 43-45, and 52-54 are amended above, and claim 55-60 are newly added. No new matter has been added.

Applicant, by amending any claims and/or canceling any claims, makes no admission as to the validity of any rejection made by the Examiner against any of these claims. Applicant reserves the right to reassert any of the claims canceled or the original or previous claim scope of any claim amended, during the prosecution of this application, in a continuing application. Further, Applicant acknowledges but does not acquiesce or agree with any Examiner assertion regarding this application and expressly reserves the right to rebut or otherwise address any such assertion.

In view of the following, further and favorable consideration is respectfully requested.

The claims are amended above to more clearly present the claimed subject matter, and to make the claims more consistent with the wording and/or phrases from the original specification.

It is noted that independent claims 1, 29, 30, 38, 53, 55, and 60 recite the claimed feature of “a power supply” (e.g. a rechargeable battery). Thus, claims 1, 29, 30, 38, 53, and 55 are amended above to be more consistent with the claimed feature of “a power supply.”

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Conclusion

In view of the foregoing, Applicant submits that the application is in condition for immediate allowance. Early notice to that effect is earnestly solicited. The Examiner is invited to contact the undersigned attorney if it is believed that such contact will expedite the prosecution of the application.

In the event this paper is not timely filed, Applicant petitions for an appropriate extension of time. Please charge any fee deficiency or credit any overpayment to Deposit Account No. 22-0585.

Respectfully submitted,

VORYS, SATER, SEYMOUR and PEASE LLP

/William L. Klima/
William L. Klima, Registration No.: 32422
Customer No.: 20230

Date: June 23, 2022

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20230 7590 06/30/2022

Vorys, Sater, Seymour and Pease LLP
1909 K St., NW
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Washington, DC 20006-1152

EXAMINER	
DIAO, M BAYE	
ART UNIT	PAPER NUMBER
2859	

DATE MAILED: 06/30/2022

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/450,422	06/24/2019	Jonathan Lewis Nook	054985-000055-US-05	1008

TITLE OF INVENTION: PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION AND JUMPER CABLE DEVICE THEREOF

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$600	$0.00	$0.00	$600	09/30/2022

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/450,422	06/24/2019	Jonathan Lewis Nook	054985-000055-US-05	1008

TITLE OF INVENTION: PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION AND JUMPER CABLE DEVICE THEREOF

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$600	$0.00	$0.00	$600	09/30/2022

EXAMINER	ART UNIT	CLASS-SUBCLASS
DIAO, M BAYE	2859	320-105000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/450,422	06/24/2019	Jonathan Lewis Nook	054985-000055-US-05	1008

20230 7590 06/30/2022

Vorys, Sater, Seymour and Pease LLP
1909 K St., NW
9th Floor
Washington, DC 20006-1152

EXAMINER	
DIAO, M BAYE	

ART UNIT	PAPER NUMBER
2859	

DATE MAILED: 06/30/2022

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

EXHIBIT 1002
Petitioner ADC (IPR2024-00577)

Notice of Allowability	Application No. 16/450,422	Applicant(s) Nook et al.	
	Examiner M'BAYE DIAO	Art Unit 2859	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to RCEX filed on 06/10/2022 and Preliminary amendment filed on 06/23/2022.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-10, 12-23,29-60 (renumbered 1-54) . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☑ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 06/10/2022.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☑ Interview Summary (PTO-413), Paper No./Mail Date. 20220624.
5. ☑ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/M BAYE DIAO/ Primary Examiner, Art Unit 2859	06/26/2022

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Continued Examination Under 37 CFR 1.114

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on 06/10/2022 has been entered. Claims 1-10,12-23,29-54 have been previously presented while claims 11,24-28 have been previously canceled.

3. Claims 1-10,12-23,29-54 are still pending in the application.

Response to Preliminary Amendment

4. Acknowledgement is made of supplementary amendment filed on 06/23/2022 in which claims 1,5,19,29-30,38-41,43-45,52-54 are currently amended, claims 11, 24-28 have been canceled while claims 55-60 have been newly added. **By this amendment, claims 1-10, 12-23,29-60 are now pending in the application.**

Information Disclosure Statement

5. The information disclosure statements (IDS) filed on 06/10/2022 have been considered and placed of record. Initialed copies are attached herewith.

EXHIBIT 1002
Petitioner ADC (IPR2024-00577)

EXAMINER'S AMENDMENT

6. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

The application has been amended as follows:

In claim 53, page 16, lines 6-7, **replace "**the USB input charge circuit**" with --** the USB input ~~charge~~ circuit **--.**

Allowable Subject Matter

7. Claims 1-10,12-23, and 29-60 (renumbered 1-54) are allowed over the prior art of record.

8. The following is an examiner's statement of reasons for allowance: The prior art filed on 11/24/2021 and 06/10/2022 together with art made of record fails to disclose or suggest, in the claimed combination,

9. As in claim 1: a jump starter apparatus comprising among other patentable features, "…a USB input circuit connected to the power supply, the USB input circuit comprising a DC/DC converter, the USB input circuit configured for converting power from a USB power source to increase power voltage to the power supply; and a USB input connector connected to the USB input circuit, the USB input connector configured for connecting to the USB power source and providing power input from the USB power source through the USB input connector and the USB input circuit to the power supply".

10. Claims 2-10,12-23,43-59 depend directly or indirectly from claim 1 and therefore are allowed for the same reasons.

EXHIBIT 1002
Petitioner ADC (IPR2024-00577)

11. As in claim 29: a jump starter apparatus comprising among other patentable features, "…a USB input circuit connected to the power supply, the USB input circuit configured for converting power from a USB power source to increase power voltage to the power supply; and a USB input connector connected to the USB input circuit, the USB input connector configured for connecting to the USB power source and providing power input from the USB power source through the USB input connector and the USB input circuit to the power supply".

12. As in claim 30: A jump starting device comprising among other patentable features, "…a USB input circuit connected to the power supply, the USB input circuit configured for converting power from a USB power source to increase power voltage to the power supply; and a USB input connector configured for connecting to the USB charger and providing charge input from the USB power source through the USB input connector and the USB input circuit to the power supply".

13. Claims 31-37 depend directly or indirectly from claim 30 and therefore are allowed for the same reasons.

14. As in claim 38: A jump starting device comprising among other patentable features, "…a USB input circuit connected to the power supply, the USB input circuit configured for converting power from a USB power source to increase power voltage to the power supply; and a USB input connector connected to the USB input circuit, the USB input connector configured for connecting to the USB power source and providing power input from the USB power source through the USB input connector and the USB input circuit to the power supply".

15. Claims 39 and 40-42 depend directly or indirectly from claim 38 and therefore are allowed for the same reasons.

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16. As in claim 53: A jump starting device comprising among other patentable features, "…--a USB input circuit connecting the USB input connector to the power supply, the USB input ~~charge~~ circuit comprising a DC/DC converter, the USB input ~~charge~~ circuit configured for converting power from the USB power source to increase power voltage to the power supply, wherein the DC-DC converter can be turned on and off by an output from the microcontroller".

17. Claim 54 depend directly from claim 53 and therefore is allowed for the same reasons.

18. As in claim 60: A jump starter apparatus comprising among other patentable features, "…a control system or circuit connected to and controlling the power switch, the control system or circuit configured to detect whether the positive and negative polarity battery terminal connectors have a correct polarity connection with the positive and negative polarity battery terminals of the depleted or discharged battery and prevent an incorrect polarity connection with the positive and negative polarity battery terminals of the depleted or discharged battery prior to turning on the power switch or circuit; a USB input connector; and a USB input circuit connecting the USB input connector to the power supply, the USB input circuit comprising a DC/DC converter for up-converting the voltage from the USB input connector to the power supply".

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

19. While US 20120187897 to Lenk et al., (Lenk) discloses a battery charger that uses external USB/external power input connection node 502 is added to enable a USB or other type of external power connector to be connected with the battery charger 512. However, this voltage

EXHIBIT 1002
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being at a voltage higher than the battery voltage, thus not requiring any voltage boost, which teaches away from the claimed invention as a boost voltage is required to charge a power supply of a jump start apparatus from a low 5V potential standard USB chargers to an up-converted voltage of 12.4Volts as required by the present application.

20. Therefore the claims as presently submitted are allowable over the art of record.

Citation of Prior Art

21. For a list of related prior art references not mentioned above but disclose related apparatus or method, see Form PTO-892.

22. US 20120187897 to Lenk et al., (Lenk) discloses a battery charger that uses external USB/external power input connection node 502 is added to enable a USB or other type of external power connector to be connected with the battery charger.

Conclusion

23. Any inquiry concerning this communication or earlier communications from the examiner should be directed to M'BAYE DIAO whose telephone number is (571)272-6127. The examiner can normally be reached M-F; 9:00AM-6:30PM.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, DREW A DUNN can be reached on 571-272-2312. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

EXHIBIT 1002
Petitioner ADC (IPR2024-00577)

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

M'BAYE DIAO
Primary Examiner
Art Unit 2859

/M BAYE DIAO/
Primary Examiner, Art Unit 2859
June 26, 2022

EXHIBIT 1002
Petitioner ADC (IPR2024-00577)

Examiner-Initiated Interview Summary	**Application No.** 16/450,422	**Applicant(s)** Nook et al.		
	Examiner M'BAYE DIAO	**Art Unit** 2859	**AIA (First Inventor to File) Status** Yes	**Page** 1 of 1

All Participants (applicant, applicants representative, PTO personnel)	**Title**	**Type**
M'BAYE DIAO	Primary Examiner	Telephonic
William L. Klima Reg. No. 32,422	Attorney of Record	

Date of Interview: 24 June 2022

Issues Discussed:

Proposed Amendment(s)

Applicant's representative suggested some preliminary amendment to the claims as attached in order to expedite the application and present the claims in better form for allowance. Examiner was also give the green light to make any examiner's amendment as necessary to obviate any subsequent objections and/ or 112 issues.

/M BAYE DIAO/ Primary Examiner, Art Unit 2859	06/24/2022

Applicant is reminded that a complete written statement as to the substance of the interview must be made of record in the application file. It is the applicants responsibility to provide the written statement, unless the interview was initiated by the Examiner and the Examiner has indicated that a written summary will be provided. See MPEP 713.04
Please further see:
MPEP 713.04
Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews, paragraph (b)
37 CFR § 1.2 Business to be transacted in writing

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

Notice of References Cited	Application/Control No. 16/450,422	Applicant(s)/Patent Under Reexamination Nook et al.	
	Examiner M'BAYE DIAO	Art Unit 2859	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20120187897-A1	07-2012	LENK; KENNETH LAWRENCE	H01M10/46	320/101
	B					
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/450,422	Nook et al.
	Examiner	**Art Unit**
	M'BAYE DIAO	2859

CPC							
Symbol						**Type**	**Version**
B60L	/	53	/	14		F	2019-02-01
H02J	/	**7**	/	0034		I	2013-01-01
H02J	/	**7**	/	0029		I	2013-01-01
H02J	/	**7**	/	0047		I	2013-01-01
H02J	/	**7**	/	342		I	2020-01-01
H02J	/	1	/	122		A	2020-01-01
H02J	/	**7**	/	00		A	2013-01-01
H02J	/	**7**	/	0048		A	2020-01-01

CPC Combination Sets								
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	54	
/M BAYE DIAO/ Primary Examiner, Art Unit 2859	26 June 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20220623

EXHIBIT 1002
Petitioner ADC (IPR2024-00577)

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/450,422	Nook et al.
	Examiner	**Art Unit**
	M'BAYE DIAO	2859

INTERNATIONAL CLASSIFICATION				
CLAIMED				
B60L53/14	/	53	/	14
H02J7/00	/	7	/	00
H02J7/34	/	7	/	34
H02J1/10	/	1	/	10

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**
320	105

CROSS REFERENCES(S)							
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**						

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	54	
/M BAYE DIAO/ Primary Examiner, Art Unit 2859	26 June 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20220623

EXHIBIT 1002
Petitioner ADC (IPR2024-00577)

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/450,422	Nook et al.
	Examiner	**Art Unit**
	M'BAYE DIAO	2859

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	10	10	18	19		28	46	37	26	46	33	55		
2	2		11	19	20	38	29	47	38	27	47	34	56		
3	3	11	12	20	21	39	30	48	39	28	48	35	57		
4	4	12	13	21	22	40	31	49	40	29	49	36	58		
5	5	13	14	22	23	41	32	50	41	30	50	37	59		
6	6	14	15		24	42	33	51	42	31	51	54	60		
7	7	15	16		25	43	34	23	43	32	52				
8	8	16	17		26	44	35	24	44	52	53				
9	9	17	18		27	45	36	25	45	53	54				

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	54	
/M BAYE DIAO/ Primary Examiner, Art Unit 2859	26 June 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office

Part of Paper No.: 20220623

EXHIBIT 1002
Petitioner ADC (IPR2024-00577)

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/450,422	Nook et al.
	Examiner	Art Unit
	M'BAYE DIAO	2859

CPC - Searched*		
Symbol	Date	Examiner
B60L53/14 H02J7/342 H02J7/0047 H02J7/0034 H02J7/0029 H02J1/122 H02J7/00 H02J7/0048 H02J2310/46	08/07/2020	MD

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
320	105	08/07/2020	MD

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

/M BAYE DIAO/ Primary Examiner, Art Unit 2859	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/450,422	Nook et al.
	Examiner	Art Unit
	M'BAYE DIAO	2859

Search Notes		
Search Notes	**Date**	**Examiner**
PE2E SEARCH(Search Notes Attached).	08/07/2020	MD
PLUS Search Conducted.	07/28/2020	MD
Inventor Name and Assignee Search (SEARCH).	08/07/2020	MD
Parent Applications Noted.	08/07/2020	MD
IPR2018-00503 Reviewed Petition for Inter Partes Review of U.S. Patent No. 9,007,015.	08/07/2020	MD
IPR2020-00944 Reviewed Petition for Inter Partes Review of U.S. Patent No. 9,007,015.	08/07/2020	MD
IPR2020-01387 Reviewed Petition for Inter Partes Review of U.S. Patent No. 9,007,015.	08/07/2020	MD
IPR2021-00309 Reviewed Petition for Inter Partes Review of U.S. Patent No. 9,007,015.	02/04/2021	MD
Updated search above.	02/04/2021	MD
(307/150 Text Search Only -- see attached Search Printout).	02/04/2021	MD
IP.com Search Conducted.	02/04/2021	MD
Updated search above.	06/21/2021	MD
Updated search above.	11/15/2021	MD
Updated search above.	03/02/2022	MD
Updated search above.	06/23/2022	MD

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
	See attached text.	06/23/2022	MD

/M BAYE DIAO/ Primary Examiner, Art Unit 2859	

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/450,422	Nook et al.
	Examiner	Art Unit
	M'BAYE DIAO	2859

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	08/07/2020	02/05/2021	06/21/2021	11/15/2021	03/02/2022	06/26/2022			
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50	41		✓	✓	=	=	=			
51	42		✓	✓	=	=	=			

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/450,422	Nook et al.
	Examiner	Art Unit
	M'BAYE DIAO	2859

CLAIM		DATE								
Final	Original	08/07/2020	02/05/2021	06/21/2021	11/15/2021	03/02/2022	06/26/2022			
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26	46		✓	✓	=	=	=			
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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16450422
Filing Date	2019-06-24
First Named Inventor	NOOK
Art Unit	2859
Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-05

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/M.D/	1	3590357		1971-06-29	REID	
	2	3638108		1972-01-25	CHANNING	
	3	5194799		1993-03-16	TOMANTSCHGER	
	4	5281904		1994-01-25	TOMKINS	
	5	5319298		1994-06-07	WANZONG	
	6	5820407		1998-10-13	MORSE et al.	
	7	6344733		2002-07-30	CRASS	
	8	6424158		2002-07-23	KLANG	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.D/

EXHIBIT 1002
Petitioner ADC (IPR2024-00577)

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16450422
Filing Date	2019-06-24
First Named Inventor	NOOK
Art Unit	2859
Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-05

/M.D/	9	6650086		2003-11-18	CHANG	
	10	6679212		2004-01-20	KELLING	
	11	6759833		2004-07-06	CHEN	
	12	7345450		2008-03-18	KRIEGER et al.	
	13	7893657		2011-02-22	CHAVAKULA	
	14	8362745		2013-01-29	TINAPHONG	
	15	9153978		2015-10-06	READE	
	16	9243601		2016-01-26	REICHOW	
	17	9525297		2016-12-20	WANG	
	18	9809183		2014-03-27	WEFLEN	
	19	9954391		2018-04-24	LEI	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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First Named Inventor	NOOK
Art Unit	2859
Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-05

/M.D/	20	10328808		2019-06-25	NOOK ET AL.	
	21	10604024		2020-03-31	NOOK ET AL.	
	22	D597029		2009-07-28	LI	
	23	8221915	B2	2012-07-17	TIKHONOV et al.	
	24	9197079	B2	2015-11-24	YIP et al.	
	25	6424158	B2	2002-07-23	KLANG	
	26	6037778	A	2000-03-14	MAKHIJA	
	27	5589757	A	1996-12-31	KLANG	
	28	10461545	B2	2019-10-29	INOUE et al.	
	29	8376775	B2	2013-02-19	RINEHARDT	
	30	5953681	A	1999-09-14	CANTATORE et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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First Named Inventor	NOOK
Art Unit	2859
Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-05

/M.D/	31	7656118	B2	2010-02-02	KRIEGER et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20010025618	A1	2001-10-04	KELLING	
	2	20040066168	A1	2004-04-08	GEORGE	
	3	20040130298	A1	2004-07-08	KRIEGER	
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	6	20040239290	A1	2004-12-02	KRIEGER	
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16450422
	Filing Date	2019-06-24
	First Named Inventor	NOOK
	Art Unit	2859
	Examiner Name	DIAO
	Attorney Docket Number	054985-000055-US-05

/M.D/	9	20060220610	A1	2006-10-05	SOLBERG	
	10	20060244412	A1	2006-11-02	BONZER	
	11	20080143290	A1	2008-07-19	CHAVAKULA	
	12	20110175461	A1	2011-07-21	TINAPHONG	
	13	20120025766	A1	2012-02-02	READE	
	14	20130162029	A1	2013-06-27	REICHOW	
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	18	20150054336	A1	2015-02-26	LIU	
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number	16450422
	Filing Date	2019-06-24
	First Named Inventor	NOOK
	Art Unit	2859
	Examiner Name	DIAO
	Attorney Docket Number	054985-000055-US-05

/M.D/	20	20150366538	A1	2015-12-24	MCKENNA	
	21	20100164439	A1	2010-07-01	IDO	
	22	20040124810	A1	2004-07-01	SMALLWOOD et al.	
	23	20090039712		2009-02-12	CZAMYSZKA	
	24	20070278990		2007-12-06	RAICHLE	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2011/113734	WO		2011-09-22	REICHOW		
	2	2012/036556	WO		2012-03-22	EIDSVIG		
	3	2012/080996	WO		2012-06-21	TRACY		
	4	2014/106407	WO		2014-10-07	LEI		

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	16450422
Filing Date	2019-06-24
First Named Inventor	NOOK
Art Unit	2859
Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-05

/M.D/	5	0616409	EP		2014-09-07	HERBERT		
	6	103066662	CN	A	2013-04-24	LEI	English abstract attached	☒
	7	2019/021007	WO	A1	2019-01-31	INTERCAL (UK) LTD		☐
	8	2012/160292	WO	A2	2012-11-29	RENAULT S.A.S.	Machine Translation	☒
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	11	2016/025869	WO	A1	2016-02-18	SCHUMACHER ELECTRIC CORP		☐
	12	202918052	CN	U	2013-05-01	LEI XINGLIANG	English Abstract attached	☒
	13	204113515	CN	U	2015-01-21	ZHANG KAILONG	English Abstract attached	☒

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NON-PATENT LITERATURE DOCUMENTS | Remove |

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.D/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	16450422
Filing Date	2019-06-24
First Named Inventor	NOOK
Art Unit	2859
Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-05

/M.D/	1	Copy of Exhibit 1008, www.xcar360.com	
	2	Copy of Exhibit 1009, www.electronicshub.org	
	3	Copy of the Petition for Inter Partes Review of U.S. Patent No. 9,007,015; IPR 2020-00944, filed May 14, 2020, 105 pages	
	4	Copy of Exhibit 1013, Model: Epower-21 brochure, 2 pages	
	5	Copy of Report on the filing or determination of an action regarding a patent or trademark, filed 10/19/17, The NOCO Company, Inc. v. Shenzhen Valuelink E-Commerce Co., Ltd., U.S. District Court for the Northern District of Ohio, Eastern Division,1 page.	
	6	Copy of Report on the filing or determination of an action regarding a patent or trademark, filed 10/19/17, The NOCO Company, Inc. v. Shenzhen ChangXin Yang Technology Co., Ltd., U.S. District Court for the Northern District of Ohio, Eastern Division, 1 page.	
	7	Copy of Report on the filing or determination of an action regarding a patent or trademark, filed 10/19/17, The NOCO Company, Inc. v. SZ Jingxinghui Electronics Technology Co., Ltd., U.S. District Court for the Northern District of Ohio, Eastern Division, 1 page	
	8	Copy of Report on the filing or determination of an action regarding a patent or trademark, filed 10/19/17, The NOCO Company, Inc. v. Shenzhen Anband Technology Co., Ltd., U.S. District Court for the Northern District of Ohio, Eastern Division, 1 page.	
	9	Copy of Report on the filing or determination of an action regarding a patent or trademark, filed 10/30/17, The NOCO Company, Inc. v. Shenzhen Dika Na'er E-Commerce Co., Ltd., U.S. District Court for the Northern District of Ohio, Eastern Division, 1 page.	
	10	Copy of PTAB notice regarding petition filed in Patent Number 9007015, Application Number 14/325938, filed on 01/15/2018, IPR2018-00503, 1 page	
	11	Copy of Report on the filing or determination of an action regarding a patent or trademark, filed 09/13/18, The NOCO Company, Inc. v. Halo2 Cloud, LLC, QVC, Inc., U.S. District Court Delaware, 1 page.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16450422
Filing Date	2019-06-24
First Named Inventor	NOOK
Art Unit	2859
Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-05

/M.D/	12	Copy of Notice of Filing Date Accorded to Petition and Time for Filing Patent Owner Preliminary Response, mailed May 21, 2020, Shenzhen Carku Technology Co., Ltd. v. The NOCO Company, IPR2020-00944, Patent 9,007,015, 4 pages.	
	13	International Search Report in corresponding PCT/US2014/045434, November 3, 2014.	
	14	Australian Patent Opposition #1, Australian Patent Application No. 2016269555, Statement of Grounds of Particulars, Brown & Watson International Pty Ltd., June 6, 2019, 6 pages; particular (e), the offering for sale and sale by Asia Bright Industrial (Hong Kong) Co, Ltd. of products identified as the JPS Jump Starter and the JPR Jump Starter prior to July 2014.	
	15	Australian Patent Opposition #1, Australian Patent Application No. 2016269555, Evidence in Support, filed September 6, 2019, 24 pages. Declaration of Max Dirnberger	
	16	Australian Patent Opposition #1, Australian Patent Application No. 2016269555, Evidence in Support – Exhibits, filed September 6, 2019,166 pages; Declaration of Max Dirnberger - Annexure MD-1, early specification sheets for "the BW Jumpstarter", 4 pages; Annexure MD-2, product manual for "the BW Jumpstarter", PROJECTA; "2x22 Amp Hour High Performance Jumpstarter"; 2013; 20 pages.	
	17	Australian Patent Opposition #2, Australian Patent Application No. 2019201559, Statement of Grounds and Particulars, filed May 21, 2020, 8 pages.	
	18	THE NOCO COMPANY v. DELTONA TRANSFORMER CORPORATION and DELTRAN USA, LLC, Defendant Deltran USA, LLC's Invalidity Contentions, In the United States District Court for the Middle District of Florida, Orlando Division, USB Implementers Forum, Inc.,Battery Charging Specification, Revision 1.1, 04-15-2009 on page 8, Prior Art Offered for Sale or Publicly Used or Known on pages 8-10, MICRO-START/PPS, E-Power, Battery Tender Power Pack, PowerAll, and Electromate 400 on page 10; 141 pages.	
	19	THE NOCO CO., INC. v. SMARTECH PRODUCTS, INC., et al., Smartech, Inc.'s Invalidity and Unenforceability Contents, Bestek 2400A Peak Current Portable Car Jump Starter Power Bank with 1000mAh Capacity (SMARTECH 00062-00069)("Bestek") on page 2; HALO 7800 mAh Portable Charger for Cell Phones & Tablets (SMARTECH 00070-00071)("HALO") on page 2; Schumacher Lithium Iron Jump Starter – SL1 Red Fuel (SMARTECH 00072-00073)("Schumacher") on page 2, filed June 19, 2019, 8 pages.	
	20	FARAH et al., "New Analog Li-ion Battery Charger Using Pulsed Charging Method, 2018, IEEE, Pps. 1-4 (Year: 2018).	
	21	MUBDIR et al. "Smart Charger for Sealed Lead Acid Batteries Based on Parallel Port PC Interfacing", Dec. 1, 2010, IEEE International Conference on Power and Energy, Pps. 119-124 (Year: 2010)	
	22	Petition for Inter Partes Review of US Patent No. 9,007,015; 49 pages; filed January 15, 2018.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16450422
Filing Date	2019-06-24
First Named Inventor	NOOK
Art Unit	2859
Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-05

/M.D/	23	Defendants' Invalidity and Unenforceability Contentions - Defendant: Shenzhen Lianfa Tong Technology Co., Ltd., et al., Judge Christopher A. Boyko, 5 pages, September 18, 2020; US Patent No.: 9007015
	24	Statement of Defence and Counterclaim - Defendant: Canadian Tire Corporation, Limited, Court File No. T-343-20, 17 pages, August 4, 2020.

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/M BAYE DIAO/	Date Considered	06/23/2022

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

Search History_16450422

Report Run Date: 2022-06-23 UTC
Searches: 2
Markers: 0

EXHIBIT 1002
Petitioner ADC (IPR2024-00577)

Search #	Timestamp	Results	Page
1	2022-06-23 21:02 UTC	13,110,824	3
2	2022-06-23 21:03 UTC	669,033	4

Content: Patent Publications (167)

US Patents | US Designs | US Applications | EPO Patents | EPO Applications | China Patents | China Applications | Japan Patents | Japan Applications | Korea Patents | Korea Applications | WIPO Applications | Argentina Patents | Argentina Applications | Brazil Patents | Brazil Applications | Canada Patents | Canada Applications | Chile Patents | Chile Applications | Colombia Applications | Costa Rica Applications | Cuba Patents | Cuba Applications | Dominican Republic Applications | Ecuador Patents | Ecuador Applications | El Salvador Applications | Guatemala Applications | Honduras Applications | Mexico Patents | Mexico Applications | Nicaragua Patents | Panama Applications | Peru Applications | Trinidad & Tobago Patents | Uruguay Applications | Austria Patents | Austria Applications | Belarus Patents | Belgium Patents | Belgium Applications | Bosnia & Herzegovina Patents | Bosnia & Herzegovina Applications | Bulgaria Patents | Bulgaria Applications | Croatia Patents | Croatia Applications | Czech Republic Patents | Czech Republic Applications | Czechoslovakia Patents | Czechoslovakia Applications | Denmark Patents | Denmark Applications | Estonia Patents | Estonia Applications | EUIPO Patents | Finland Patents | Finland Applications | France Patents | France Applications | Germany Patents | Germany Applications | Great Britain Patents | Great Britain Applications | Greece Patents | Greece Applications | Hungary Patents | Hungary Applications | Iceland Patents | Iceland Applications | Ireland Patents | Ireland Applications | Italy Patents | Italy Applications | Latvia Patents | Latvia Applications | Lithuania Patents | Lithuania Applications | Luxembourg Patents | Malta Patents | Monaco Patents | Montenegro Patents | Montenegro Applications | Netherlands Patents | Netherlands Applications | Norway Patents | Norway Applications | Poland Patents | Poland Applications | Portugal Patents | Portugal Applications | Republic of Moldova Patents | Republic of Moldova Applications | Romania Patents | Romania Applications | San Marino Patents | San Marino Applications | Serbia Patents | Serbia Applications | Slovakia Patents | Slovakia Applications | Slovenia Patents | Spain Patents | Spain Applications | Sweden Patents | Sweden Applications | Switzerland Patents | Switzerland Applications | Ukraine Patents | Yugoslavia/Serbia and Montenegro Patents | Yugoslavia/Serbia and Montenegro Applications | Armenia Patents | Australia Patents | Australia Applications | Cyprus Patents | Gulf Cooperation Council Patents | Hong Kong Patents | India Patents | India Applications | Indonesia Patents | Indonesia Applications | Israel Applications | Jordan Patents | Jordan Applications | Kyrgyzstan Patents | Macao Applications | Malaysia Patents | Mongolia Patents | New Zealand Patents | Philippines Patents | Philippines Applications | Saudi Arabia Patents | Saudi Arabia Applications | Singapore Patents | Singapore Applications | Taiwan Patents | Taiwan Applications | Tajikistan Patents | Tajikistan Applications | Thailand Patents | Thailand Applications | Uzbekistan Patents | Vietnam Patents | Algeria Patents | ARIPO Patents | ARIPO Applications | Egypt Patents | Kenya Patents | Malawi Patents | Morocco Patents | Morocco Applications | OAPI Patents | South Africa Patents | Tunisia Applications | Zambia Patents | Zimbabwe Patents | EAPO Patents | EAPO Applications | Georgia Patents | Georgia Applications | Kazakhstan Patents | Kazakhstan Applications | Russia Patents | Russia Applications | Turkey Patents | Turkey Applications

1 **2022-06-23 21:02 UTC | 13,110,824 results from**

De-Dup: None | **Cut-off:** None | **Sort:** Relevance

Main Concept: Text

A jump starting apparatus comprising: a power supply; a positive polarity battery terminal connector configured for connecting the jump starting apparatus to the positive polarity battery terminal of the depleted or discharged battery; a negative polarity battery terminal connector configured for connecting the jump starting apparatus to the negative polarity battery terminal of the depleted or discharged battery; a power switch or circuit configured to turn on power from the power supply to the positive and negative polarity battery terminal connectors; a control system or circuit connected to and controlling the power switch, the control system or circuit comprising a microcontroller, the control system or circuit configured to detect whether the positive and negative polarity battery terminal connectors have a proper or improper connection with the positive and negative polarity battery terminals of the depleted or discharged battery prior to turning on the power switch; a USB input connector configured for removably connecting to an external USB charger and providing charge input from the USB charger through the USB input connector to the power

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Petitioner ADC (IPR2024-00577) EXHIBIT 1002

supply; and a USB input charge circuit connecting the USB connector to the power supply, the USB input charge circuit comprising a DC/DC converter, the USB input charge circuit configured for converting power from the external USB charger to charge voltage and current for charging the power supply, wherein the DC-DC converter can be turned on and off by an output of the microcontroller

Concept Modifiers: None

Filters: None

Content: Non-Patent Literature (23)

IEEE Xplore Publications: IEEE Periodicals | IEEE Xplore Publications: IEEE Conferences | IEEE Xplore Publications: IEEE Standards | IEEE Xplore Publications: IEEE Early Access | IEEE Xplore Publications: SMPTE Periodicals | IEEE Xplore Publications: SMPTE Conferences | IEEE Xplore Publications: SMPTE Standards | IEEE Xplore Publications: MIT Press eBooks | IEEE Xplore Publications: Wiley-IEEE eBooks | IEEE Xplore Publications: IBM Periodicals | IEEE Xplore Publications: URSI Periodicals | IEEE Xplore Publications: VDE Conferences | IEEE Xplore Publications: Periodicals from China | IP.com Prior Art Database: The IP.com Journal | IP.com Prior Art Database: Internet Society RFC | IP.com Prior Art Database: IBM TDB Archive | IP.com Prior Art Database: Legacy Journals | IP.com Prior Art Database: Software Patent Institute | OnePetro.org: Periodicals at OnePetro.org | OnePetro.org: Conferences at OnePetro.org | Other Literature: IBM Redbooks | Other Literature: PubMed Central | Other Literature: arXiv.org

2 **2022-06-23 21:03 UTC | 669,033 results from**

De-Dup: None | **Cut-off:** None | **Sort:** Relevance

Main Concept: Text

A jump starting apparatus comprising: a power supply; a positive polarity battery terminal connector configured for connecting the jump starting apparatus to the positive polarity battery terminal of the depleted or discharged battery; a negative polarity battery terminal connector configured for connecting the jump starting apparatus to the negative polarity battery terminal of the depleted or discharged battery; a power switch or circuit configured to turn on power from the power supply to the positive and negative polarity battery terminal connectors; a control system or circuit connected to and controlling the power switch, the control system or circuit comprising a microcontroller, the control system or circuit configured to detect whether the positive and negative polarity battery terminal connectors have a proper or improper connection with the positive and negative polarity battery terminals of the depleted or discharged battery prior to turning on the power switch; a USB input connector configured for removably connecting to an external USB charger and providing charge input from the USB charger through the USB input connector to the power supply; and a USB input charge circuit connecting the USB connector to the power supply, the USB input charge circuit comprising a DC/DC converter, the USB input charge circuit configured for converting power from the external USB charger to charge voltage and current for charging the power supply, wherein the DC-DC converter can be turned on and off by an output of the microcontroller

Concept Modifiers: None

Filters: None

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Petitioner ADC (IPR2024-00577)
EXHIBIT 1002

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16450422
Filing Date	2019-06-24
First Named Inventor	NOOK
Art Unit	2859
Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-05

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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	2	5831350		1998-11-03	McCONKEY et al.	
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	6	6249106		2001-06-19	TURNER et al.	
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	8	6774607		2004-08-10	MOSENEDER et al.	

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EXHIBIT 1002
Petitioner ADC (IPR2024-00577)

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Examiner Name	DIAO
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/M.D/	9	6856764		2005-02-15	HIGUMA	
	10	6919704		2005-07-19	HEALEY	
	11	7339347		2008-03-04	ELDER et al.	
	12	7508171		2009-03-24	CARRIER et al.	
	13	7579811		2009-08-25	SATL et al.	
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	19	8030900		2011-10-04	HUSSAIN et al.	

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/M.D/	20	8125181		2012-02-28	GREGG et al.	
	21	8686688		2014-04-01	HAN et al.	
	22	8786247		2014-07-22	ISHINO et al.	
	23	8994327		2015-03-31	KUSCH et al.	
	24	9007023		2015-04-14	DAO	
	25	9263717		2016-02-16	NAKANO et al.	
	26	9263907		2016-02-16	RICHARDSON et al.	
	27	9287725		2016-03-15	HUFFMAN et al.	
	28	9718419		2017-08-01	PROEBSTLE	
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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	2	20020007500		2002-06-20	FRIDMAN et al.	
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/M.D/	9	20090236859		2009-09-24	MCFADDEN	
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	21	20120299533		2012-11-29	HUFFMAN et al.	
	22	20130154544		2013-06-20	YOKOYAMA et al.	
	23	20150012174		2015-01-08	KIM et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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	2	107977	CA	A	1907-10-15	EMPIRE LIGHT LTD; MIESS JACOB HENRY		
	3	118796	CA	S	2008-01-15	XANTREX INT		
	4	137883	CA	S	2011-06-08	CHERVON LTD		
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/M.D/	6	2000/024108	WO	A1	2000-04-27	CENTURY MFG. CO.		
	7	2005/038952	WO	A2	2005-04-28	BLACK & DECKER INC.	corresponds to EP 1673828	
	8	6997198	AU	A	1998-07-30	CLORE AUTOMOTIVE LLC		
	9	2015-115979	JP	A	2015-06-22	ASIA BRIGHT IND HONG KONG CO LTD; SFJ CORP	English Abstract attached	☒
	10	104118374	CN	A	2014-10-29	HUIZHOU HUAYITONG TECHNOLOGY CO LTD	English Abstract attached	☒
	11	201947042	CN	U	2011-08-24	SHENZHEN SIBEISHENG ELECTRONIC TECHNOLOGY CO LTD	English Abstract attached	☒
	12	203211234	CN	U	2013-09-25	HUIZHOU HUAYITONG TECHNOLOGY CO LTD	English translation attached	☒
	13	203504235	CN	U	2014-03-26	LUO WUQIANG	English Abstract attached	☒
	14	203522157	CN	U	2014-04-02	SHENZHEN SBASE ELECTRONICS TECHNOLOGY CO LTD	English Abstract attached	☒

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.D/

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/M.D/	1	Copy of Report on the Filing or Determination of an Action Regarding a Patent or Trademark, filed 08/14/19, The NOCO Company, Inc. v. Shenzhen Lianfa Tong Technology Co., Ltd. and Shenzhen Meditek Tong Technology Co., Ltd., 1 page.	
	2	Copy of Report on the Filing or Determination of an Action Regarding a Patent or Trademark, filed 08/14/19, The NOCO Company, Inc. v. Sictec Instruments Company Limited, 1 page.	
	3	Copy of Decision Granting Institution of Inter Partes Review, Patent Number 9007015, Application 14/325938 on 11/12/20, IPR2020-00944, 70 pages.	
	4	Copy of Report on the Filing or Determination of an Action Regarding a Patent or Trademark, filed 05/28/20, The NOCO Company, Inc. v. Shenzhen Yike Electronics, 1 page.	
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	8	Copy of Report on the Filing or Determination of an Action Regarding a Patent or Trademark, filed 05/28/20, The NOCO Company, Inc. v. Nice Team Enterprise Limited, 1 page.	
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EXHIBIT 1002
Petitioner ADC (IPR2024-00577)

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Application Number	16450422
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First Named Inventor	NOOK
Art Unit	2859
Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-05

/M.D/	12	Australian Patent Opposition #2, Notice of Opposition, Australian Patent Application No. 2019201559, Brown & Watson International Pty Ltd., February 21, 2020, 1 page.	
	13	The offering for sale and sale by ATD Tools, Inc of a product identified as the ADT 5900 Jump Starter prior to July 2014.	
	14	Australian Patent Opposition #3, Notice of Opposition, Australian Patent Application No. 2020201223, Brown & Watson International Pty Ltd., August 7, 2020.	
	15	German Patent Opposition. German Patent Application No. 102014114997	
	16	D21 advertisement brochure of the opponent transmitted on 12-22-2013.	
	17	D22 advertisement brochure of the opponent transmitted on 04-23-2014.	
	18	D23 SGS test report relating to jump start devices of the opponent dated 04-21-2014.	
	19	D24 TWM417714U1	
	20	D24a machine translation of D24	
	21	D25 data sheet of TOPCOMTECHNOLOGY CO., LTD., for the product "Universal Power Bank", dated November 15, 2011.	
	22	D28 affidavit of the manager of the requesting party, 2013.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
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Art Unit	2859
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/M.D/	23	German Nullity Action, German Patent Application No. 202014011347.5
	24	THE NOCO COMPANY v. RING AUTOMOTIVE LIMITED, HP-2020-000022, Grounds of Invalidity, In the High Court of Justice Business And Property Courts of England and Wales Intellectual Property List (ChD) Patents Court, 2 pages
	25	the making available to the public by supply, description and/or use of the HP2200 jump starter described in the manual dated August 2013 at Annex A Before 3 July 2014 including in and after August 2013('HP2200') (cited on page 1 of reference THE NOCO COMPANY v. RING AUTOMOTIVE LIMITED, HP-2020-000022, Grounds of Invalidity).
	26	the Carku E-Power 21 device in so far as it is established to have been made available to the public in the Eariler Proceedings ('Carku E-Power 21) (cited on page 2 of reference THE NOCO COMPANY v. RING AUTOMOTIVE LIMITED, HP-2020-000022, Grounds of Invalidity)
	27	THE NOCO COMPANY v. SHENZHEN VALUELINK E-COMMERCES CO., LTD, Case No. 1:17-cv-02210, Defendants' Amended Final Invalidity and Unenforceability Contents, 9/23/2019, 5 pages.; The Powerall PBJS12000RD Jump Starter ("Powerall Jump Starter"), offered For sale by Gryphon Mobile Electronics at least as early as 11/5/2013; The Lightning 12V Jump Starter ("Lightning Jump Starter), offered for sale by Pilot, Inc. at least as early as 3/2014; The L3 Model Jump Starter, offered for sale by Shenzhen Tsevie Company as Early as 5/19/2019.
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	30	This Portable USB Charger Battery Pack Can Also Jump Start Your Car (viewed on Internet on October 27, 2020] <URL: https://www.howto geek.com/179499/this-portable-usb-charger-battery-pack-can-also-jump-start-your-car/>, published on January 13, 2014.
	31	Clore Automotive, LLC, U.S. International Trade Commission, Investigation No. 337-TA-1256, RESPONSE OF CLORE AUTOMOTIVE, LLC TO THE AMENDED COMPLAINT AND NOTICE OF INVESTIGATION, pages 150-151.
	32	Deltran USA, LLC, U.S. International Trade Commission, Investigation No. 337-TA-1256 DELTRAN USA, LLC'S RESPONSE TO THE AMENDED COMPLAINT AND NOTICE OF INVESTIGATION, pages 196-219.
	33	Schumaker Electric Corporation and Schumacher Power Technology (Binhai) Co. Ltd., U.S. International Trade Commission, Investigation No. 337-TA-1256, RESPONSE OF SCHUMACHER ELECTRIC CORPORATON AND SCHUMACHER POWER TECHNOLOGY (BINHAI) CO. LTD., TO THE COMPLAINT OF THE NOCO COMPANY UNDER SECTION 337 OF THE TARIFF ACT OF 1930 AND NOTICE OF INVESTIGATION, pages 180-184.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
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Attorney Docket Number	054985-000055-US-05

/M.D/	34	Best Buy Co., Inc.., U.S. International Trade Commission, Investigation No. 337-TA-1256, RESPONSE OF BEST BUY CO., INC. TO THE FIRST AMENDED COMPLAINT AND THE NOTICE OF INVESTIGATION, pages 69-71.	
	35	Guangdong Boltpower Energy Co, Ltd., U.S. International Trade Commission, Investigation No. 337-TA-1256, RESPONSE OF GUANGDONG BOLTPOWER ENERGY CO., LTD. TO THE FIRST AMENDED COMPLAINT AND THE NOTICE OF INVESTIGATION, pages 73-74.	
	36	Winplus North America, Inc. U.S. International Trade Commission, Investigation No. 337-TA-1256, RESPONSE OF WINPLUS NORTH AMERICA, INC. TO THE AMENDED COMPLAINT AND THE COMMISSIONER'S NOTICE OF INVESTIGATION, Exhibit B, pages 1-5.	
	37	Autozone, Inc.,, U.S. International Trade Commission, Investigation No. 337-TA-1256, RESPONDENTS AUTOZONE, INC. AND BEST PARTS, INC.'S RESPONSE TO THE AMENDED COMPLAINT AND NOTICE OF INVESTIGATION.	
	38	Shenzhen Carku Technology Co., Ltd., 70MAI Co., Ltd., Antigravity Batteries LLC, Gooloo Technologies LLC, Great Neck Saw Manufactures, Inc., Horizon Tool, Inc., MATCO Tools Corporation, Nekteck, Inc., Paris Corporation, Powermax Battery (U.S.A.), Inc., and Shenzhen Gooloo E-Commerce Co., Ltd. U.S. International Trade Commission, Investigation No. 337-TA-1256, SHENZHEN CARKU TECHNOLOGY CO., LTD., 70MAI CO., LTD., ANTIGRAVITY BATTERIES LLC, GOOLOO TECHNOLOGIES LLC, GREAT NECK SAW MANUFACTURERS, INC., HORIZON	
	39	Walmart Inc., U.S. International Trade Commission, Investigation No. 337-TA-1256, RESPONSE OF WALMATR INC., TO THE COMPLAINT OF THE NOCO COMPANY UNDER SECTION 337 OF THE TARIFF ACT OF 1930 AND NOTICE OF INVESTIGATION	
	40	Smartech Products, Inc., U.S. International Trade Commission, Investigation No. 337-TA-1256, RESPONDENT SMARTECH PRODUCTS, INC.'S RESPONSE TO THE COMPLAINT UNDER 337 OF THE TARIFF ACT OF 1930, AS AMENDED, AND NOTICE OF INVESTIGATION, pages 98-102.	
	41	Halo2Cloud, LLC and ZAGG Inc., U.S. International Trade Commission, Investigation No. 337-TA-1256, RESPONSE OF HALO2CLOUD, LLC AND ZAGG INC TO THE SECOND AMENDED COMPLAINT AND NOTICE OF INVESTIGATION, pages 141-142.	
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	43	In re Certain Portable Battery Jumpstarters and Components Thereof, 3370TA01256, United States International Trade Commission (March 17, 2021); Respondents Initial Invalidity Contentions, 14pages	
	44	Fairchild MC78XX/LM78XX/MC78XXA 3-Terminal 1A Positive Voltage Regulator	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99**)	Application Number	16450422
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	Examiner Name	DIAO
	Attorney Docket Number	054985-000055-US-05

/M.D/	45	USB Battery Charging 1.2 Compliance Plan, Rev. 1.0	
	46	Xysemi XR3403	
	47	Texas Instruments LM2621	
	48	USB Implementers Forum, Inc., Battery Charging Specification, Revision 1.1	
	49	Carku Epower-20B catalog information	
	50	USB Power Delivery Specification 1.0, July 16, 2012, Exhibit 1045	

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EXAMINER SIGNATURE

Examiner Signature	/M BAYE DIAO/	Date Considered	06/23/2022

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.D/

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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	4	4972135		1990-11-20	BATES et al.	
	5	4990723		1991-02-05	ZIBERNA et al.	
	6	5496658		1996-03-05	HEIN et al.	
	7	5707257		1998-01-13	KOTAJIMA et al.	
	8	6002235		1999-12-14	CLORE	

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	10	6222342		2001-04-24	EGGERT et al.	
	11	6300742		2001-10-09	HUNG	
	12	6384573		2002-05-07	DUNN	
	13	6679708		2004-01-20	DEPP et al.	
	14	7095339		2006-08-22	PENG et al.	
	15	D597029		2009-07-28	LI	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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	2	20080131764		2008-06-05	SAIKI	

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	First Named Inventor	NOOK
	Art Unit	2859
	Examiner Name	DIAO
	Attorney Docket Number	054985-000055-US-05

/M.D/	3	20090174362		2009-07-09	RICHARDSON et al.	
	4	20100001682		2009-07-02	DICKSON et al.	
	5	20100129723		2010-05-27	NODA et al.	
	6	20100244766		2010-09-30	OLSBERG	
	7	20110117408		2011-05-19	LENNOX	
	8	20110140651		2011-06-16	DAI	
	9	20120126818		2012-05-24	ISHIHARA	
	10	20130084471		2013-04-04	HAN et al.	
	11	20130241498		2013-09-19	KOEBLER	
	12	20130104817		2013-05-02	MILLER	
	13	20140045001		2014-02-13	YANG	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16450422
Filing Date	2019-06-24
First Named Inventor	NOOK
Art Unit	2859
Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-05

/M.D/	14	20140113463		2014-04-24	PETERSON et al.	
	15	20150087182		2015-03-26	ZHAO et al.	
	16	20160141728		2016-05-19	FAUTEUX et al.	
	17	20160181587		2016-06-23	KOEBLER et al.	
	18	20170084899		2017-03-23	DENG et al.	
	19	20070178777		2007-08-02	MIEKKA	
	20	20110250473		2011-10-13	KIM	

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FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2006/057497	WO		2006-06-01	LG CHEM		
	2	2012/074548	WO		2012-06-07	KOEBLER MARTIN		

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Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-05

/M.D/	3	2014/206323	WO		2014-12-31	FAUTEUX DENIS GASTON; TECHTRONIC POWER TOOLS...		
	4	2105980	EP		2009-09-30	SAMSUNG SDI CO LTD		
	5	2605313	EP		2013-06-19	OXIS ENERGY LTD		
	6	102010062708	DE		2012-06-14	BOSCH GMBH ROBERT	English Abstract attached	X
	7	3185027	JP	U	2013-07-25	SFJ Co., Ltd.; Asia Bright Industrial (Hong Kong)	English Abstract attached	☒
	8	2001069673	JP	A	2001-03-16	HITACHI LTD	English Abstract attached	☒
	9	2011023249	JP	A	2011-02-03	NISSAN MOTOR	English Abstract attached	☒
	10	2012169161	JP	A	2012-09-06	PANASONIC CORP	English Abstract attached	☒
	11	2014232666	JP	A	2014-12-11	KANEKA CORP	English Abstract attached	☒
	12	103035874	CN	A	2013-04-10	BOSCH GMBH ROBERT; SAMSUNG SDI CO LTD	English Abstract attached	☒
	13	104795527	CN	A	2015-07-22	MICROVAST POWER SYSTEMS CO LTD	English Abstract attached	☒

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16450422
	Filing Date	2019-06-24
	First Named Inventor	NOOK
	Art Unit	2859
	Examiner Name	DIAO
	Attorney Docket Number	054985-000055-US-05

/M.D/	14	202696190	CN	U	2013-01-23	GUANGWEI AMERICA LINE ELECTRICAL APPLIANCE CO...	English Machine Translation attached	☒
	15	204516832	CN	U	2015-07-29	CONTEMPORARY AMPEREX TECHNOLOGY LTD	English Abstract attached	☒
	16	204966731	CN	U	2016-01-13	PRIME ELECTRIC (SHENZHEN) CO LTD	English Abstract attached	☒

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1	XP 55517268A 1, NOCO Product Brochure, Jump Starter, Lithium GB70 2000A 12V.	
	2	XP 55517270A 1, NOCO Product Brochure, Jump Starter, Lithium GB40 1000A 12V.	
	3	USB Battery Charging Specification Version 1.2 (EX1009)	
	4	GROUNDS OF INVALIDITY: Annex A to the Grounds of Invalidity; PROJECTA product manual for 2200A JUMPSTARTER, P/No.s HP 2012, HP 2200.; Carku E-Power 21 device.	
	5	GROUNDS OF INVALIDITY: Prior use of the Carku E-Power 21 device ("Carku E-Power 21").; User manual for Carku E-Power 21 (Ann 1).; Specification sheet for Carku E-Power 21 (Ann 2).; Claimant's E-catalogue dated 22 April 2014, which included Carku E-Power 21 (Ann 3).; Photograph of claimants' booth at 115th 2014 Canton Fair (Ann 4).; Photographs and quotation sheet rcvd by Edelbert Lenz GmbH & Co. KG (Ann 5).; User manuals and specification sheets rcvd by Kaz Corp. of Japan (Ann 6).; E-Catalogue rcvd by email by Krautli (Schweiz) AG (Ann 7).	
	6	DEFENDANT DELTONA TRANSFORMER CORPORATION'S INVALIDITY CONTENTIONS: USB Implementers Forum, Inc, Battery Charging Specification, Rev 1.1, 4/15/2009.; MICRO-START/PPS, offered for sale as late as 07/29/2013, by Antigravity Batteries.; E-Power, offered for sale as late as 04/15/2013 by Carku.; Battery Tender Power Pack, offered for sale prior to 07/03/2014 by Carku/Deltran USA LLC.; PowerAll, offered for sale as late as 03/26/2014 by Gryphon Mobile Electronics LLC.; Electromate 400, offered for sale as late as 2013 by Black & Decker.	

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Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-05

/M.D/	7	DEFENDANT TII TRADING INC.'S INVALIDITY CONTENTIONS
	8	DEFENDANT'S INVALIDITY AND UNENFORCEABILITY CONTENTIONS: USB Battery Charging Spec Ver 1.2.; E-flite EC Connector Assembly Instruct w 2008.; Datasheet for LM7805 Voltage Regulator from Fairchild Semiconductor.; Carku Product Brochure for Epower-20 jump starter product.; Carku Product Brochure for Epower-21 jump starter product.; MC78XX/LM78XX/MC78XXA 3-Terminal 1A Positive Voltage Regulator from Fairchild Semiconductor Corp. 2001.; Patent Owner The NOCO Company's Preliminary Response in Dongguan IPR.
	9	Memo Opin and Order of US Dist Ct Jud Barker construing disputed terms of claims 1, 9 and 19 of the '015 issued NOCO v. SmarTech Produts, Inc., 1:18-cv-2780 (N.D. Ohio April 2, 2020; NOCO Amend Compl NOCO v Shenzhen Lianfa Tong Tech Co., Ltd., et al., 1:19-cv-01855 (N.D. Ohio April 2, 2020; Dec Wan; Dec Hartup; Dec Kirtley; Special Master Report on Prop Claim Const For USPN 9,007,015 issued NOCO v. Shenzhen Dika Na'Er E-Commerce Co., 1:17CV2282 (N.D. Ohio June 28, 2018) acc/adopt by US Dist Ct Jud Boyko, 2019 WL 1723358
	10	DEFENDANTS' AMENDED FINAL INVALIDITY AND UNENFORCEABILITY CONTENTIONS: The Powerall PBJS12000RD Jump Starter, offered for sale by Gryphon Mobile Electronics at least as early as 11/05/2013.; The Lightning 12V Jump Starter, offered for sale by Pilot, Inc. at least as early as 03/2014.; The L3 Model Jump Starter, offered for sale by Shenzhen Tsevie Company at least as early as 05/19/2019.
	11	STATEMENT OF DEFENSE AND COUNTERCLAIM: Carku Epower-20 jump starter; Carku Epower-21 jump starter; Carku Product Brochure for the Epower-20 jump starter product; Carku Product Brochure for the Epower-21 jump starter product

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/M BAYE DIAO/	Date Considered	06/23/2022

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	3558	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:42 PM
L2	24862	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:43 PM
L3	166340	output adj port	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:43 PM
L4	0	vehicle adj batter$3 adj isolat$3 adj sens$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:44 PM
L5	1674253	(isolat$3 (batter$3 adj presence) adj sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:47 PM
L6	6642	(isolat$3 (batter$3 adj presence)) adj sens$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:48 PM
L7	0	reverse adj popularity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:49 PM
L8	186	reverse adj polarity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:49 PM
L9	0	(microcontroller microcomputer microprocessor processor controller) and L1 and L2 and L3 and L6 and L8	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L10	2960317	(microcontroller microcomputer microprocessor processor controller)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L11	0	L1 and L2 and L3 and L6 and L8	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L12	0	L1 and L2 and L3 and L6	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L13	0	L1 and L2 and L3 and L8	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L14	15	L1 and L2 and L3 and L10	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L15	3	L6 and L8	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:52 PM
L16	195	320/105.ccls. and (@ad<="20140708")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:55 PM
L17	1845	320/110-112.ccls. and (@ad<="20140708")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:55 PM
L18	0	(L16 L17) and (L14 L15)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:56 PM
L19	22	("5635817"|"8493021"|"7872361"|"20040130298"|"20100301800"|"5921809"|"6140796"|"6632	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:57 PM

		103"|"7301303"|"5793185"|"6262492"|"5635818"|"8376775"|"20140159509"|"5111130"|"5189359"|"6756764"|"5795182"|"6212054"|"8199024"|"20020041174"|"20130154543").PN.					
L20	0	((integrated combo) adj jumper) with ((plug connector) same (other another) adj end$2)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:48 PM
L21	0	((integrated combo combination assembly) adj jumper) with ((plug connector) same (other another) adj end$2)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:48 PM
L22	0	((integrated combo combination assembly) adj jumper) and ((plug connector) same (other another) adj end$2)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:49 PM
L23	222	((integrated combo combination assembly) adj jumper) and ((plug connector))	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:49 PM
L24	1674253	(isolat$3 (batter$3 adj presence) adj sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:49 PM
L25	6642	(isolat$3 (batter$3 adj presence)) adj sens$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:49 PM
L26	186	reverse adj polarity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:49 PM
L27	3	L24 and L25 and L26	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:49 PM
L28	3558	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:50 PM
L29	24862	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:50 PM
L30	48	L28 and L29	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:50 PM
L31	0	L23 L24 L25 L26	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2014/10/23 03:50 PM
L32	0	L23 L24 L25	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2014/10/23 03:50 PM
L33	0	L23 L30	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2014/10/23 03:51 PM
L34	0	L23 L30	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2014/10/23 03:51 PM
L35	1	L26 L30	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2014/10/23 03:51 PM
L36	8	L24 L30	(US-PGPUB; USPAT;	AND	ON	ON	2014/10/23

			EPO)				03:51 PM
L37	12	L27 L35 L36	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:52 PM
L38	195	320/105.ccls. and (@ad<="20140708")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:52 PM
L39	1845	320/110-112.ccls. and (@ad<="20140708")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:52 PM
L40	1	(L38 L39) and (L37 L30)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:52 PM
L41	8	(L36) and (L37)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:56 PM
L42	8	(L36) and (L37)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:56 PM
L43	8	(L36) and (L30)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:56 PM
L44	8	L42 L43	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:56 PM
L45	0	L23 and L30	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 04:03 PM
L46	0	L23 and L29 and L26	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 04:04 PM
L47	0	L23 and L26	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 04:04 PM
L48	1	L30 and L26	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 04:04 PM
L49	150	(US-5793185-$ or US-5752754-$ or US-4562893-$ or US-4793175-$ or US-4972135-$ or US-5886501-$ or US-5936317-$ or US-4521204-$ or US-4540376-$ or US-4554221-$ or US-4565538-$ or US-4573943-$ or US-4759728-$ or US-4798975-$ or US-4878877-$ or US-4889516-$ or US-4969834-$ or US-5179494-$ or US-5219034-$ or US-5281792-$ or US-5354215-$ or US-5367250-$ or US-5479160-$ or US-5515939-$ or US-5635804-$ or US-5635818-$).did. or (US-5687573-$ or US-5754031-$ or US-5780953-$ or US-	(USPAT)	OR	ON	ON	2014/10/23 05:39 PM

		5796255-$ or US- 6036574-$ or US- 6111393-$ or US- 6130519-$ or US- 6232728-$ or US- 3590357-$ or US- 3585358-$ or US- 3654538-$ or US- 3648146-$ or US- 3783846-$ or US- 4246559-$ or US- 4251847-$ or US- 4272142-$ or US- 4274690-$ or US- 4305004-$ or US- 4309675-$ or US- 4321542-$ or US- 4323830-$ or US- 4327420-$ or US- 4327519-$ or US- 4346335-$ or US- 4346893-$ or US- 4349774-$ or US- 4359893-$).did. or (US- 4366430-$ or US- 4379989-$ or US- 4380718-$ or US- 4383213-$ or US- 4388618-$ or US- 4420212-$ or US- 4435660-$ or US- 4449089-$ or US- 4459536-$ or US- 4461958-$ or US- 4463402-$ or US- 4479083-$ or US- 4482830-$ or US- 4488147-$ or US- 4491110-$ or US- 4497306-$ or US- 4503378-$ or US- 4508516-$ or US- 4511831-$ or US- 4511825-$ or US- 4516648-$ or US- 4537174-$ or US- 4550280-$ or US- 4575670-$ or US- 4584513-$ or US- 4615958-$ or US- 4616166-$).did. or (US- 4631455-$ or US- 4760000-$ or US- 4764852-$ or US- 4769586-$ or US- 4799135-$ or US- 4820966-$ or US- 4829223-$ or US-					

		4831321-$ or US- 4840583-$ or US- 4859987-$ or US- 4868409-$ or US- 4871957-$ or US- 4871959-$ or US- 4884464-$ or US- 4885524-$ or US- 4892204-$ or US- 4913981-$ or US- 4923415-$ or US- 4924176-$ or US- 4975089-$ or US- 5012689-$ or US- RE34159-$ or US- 5241242-$ or US- 5245258-$ or US- H001236-$ or US- 5253138-$ or US- 5277285-$).did. or (US- 5287085-$ or US- 5306990-$ or US- 5343128-$ or US- 5343135-$ or US- 5357186-$ or US- 5430334-$ or US- 5498933-$ or US- 5502368-$ or US- 5522582-$ or US- 5546264-$ or US- 5548462-$ or US- 5555864-$ or US- 5560442-$ or US- 5565760-$ or US- 5571999-$ or US- 5593797-$ or US- 5604653-$ or US- 5626504-$ or US- 5631544-$ or US- 5635817-$ or US- 5650242-$ or US- 5652471-$ or US- 5656922-$ or US- 5691892-$ or US- 5693995-$ or US- 5701038-$ or US- 5710471-$).did. or (US- 5712549-$ or US- 5712568-$ or US- 5731669-$ or US- 5747909-$ or US- 5753989-$ or US- 5767660-$ or US- 5772468-$ or US- 5777455-$ or US- 5790037-$ or US- 5795182-$ or US- 5820407-$ or US-				

		5847911-$ or US-5868076-$ or US-5892342-$ or US-5913911-$ or US-5921809-$).did.					
L50	3558	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 05:41 PM
L51	24862	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 05:41 PM
L52	48	L50 and L51	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 05:41 PM
L53	1	L52 and L49	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 05:41 PM
L54	84	(jump adj (start$3 cable)) with (alligator$2 clamp$2)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:17 PM
L55	0	L54 with ((integrated embedded) adj plug)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:21 PM
L56	0	L54 and ((integrated embedded) adj plug)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:21 PM
L57	0	L54 and ((integrated embedded) adj (plug connect$3 socket$2))	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:23 PM
L58	83	L54 and (plug connect$3 socket$2)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:28 PM
L59	36	L54 and (plug)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:28 PM
L60	3558	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:29 PM
L61	24862	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:29 PM
L62	48	L60 and L61	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:29 PM
L63	0	L59 and L62	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:29 PM
L64	225	(reverse reversed) adj polarity adj (sens$3 detect$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:19 PM
L65	0	(vehicle automobile car locomotive motorbike motorcycle) adj battery adj (presence connection) adj (sens$3 detect$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:21 PM
L66	95	battery adj (presence connection) adj (sens$3 detect$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:21 PM
L67	2960317	(microcontroller microcomputer microprocessor	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:22 PM

		processor controller)					
L68	0	L64 and L66 and L67	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:22 PM
L69	3558	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:22 PM
L70	0	L64 and L66 and L69	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:22 PM
L71	0	L64 and L66	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:23 PM
L72	10	(US-20130314041-$ or US-20120091944-$ or US-20070285049-$ or US-20050252573-$ or US-20050040788-$).did. or (US-6130519-$ or US-8172603-$ or US-6262559-$ or US-5083076-$ or US-4885524-$).did.	(US-PGPUB; USPAT)	OR	ON	ON	2014/10/24 11:49 PM
L73	22	("5635817"|"8493021"|"7872361"|"20040130298"|"20100301800"|"5921809"|"6140796"|"6632103"|"7301303"|"5793185"|"6262492"|"5635818"|"8376775"|"20140159509"|"5111130"|"5189359"|"6756764"|"5795182"|"6212054"|"8199024"|"20020041174"|"20130154543").PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:50 PM
L74	0	L72 and L73	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:50 PM
L75	4	("20050110467"|"6362599"|"6803743"|"7148580").PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/11/12 05:02 PM
L76	2	WO-2013137873-$.did.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2014/12/03 12:05 PM
L77	134	advantages near4 (lithium-ion) adj batter$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:03 PM
L78	196	320/105.ccls. and (@ad<="20140703")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L79	0	L77 and L78	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L80	3573	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L81	25112	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L82	167713	output adj port	(US-PGPUB; USPAT;	OR	ON	ON	2014/12/03

			EPO)				01:04 PM
L83	2991441	(microcontroller microcomputer microprocessor processor controller)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L84	15	L80 and L81 and L82 and L83	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L85	0	L77 and L84	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L86	188	reverse adj polarity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:05 PM
L87	0	L77 and L86	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:05 PM
L88	224	((integrated combo combination assembly) adj jumper) and ((plug connector))	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:05 PM
L89	0	L77 and L88	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:05 PM
L90	25112	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:05 PM
L91	0	L77 and L90	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:05 PM
L92	1687265	(isolat$3 (batter$3 adj presence) adj sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:06 PM
L93	53	L77 and L92	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:06 PM
L94	0	L93 and L90	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:07 PM
L95	84	(jump adj (start$3 cable)) with (alligator$2 clamp$2)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:07 PM
L96	0	L93 and L95	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:07 PM
L97	150	(US-5793185-$ or US-5752754-$ or US-4562893-$ or US-4793175-$ or US-4972135-$ or US-5886501-$ or US-5936317-$ or US-4521204-$ or US-4540376-$ or US-4554221-$ or US-4565538-$ or US-4573943-$ or US-4759728-$ or US-4798975-$ or US-4878877-$ or US-4889516-$ or US-4969834-$ or US-5179494-$ or US-	(USPAT)	OR	ON	ON	2014/12/03 01:08 PM

		5219034-$ or US- 5281792-$ or US- 5354215-$ or US- 5367250-$ or US- 5479160-$ or US- 5515939-$ or US- 5635804-$ or US- 5635818-$).did. or (US- 5687573-$ or US- 5754031-$ or US- 5780953-$ or US- 5796255-$ or US- 6036574-$ or US- 6111393-$ or US- 6130519-$ or US- 6232728-$ or US- 3590357-$ or US- 3585358-$ or US- 3654538-$ or US- 3648146-$ or US- 3783846-$ or US- 4246559-$ or US- 4251847-$ or US- 4272142-$ or US- 4274690-$ or US- 4305004-$ or US- 4309675-$ or US- 4321542-$ or US- 4323830-$ or US- 4327420-$ or US- 4327519-$ or US- 4346335-$ or US- 4346893-$ or US- 4349774-$ or US- 4359893-$).did. or (US- 4366430-$ or US- 4379989-$ or US- 4380718-$ or US- 4383213-$ or US- 4388618-$ or US- 4420212-$ or US- 4435660-$ or US- 4449089-$ or US- 4459536-$ or US- 4461958-$ or US- 4463402-$ or US- 4479083-$ or US- 4482830-$ or US- 4488147-$ or US- 4491110-$ or US- 4497306-$ or US- 4503378-$ or US- 4508516-$ or US- 4511831-$ or US- 4511825-$ or US- 4516648-$ or US- 4537174-$ or US- 4550280-$ or US-					

		4575670-$ or US- 4584513-$ or US- 4615958-$ or US- 4616166-$).did. or (US- 4631455-$ or US- 4760000-$ or US- 4764852-$ or US- 4769586-$ or US- 4799135-$ or US- 4820966-$ or US- 4829223-$ or US- 4831321-$ or US- 4840583-$ or US- 4859987-$ or US- 4868409-$ or US- 4871957-$ or US- 4871959-$ or US- 4884464-$ or US- 4885524-$ or US- 4892204-$ or US- 4913981-$ or US- 4923415-$ or US- 4924176-$ or US- 4975089-$ or US- 5012689-$ or US- RE34159-$ or US- 5241242-$ or US- 5245258-$ or US- H001236-$ or US- 5253138-$ or US- 5277285-$).did. or (US- 5287085-$ or US- 5306990-$ or US- 5343128-$ or US- 5343135-$ or US- 5357186-$ or US- 5430334-$ or US- 5498933-$ or US- 5502368-$ or US- 5522582-$ or US- 5546264-$ or US- 5548462-$ or US- 5555864-$ or US- 5560442-$ or US- 5565760-$ or US- 5571999-$ or US- 5593797-$ or US- 5604653-$ or US- 5626504-$ or US- 5631544-$ or US- 5635817-$ or US- 5650242-$ or US- 5652471-$ or US- 5656922-$ or US- 5691892-$ or US- 5693995-$ or US- 5701038-$ or US- 5710471-$).did. or (US-					

		5712549-$ or US-5712568-$ or US-5731669-$ or US-5747909-$ or US-5753989-$ or US-5767660-$ or US-5772468-$ or US-5777455-$ or US-5790037-$ or US-5795182-$ or US-5820407-$ or US-5847911-$ or US-5868076-$ or US-5892342-$ or US-5913911-$ or US-5921809-$).did.					
L98	0	L93 and L97	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:08 PM
L99	1856	320/110-112.ccls. and (@ad<="20140703")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:08 PM
L100	0	L93 and L99	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:08 PM
L101	1	"20130241488"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:39 PM
L102	1	"20050110467"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 11:35 AM
L103	3824	(H02J7/0034 H02J7/0054 Y02E60/12 H02J7/0042, H02J2001/006).cpc.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:06 PM
L104	3612	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:07 PM
L105	25490	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:07 PM
L106	169705	output adj port	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:07 PM
L107	17	L104 and L105 and L106	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:07 PM
L108	4	L103 and L105 and L106	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:08 PM
L110	1	"6130519".pn.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:32 PM
L121	3824	(H02J7/0034 H02J7/0054 Y02E60/12 H02J7/0042, H02J2001/006).cpc.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 10:34 PM
L122	25490	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 10:34 PM
L123	169705	output adj port	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 10:34 PM

L124	4	L121 and L122 and L123	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 10:34 PM
L125	4	L124 and (@ad<="20140703")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 10:34 PM
L126	1	"9007015".PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/23 12:22 PM
L127	2	"9506446".PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/23 08:53 PM
L128	2	"20040130298"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/23 09:12 PM
L129	1	"20050110467"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 03:49 PM
L130	154	("5793185" "5752754" "4562893" "4793175" "4972135" "5886501" "5936317" "4521204" "4540376" "4554221" "4565538" "4573943" "4759728" "4798975" "4878877" "4889516" "4969834" "5179494" "5219034" "5281792" "5354215" "5367250" "5479160" "5515939" "5635804" "5635818" "5687573" "5754031" "5780953" "5796255" "6036574" "6111393" "6130519" "6232728" "3590357" "3585358" "3654538" "3648146" "3783846" "4246559" "4251847" "4272142" "4274690" "4305004" "4309675" "4321542" "4323830" "4327420" "4327519" "4346335" "4346893" "4349774" "4359893" "4366430" "4379989" "4380718" "4383213" "4388618" "4420212" "4435660" "4449089" "4459536" "4461958" "4463402" "4479083" "4482830" "4488147" "4491110" "4497306" "4503378" "4508516" "4511831" "4511825" "4516648" "4537174" "4550280" "4575670" "4584513" "4615958" "4616166" "4631455" "4760000" "4764852" "4769586" "4799135" "4820966" "4829223" "4831321"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 06:18 PM

		"4840583" "4859987" "4868409" "4871957" "4871959" "4884464" "4885524" "4892204" "4913981" "4923415" "4924176" "4975089" "5012689" RE34159 "5241242" "5245258" H001236 "5253138" "5277285" "5287085" "5306990" "5343128" "5343135" "5357186" "5430334" "5498933" "5502368" "5522582" "5546264" "5548462" "5555864" "5560442" "5565760" "5571999" "5593797" "5604653" "5626504" "5631544" "5635817" "5650242" "5652471" "5656922" "5691892" "5693995" "5701038" "5710471" "5712549" "5712568" "5731669" "5747909" "5753989" "5767660" "5772468" "5777455" "5790037" "5795182" "5820407" "5847911" "5868076" "5892342" "5913911" "5921809").pn.					
L131	4480	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 06:18 PM
L132	35042	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 06:18 PM
L133	62	L131 and L132	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 06:18 PM
L134	1	L130 AND L133	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 06:18 PM
L135	73	((batter$3 adj presence)) adj (sens$3 detect$4)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 07:16 PM
L136	259	reverse adj polarity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 07:16 PM
L137	0	L135 and L136	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 07:16 PM
L138	35	(positive negative) near vehicle near connect$2	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 07:18 PM
L139	73	((batter$3 adj presence)) adj (sens$3 detect$4)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:13 PM
L140	35	(positive negative) near vehicle near connect$2	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:13 PM

L141	0	L139 and L140	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:13 PM
L142	302	((integrated combo combination assembly) adj jumper) and ((plug connector))	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:24 PM
L143	0	L139 and L142	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:24 PM
L144	37280	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:25 PM
L145	7	L139 and L144	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:25 PM
L146	4703	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:26 PM
L147	37280	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:26 PM
L148	67	L146 and L147	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:26 PM
L149	0	L145 and L148	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:26 PM
L150	130	battery adj (presence connection) adj (sens$3 detect$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:29 PM
L151	7	L145 and L150	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:29 PM
L152	2	"20040130298"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 11:34 PM
L153	14677	(B60L53/14 or H02J7/0047 or H02J7/0054 or H02J7/0029 or H02J7/0034 or H02J2007/0062 or H02J2007/005 or H02J2001/006).cpc.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/07/25 02:58 PM
L157	1	"9007015".PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 11:00 AM
L158	1	"9770992".PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 12:07 PM
L159	150	(US-6014016-$ or US-6157148-$ or US-5819695-$ or US-6057055-$ or US-6168470-$ or US-6184794-$ or US-6240637-$ or US-4403274-$ or US-4413234-$ or US-4546265-$ or US-5193212-$ or US-5194799-$ or US-	(USPAT)	OR	ON	ON	2019/10/07 01:22 PM

		5245304-$ or US- 5309031-$ or US- 5685630-$ or US- 5778026-$ or US- 5789099-$ or US- 5811913-$ or US- 5850134-$ or US- 4270834-$ or US- 4270827-$ or US- 4274043-$ or US- 4303962-$ or US- 4305550-$ or US- 4314193-$ or US- 4320333-$).did. or (US- 4354725-$ or US- 4374347-$ or US- 4373763-$ or US- 4373762-$ or US- 4377317-$ or US- 4384240-$ or US- 4409538-$ or US- 4467263-$ or US- 4470654-$ or US- 4496204-$ or US- 4516066-$ or US- 4527223-$ or US- 4552542-$ or US- 4555656-$ or US- 4567476-$ or US- 4785229-$ or US- 4794315-$ or US- 4808495-$ or US- 4811176-$ or US- 4816972-$ or US- 4924358-$ or US- 4928094-$ or US- 4929522-$ or US- 4959640-$ or US- 5192904-$ or US- 5193198-$ or US- 5204611-$).did. or (US- 5206636-$ or US- 5225760-$ or US- 5237257-$ or US- 5245269-$ or US- 5260636-$ or US- 5267800-$ or US- 5287298-$ or US- 5291388-$ or US- 5304434-$ or US- 5406272-$ or US- 5426358-$ or US- 5472802-$ or US- 5506488-$ or US- 5528901-$ or US- 5536977-$ or US- 5539610-$ or US- 5587916-$ or US-					

		5608303-$ or US- 5614807-$ or US- 5643693-$ or US- 5660946-$ or US- 5662504-$ or US- 5672952-$ or US- 5682050-$ or US- 5689209-$ or US- 5723973-$ or US- 5747891-$).did. or (US- 5796181-$ or US- 5833499-$ or US- 5876423-$ or US- 5886501-$ or US- 5908714-$ or US- 5915224-$ or US- 5916709-$ or US- 5929604-$ or US- 5936317-$ or US- 5940520-$ or US- 5978491-$ or US- 6046445-$ or US- 6078214-$ or US- 6087740-$ or US- 6091906-$ or US- 6131065-$ or US- 6174618-$ or US- 4245308-$ or US- 4246635-$ or US- 4246544-$ or US- 4247813-$ or US- 4247753-$ or US- 4258292-$ or US- 4259631-$ or US- 4262278-$ or US- 4271092-$ or US- 4275385-$).did. or (US- 4276236-$ or US- 4281368-$ or US- 4290060-$ or US- 4292840-$ or US- 4307437-$ or US- 4306374-$ or US- 4314194-$ or US- 4316097-$ or US- 4321523-$ or US- 4321646-$ or US- 4322484-$ or US- 4323837-$ or US- 4326161-$ or US- 4330686-$ or US- 4332003-$ or US- 4335375-$ or US- 4335481-$ or US- 4339677-$ or US- 4345154-$ or US- 4355263-$ or US- 4355422-$ or US-					

		4356442-$ or US-4360789-$ or US-4361730-$ or US-4368507-$ or US-4382221-$ or US-4392185-$).did. or (US-4395774-$ or US-4399201-$ or US-4401856-$ or US-4410835-$ or US-4414298-$ or US-4413364-$ or US-4415272-$ or US-4415843-$ or US-4417240-$ or US-4416550-$ or US-4424854-$ or US-4430396-$ or US-4432938-$ or US-4435742-$ or US-4435486-$ or US-4445358-$).did.					
L160	150	(US-6014016-$ or US-6157148-$ or US-5819695-$ or US-6057055-$ or US-6168470-$ or US-6184794-$ or US-6240637-$ or US-4403274-$ or US-4413234-$ or US-4546265-$ or US-5193212-$ or US-5194799-$ or US-5245304-$ or US-5309031-$ or US-5685630-$ or US-5778026-$ or US-5789099-$ or US-5811913-$ or US-5850134-$ or US-4270834-$ or US-4270827-$ or US-4274043-$ or US-4303962-$ or US-4305550-$ or US-4314193-$ or US-4320333-$).did. or (US-4354725-$ or US-4374347-$ or US-4373763-$ or US-4373762-$ or US-4377317-$ or US-4384240-$ or US-4409538-$ or US-4467263-$ or US-4470654-$ or US-4496204-$ or US-	(USPAT)	OR	ON	ON	2019/10/07 01:22 PM

		4516066-$ or US- 4527223-$ or US- 4552542-$ or US- 4555656-$ or US- 4567476-$ or US- 4785229-$ or US- 4794315-$ or US- 4808495-$ or US- 4811176-$ or US- 4816972-$ or US- 4924358-$ or US- 4928094-$ or US- 4929522-$ or US- 4959640-$ or US- 5192904-$ or US- 5193198-$ or US- 5204611-$).did. or (US- 5206636-$ or US- 5225760-$ or US- 5237257-$ or US- 5245269-$ or US- 5260636-$ or US- 5267800-$ or US- 5287298-$ or US- 5291388-$ or US- 5304434-$ or US- 5406272-$ or US- 5426358-$ or US- 5472802-$ or US- 5506488-$ or US- 5528901-$ or US- 5536977-$ or US- 5539610-$ or US- 5587916-$ or US- 5608303-$ or US- 5614807-$ or US- 5643693-$ or US- 5660946-$ or US- 5662504-$ or US- 5672952-$ or US- 5682050-$ or US- 5689209-$ or US- 5723973-$ or US- 5747891-$).did. or (US- 5796181-$ or US- 5833499-$ or US- 5876423-$ or US- 5886501-$ or US- 5908714-$ or US- 5915224-$ or US- 5916709-$ or US- 5929604-$ or US- 5936317-$ or US- 5940520-$ or US- 5978491-$ or US- 6046445-$ or US- 6078214-$ or US- 6087740-$ or US-					

		6091906-$ or US-6131065-$ or US-6174618-$ or US-4245308-$ or US-4246635-$ or US-4246544-$ or US-4247813-$ or US-4247753-$ or US-4258292-$ or US-4259631-$ or US-4262278-$ or US-4271092-$ or US-4275385-$).did. or (US-4276236-$ or US-4281368-$ or US-4290060-$ or US-4292840-$ or US-4307437-$ or US-4306374-$ or US-4314194-$ or US-4316097-$ or US-4321523-$ or US-4321646-$ or US-4322484-$ or US-4323837-$ or US-4326161-$ or US-4330686-$ or US-4332003-$ or US-4335375-$ or US-4335481-$ or US-4339677-$ or US-4345154-$ or US-4355263-$ or US-4355422-$ or US-4356442-$ or US-4360789-$ or US-4361730-$ or US-4368507-$ or US-4382221-$ or US-4392185-$).did. or (US-4395774-$ or US-4399201-$ or US-4401856-$ or US-4410835-$ or US-4414298-$ or US-4413364-$ or US-4415272-$ or US-4415843-$ or US-4417240-$ or US-4416550-$ or US-4424854-$ or US-4430396-$ or US-4432938-$ or US-4435742-$ or US-4435486-$ or US-4445358-$).did.					
L161	4959	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:28 PM

L162	39692	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:28 PM
L163	70	L161 and L162	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:28 PM
L164	13669	320/105.ccls. (H02J7/0054 or H02J7/0034 or H02J7/0029 or H02J7/0047 or H02J2001/006 or H02J2007/005 or H02J2007/0062 or H02J7/0063 or H02J1/06 or H02J2007/004 or H02J2007/0037).cpc.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:31 PM
L165	331	(reverse reversed) adj polarity adj (sens$3 detect$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:32 PM
L166	135	battery adj (presence connection) adj (sens$3 detect$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:32 PM
L167	0	L165 and L166	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:32 PM
L168	0	L163 and (L165 L166) and L160	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:34 PM
L169	10	L163 and (L165 L166) and L164	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:34 PM
L170	4639064	(microcontroller microcomputer microprocessor processor controller)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:35 PM
L171	10	L169 and L170	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:35 PM
L172	38	((("THE") near3 ("NOCO") near3 ("COMPANY"))).AS,AANM.	(USPAT)	OR	ON	ON	2019/10/07 01:48 PM
L173	87	((("NOOK") near3 ("Jonathan")) OR (("NOOK") near3 ("William")) OR (("STANFIELD") near3 ("James")) OR (("UNDERHILL") near3 ("Derek"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2019/10/07 01:48 PM
L174	64	("20020041174"|"20040066168"|"20040130298"|"20050040788"|"20050110467"|"20050252573"|"20070285049"|"20100301800"|"20110068734"|"20120091944"|"20	(US-PGPUB; USPAT)	OR	ON	ON	2020/03/02 07:34 PM

		130154543"|"20130314041"|"20140159509"|"20150306964"|"20160001666"|"3933140"|"4041445"|"4885524"|"4910628"|"4931731"|"5083076"|"5111130"|"5189359"|"5486434"|"5635817"|"5635818"|"5793185"|"5795182"|"5921809"|"5965998"|"6054779"|"6130519"|"6140796"|"6147471"|"6212054"|"6262492"|"6262559"|"6362599"|"6386907"|"6426606"|"6632103"|"6648701"|"6756764"|"6803743"|"6822425"|"7148580"|"7301303"|"7749031"|"7872361"|"8076900"|"8172603"|"8199024"|"8376775"|"8493021"|"9506446"|"9770992"|"D625265"|"D649116"|"D689020"|"D726109"|"D726114"|"D726121"|"D735665"|"D746774").PN.					
L175	474	reverse near (polarity voltage) near detect$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/03/02 08:29 PM
L176	20	battery near isolat$3 near (sensor detector)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/03/02 08:29 PM
L177	0	L175 and L176	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/03/02 08:31 PM
L178	8	(L175 L176) and L174	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/03/02 08:32 PM
L179	2	("20180345803").PN.	(US-PGPUB; USPAT; USOCR; DERWENT)	OR	ON	ON	2020/03/03 02:58 PM
L180	13	("10328808"|"10604024"|"20050110467"|"20070278990"|"20180111491"|"20180215274"|"20180269703"|"20180342891"|"20180345803"|"20190308518"|"5953681"|"9007015"|"9770992").PN.	(US-PGPUB; USPAT)	OR	ON	ON	2020/07/13 10:55 PM
L181	1	"9007015".PN.	(US-PGPUB; USPAT)	OR	ON	ON	2020/07/14 01:25 PM
L182	3	"20130154543"	(US-PGPUB; USPAT; USOCR; DERWENT)	OR	ON	ON	2020/07/16 01:04 PM
L183	3	"9954391".pn.	(US-PGPUB; USPAT; USOCR; DERWENT)	OR	ON	ON	2020/07/16 02:39 PM
L184	240	output near port same (receptacle same plug)	(US-PGPUB; USPAT; USOCR; DERWENT)	OR	ON	ON	2020/07/16 02:42 PM

L185	5219	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/07/16 02:43 PM
L186	0	L184 and L185	(US-PGPUB; USPAT; USOCR; DERWENT)	OR	ON	ON	2020/07/16 02:43 PM
L187	42234	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/07/16 02:44 PM
L188	248140	output adj port	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/07/16 02:44 PM
L189	2441926	(isolat$3 (batter$3 adj presence) adj sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/07/16 02:44 PM
L190	10187	(isolat$3 (batter$3 adj presence)) adj sens$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/07/16 02:44 PM
L191	11	L187 and L188 and L189 and L190 and L185	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/07/16 02:44 PM
L192	240	(output near port) same (receptacle same plug)	(US-PGPUB; USPAT; USOCR; DERWENT)	OR	ON	ON	2020/07/16 02:45 PM
L193	1949	(output near port) and (receptacle same plug)	(US-PGPUB; USPAT; USOCR; DERWENT)	OR	ON	ON	2020/07/16 02:45 PM
L194	0	L191 and (L192 L193)	(US-PGPUB; USPAT; USOCR; DERWENT)	OR	ON	ON	2020/07/16 02:45 PM
L195	5219	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/07/16 04:00 PM
L196	42234	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/07/16 04:00 PM
L197	248140	output adj port	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/07/16 04:00 PM
L198	2441926	(isolat$3 (batter$3 adj presence) adj sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/07/16 04:00 PM
L199	10187	(isolat$3 (batter$3 adj presence)) adj sens$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/07/16 04:00 PM
L200	11	L196 and L197 and L198 and L199 and L195	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/07/16 04:00 PM
L201	2	"20040130298"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/07/16 04:35 PM
L202	2	("20180264959").PN.	(US-PGPUB; USPAT; USOCR; DERWENT)	OR	ON	ON	2020/07/16 11:46 PM
L203	1	"20090174362"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/08/07 07:14 PM
L204	25362	(B60L53/14 or H02J7/342 or H02J7/0047 or H02J7/0034 or H02J7/0029 or H02J1/122 or H02J7/00 or H02J7/0048 or H02J2310/46).cpc. 320/105.ccls.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/08/07 08:21 PM

L205	5229	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/08/07 08:22 PM
L206	42408	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/08/07 08:22 PM
L207	249036	output adj port	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/08/07 08:22 PM
L208	2450598	(isolat$3 (batter$3 adj presence) adj sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/08/07 08:22 PM
L209	10231	(isolat$3 (batter$3 adj presence)) adj sens$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/08/07 08:22 PM
L210	295	reverse adj polarity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/08/07 08:22 PM
L211	11	L204 and L205 and L206 and L207 and (L208 L209) and L210	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/08/07 08:22 PM
L212	149	(US-6014030-$ or US-4306374-$ or US-4559478-$ or US-4771451-$ or US-5378549-$ or US-5745587-$ or US-6229381-$ or US-6232752-$ or US-4297531-$ or US-4356442-$ or US-4370526-$ or US-4386818-$ or US-4426678-$ or US-4459536-$ or US-4855662-$ or US-4872199-$ or US-4927722-$ or US-4935959-$ or US-4994727-$ or US-5349285-$ or US-5367250-$ or US-5371455-$ or US-5376476-$ or US-5408223-$ or US-5410237-$ or US-5425004-$).did. or (US-5560442-$ or US-5571999-$ or US-5739711-$ or US-6016044-$ or US-6042961-$ or US-6147471-$ or US-6211642-$ or US-3783846-$ or US-4253056-$ or US-4262353-$ or US-4272142-$ or US-4291106-$ or US-4301407-$ or US-4314009-$ or US-	(USPAT)	OR	ON	ON	2020/08/07 08:24 PM

		4315973-$ or US- 4321542-$ or US- 4322143-$ or US- 4333721-$ or US- 4343982-$ or US- 4346893-$ or US- 4349774-$ or US- 4361795-$ or US- 4379267-$ or US- 4380718-$ or US- 4397184-$ or US- 4399499-$ or US- 4399818-$).did. or (US- 4409304-$ or US- 4413248-$ or US- 4413220-$ or US- 4424264-$ or US- 4424812-$ or US- 4431868-$ or US- 4463402-$ or US- 4473756-$ or US- 4474537-$ or US- 4479083-$ or US- 4480018-$ or US- 4484145-$ or US- 4485271-$ or US- 4488147-$ or US- 4488110-$ or US- 4489341-$ or US- 4502211-$ or US- 4504556-$ or US- 4507856-$ or US- 4525438-$ or US- 4527111-$ or US- 4528255-$ or US- 4528424-$ or US- 4537174-$ or US- 4550280-$ or US- 4551670-$ or US- 4562128-$).did. or (US- 4564728-$ or US- 4579790-$ or US- 4581549-$ or US- 4588860-$ or US- 4592087-$ or US- 4592360-$ or US- 4602850-$ or US- 4625174-$ or US- 4631455-$ or US- 4757250-$ or US- 4770613-$ or US- 4774952-$ or US- 4774993-$ or US- 4782242-$ or US- 4798975-$ or US- 4803472-$ or US- 4809322-$ or US- 4818340-$ or US-					

		4819116-$ or US-4841203-$ or US-4871959-$ or US-4892204-$ or US-4903318-$ or US-4907261-$ or US-4923415-$ or US-4974588-$ or US-4990836-$).did. or (US-4998141-$ or US-5006427-$ or US-5007436-$ or US-5010307-$ or US-5020517-$ or US-5023493-$ or US-5189359-$ or US-5191507-$ or US-5193107-$ or US-5197085-$ or US-5198702-$ or US-5224476-$ or US-5229220-$ or US-5230637-$ or US-5230967-$ or US-5240655-$ or US-5245258-$ or US-H001236-$ or US-5253138-$ or US-5254081-$ or US-5280459-$ or US-5281491-$ or US-5296314-$ or US-5319300-$ or US-5325835-$ or US-5329588-$ or US-5344725-$).did. or (US-5347440-$ or US-5370665-$ or US-5384211-$ or US-5385512-$ or US-5404859-$ or US-5419745-$ or US-5425348-$ or US-5453643-$ or US-5453715-$ or US-5463380-$ or US-5481185-$ or US-5498984-$ or US-5508122-$ or US-5534368-$ or US-5539820-$).did.					
L213	0	L205 L206 (L208 or L209) L210 L212	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2020/08/07 08:24 PM
L214	3	"20160359375"	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO;	OR	ON	ON	2021/02/03 06:42 PM

			DERWENT; IBM_TDB)				
L215	12	battery WITH (jump ADJ start$3 NEAR (device apparatus)) SAME (USB universal NEAR serial NEAR bus NEAR (circuit$2 (connect$2 coupl$2)))	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2021/02/04 10:11 AM
L216	0	battery WITH (jump ADJ start$3 NEAR (device apparatus)) WITH (USB universal NEAR serial NEAR bus NEAR (circuit$2 (connect$2 coupl$2))) SAME (USB NEAR (cable connect$2))	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2021/02/04 11:36 AM
L217	20	battery WITH (jump ADJ start$3 NEAR (device apparatus)) AND (USB universal NEAR serial NEAR bus NEAR (circuit$2 (connect$2 coupl$2))) AND (USB NEAR (cable connect$2))	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2021/02/04 11:37 AM
L218	2	"20090174362"	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/02/04 06:50 PM
L219	10	"9506446".pn.	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/02/04 07:34 PM
L220	20	(jump ADJ start$3 NEAR (device apparatus)) AND (USB universal NEAR serial NEAR bus NEAR (circuit$2 (connect$2 coupl$2))) AND (USB NEAR (cable connect$2)) AND ((boost up DC/DC DC-DC DC-to-DC) NEAR convert$2)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2021/02/05 08:48 AM
L221	2	"9506446".pn.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2021/02/05 10:46 AM
L222	1568	((DC-DC DC-to-DC boost DC/DC up) NEAR convert$2) WITH (resist$2 voltage) NEAR divi$4	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2021/02/05 11:39 AM

L223	161	(boost jump) NEAR start$3 NEAR (device apparatus)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2021/02/05 11:40 AM
L224	0	L223 L222	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2021/02/05 11:40 AM
L225	1962	((DC-DC DC-to-DC boost DC/DC up) NEAR convert$2) WITH (resist$2 voltage) NEAR divi$4	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/02/05 11:41 AM
L226	355	(boost jump) NEAR start$3 NEAR (device apparatus)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/02/05 11:41 AM
L227	0	L226 L225	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2021/02/05 11:42 AM
L228	315	L226 L185	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2021/02/05 11:43 AM
L229	54	(B60L53/14 OR H02J7/0047 OR H02J7/0054 OR H02J7/0029 OR H02J7/0034 OR H02J2007/0062 OR H02J2007/005 OR H02J2001/006).cpc. AND L228	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2021/02/05 11:44 AM
L230	474	(usb (universal NEAR serial NEAR bus)) WITH ((resist$2 voltage) NEAR divi$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/02/05 12:03 PM
L231	1456	(usb (universal NEAR serial NEAR bus)) SAME ((resist$2 voltage) NEAR divi$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/02/05 12:03 PM
L232	15	L231 L230 L226	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2021/02/05 12:04 PM
L233	474	L231 L230	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2021/02/05 12:05 PM
L234	15	L185 L233	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2021/02/05 12:05 PM
L235	35	L233 L121	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	AND	ON	ON	2021/02/05 12:06 PM

			IBM_TDB)				
L236	9	"9506446".pn.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2021/02/05 12:27 PM
L237	0	L2 WITH (USB (universal NEAR serial NEAR bus)) NEAR input NEAR charg$3 NEAR circuit$2	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/24 10:10 AM
L238	0	L2 AND (USB (universal NEAR serial NEAR bus)) NEAR input NEAR charg$3 NEAR circuit$2	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/24 10:47 AM
L239	10	"9506446".pn.	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/24 10:48 AM
L240	7	(USB (universal NEAR serial NEAR bus)) NEAR input NEAR charg$3 NEAR circuit$2	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/24 11:56 AM
L241	1641	(USB (universal NEAR serial NEAR bus)) NEAR input NEAR (connect$3 coupl$2 adapt$3 male female mater mating plug receptacle)	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/24 12:00 PM
L242	1	L241 L240	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2021/05/24 12:01 PM
L243	4	L60 L241	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2021/05/24 12:04 PM
L244	0	((jump ADJ start$3 NEAR (apparatus device module)) L226) SAME L241 SAME ((usb (universal NEAR serial NEAR bus)) NEAR input NEAR connect$2)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2021/05/24 12:45 PM
L245	0	((jump ADJ start$3 NEAR (apparatus device module)) L226) SAME L241 SAME ((usb (universal NEAR	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2021/05/24 12:46 PM

		serial NEAR bus)) NEAR input NEAR charg$3 NEAR circuit$2)					
L246	0	((jump ADJ start$3 NEAR (apparatus device module)) L226) AND L241 AND ((usb (universal NEAR serial NEAR bus)) NEAR input NEAR charg$3 NEAR circuit$2)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2021/05/24 12:46 PM
L247	0	((jump ADJ start$3 NEAR (apparatus device module)) L226) AND L241 AND ((usb (universal NEAR serial NEAR bus)) NEAR charg$3 NEAR circuit$2)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2021/05/24 12:46 PM
L248	0	L233 L121 L222 L223	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2021/06/21 03:31 PM
L249	0	L2 WITH (USB (universal NEAR serial NEAR (cable bus connect$2))) NEAR input NEAR charg$3 NEAR circuit$2	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/21 03:32 PM
L250	7	((USB (universal NEAR serial NEAR (cable bus connect$2))) NEAR input NEAR charg$3 NEAR circuit$2)	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/06/21 03:33 PM
L251	0	L231 L233 L241 L228	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2021/06/21 03:49 PM
L252	0	L231 L233 L241 L205	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2021/06/21 03:50 PM
L253	163392	((USB (universal NEAR serial NEAR bus)) input NEAR charg$3 NEAR circuit$2) WITH (USB NEAR (connector coupler))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO,	OR	ON	ON	2021/11/15 10:30 AM

			NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L254	515	external NEAR USB NEAR charg$3	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/15 10:47 AM
L255	6101	(jump boost) ADJ start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2021/11/15 10:51 AM
L256	15004989	power NEAR supply	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/15 10:51 AM
L257	0	L253 L254 L255 L256	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2021/11/15 10:52 AM

L258	0	(L223 L226) AND L253 AND L254 AND L255 AND L256	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/15 10:57 AM
L259	0	(L223 L226) AND L253 AND L254 AND L255	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/15 11:02 AM
L260	2	"20120187897".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/03/02 06:36 PM
L261	2	"20080157732".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO,	OR	ON	ON	2022/03/02 07:33 PM

			MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L262	2	"9093855".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/21 07:25 PM
L263	1	L253 L254 L255 L256	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	OFF	2022/06/23 04:55 PM
L264	199	("10084173" OR "10128483" OR "10218172" OR "10328806" OR "10328808" OR "10461545" OR "10604024" OR "10981452" OR "20010003827" OR "20010025618" OR "20020007500" OR "20020007699" OR "20020121877" OR "20020155752" OR "20030096158" OR "20030141845" OR "20040066168" OR "20040106038" OR	(US-PGPUB; USPAT)	AND	ON	ON	2022/06/23 05:11 PM

		"20040124810" OR "20040130298" OR "20040150373" OR "20040239290" OR "20050082833" OR "20050116688" OR "20050162124" OR "20050213867" OR "20060071631" OR "20060176011" OR "20060220610" OR "20060244412" OR "20070132427" OR "20070132537" OR "20070178777" OR "20070182363" OR "20070278990" OR "20080131764" OR "20080143290" OR "20080150473" OR "20080157732" OR "20090026837" OR "20090039712" OR "20090108814" OR "20090174362" OR "20090218988" OR "20090236859" OR "20090253312" OR "20100001682" OR "20100013302" OR "20100052620" OR "20100055546" OR "20100129723" OR "20100164439" OR "20100173182" OR "20100181959" OR "20100244766" OR "20100283623" OR "20110117408" OR "20110127947" OR "20110140651" OR "20110175461" OR "20110250473" OR "20110268996" OR "20110279089" OR "20110308856" OR "20120013189" OR "20120025766" OR "20120038365" OR "20120068662" OR "20120126818" OR "20120139498" OR "20120169116" OR "20120187897" OR "20120270097" OR "20120295150" OR "20120299533" OR "20130084471" OR					

		"20130104817" OR "20130154544" OR "20130154550" OR "20130162029" OR "20130241498" OR "20130295444" OR "20140045001" OR "20140077755" OR "20140084844" OR "20140113463" OR "20140127550" OR "20140139175" OR "20140210399" OR "20140368155" OR "20150012174" OR "20150015184" OR "20150037662" OR "20150054336" OR "20150087182" OR "20150222060" OR "20150236329" OR "20150340907" OR "20150366538" OR "20150380697" OR "20160111914" OR "20160141728" OR "20160155996" OR "20160181587" OR "20170084899" OR "20170309872" OR "20180369599" OR "20190081472" OR "3085187" OR "3105183" OR "3267452" OR "3590357" OR "3638108" OR "4142771" OR "4740740" OR "4972135" OR "4990723" OR "5194799" OR "5281904" OR "5319298" OR "5496658" OR "5589757" OR "5637978" OR "5707257" OR "5716735" OR "5820407" OR "5831350" OR "5953681" OR "6002235" OR "6037778" OR "6057667" OR "6144110" OR "6160381" OR "6215273" OR					

		"6222342" OR "6249106" OR "6271605" OR "6300742" OR "6344733" OR "6384573" OR "6424158" OR "6650086" OR "6679212" OR "6679708" OR "6759833" OR "6774607" OR "6799993" OR "6822425" OR "6856764" OR "6919704" OR "7015674" OR "7017055" OR "7095339" OR "7339347" OR "7345450" OR "7508171" OR "7514900" OR "7579811" OR "7656118" OR "7675261" OR "7679317" OR "7791319" OR "7847520" OR "7868582" OR "7893558" OR "7893655" OR "7893657" OR "8030900" OR "8076900" OR "8125181" OR "8221915" OR "8362745" OR "8376775" OR "8493021" OR "8686688" OR "8736227" OR "8786247" OR "8994327" OR "9007023" OR "9048666" OR "9070938" OR "9153978" OR "9197079" OR "9243601" OR "9263717" OR "9263907" OR "9287725" OR "9525297" OR "9537136" OR "9601800" OR "9608294" OR "9718419" OR					

		"9748541" OR "9748778" OR "9809183" OR "9871392" OR "9874611" OR "9954391" OR "D597029").pn.					
L265	0	L264 AND (boost (step ADJ up) step-up) NEAR converter SAME charg$3 near5(internal NEAR battery) SAME (USB (universal NEAR serial NEAR bus))	(US-PGPUB; USPAT)	AND	ON	ON	2022/06/23 05:13 PM
L266	0	L264 AND (boost (step ADJ up) step-up) NEAR converter AND (charg$3 near5(internal NEAR battery) SAME (USB (universal NEAR serial NEAR bus)))	(US-PGPUB; USPAT)	AND	ON	ON	2022/06/23 05:13 PM
L267	1	L264 AND (boost (step ADJ up) step-up) NEAR converter AND charg$3 SAME (USB (universal NEAR serial NEAR bus))	(US-PGPUB; USPAT)	AND	ON	ON	2022/06/23 05:14 PM
L268	1	L264 AND (boost (step ADJ up) step-up) NEAR converter AND charg$3 AND (USB (universal NEAR serial NEAR bus))	(US-PGPUB; USPAT)	AND	ON	ON	2022/06/23 05:15 PM
L269	7	L264 AND (boost (step ADJ up) step-up) NEAR converter AND charg$3 AND (USB (universal NEAR serial NEAR bus))	(US-PGPUB; USPAT)	OR	ON	ON	2022/06/23 05:15 PM
L270	7	L264 AND (boost (step ADJ up) step-up) NEAR converter AND charg$3 AND (USB (universal NEAR serial NEAR bus))	(US-PGPUB; USPAT)	OR	ON	ON	2022/06/23 05:15 PM
L271	7	L264 AND (boost (step ADJ up) step-up) NEAR converter AND charg$3 AND (USB (universal NEAR serial NEAR bus))	(US-PGPUB; USPAT)	OR	ON	ON	2022/06/23 05:15 PM
L272	7	L264 AND (boost (step ADJ up) step-up) NEAR converter AND charg$3 SAME (USB (universal	(US-PGPUB; USPAT)	OR	ON	ON	2022/06/23 05:15 PM

		NEAR serial NEAR bus))					
L273	7	L269 L270 L271 L272	(US-PGPUB; USPAT)	OR	ON	ON	2022/06/23 05:16 PM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N111	0	(jump and vehicle and internal and power and supply and polarity and output$2 and isolation and sensor and reverse and polarity and sensor and switch and microcontrol$3 and input and signal$2).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2015/01/29 04:50 PM
N112	0	(vehicle and internal and power and supply and polarity and output$2 and isolation and sensor and reverse and polarity and sensor and switch and microcontrol$3 and input and signal$2).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2015/01/29 04:50 PM
N113	0	(vehicle and internal and power and supply and output$2 and isolation and sensor and reverse and polarity and sensor and switch and microcontrol$3 and input and signal$2).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2015/01/29 04:50 PM
N114	0	(vehicle and internal and power and supply and output$2 and isolation and sensor and reverse and polarity and switch and microcontrol$3 and input and signal$2).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2015/01/29 04:51 PM
N115	0	(vehicle and internal and power and supply and output$2 and isolation and sensor and reverse and polarity and switch$3 and microcontrol$3 and input and signal$2).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2015/01/29 04:51 PM
N116	0	(vehicle and power and supply and output$2 and isolation and sensor and reverse and	(US-PGPUB; USPAT)	OR	OFF	OFF	2015/01/29 04:52 PM

		polarity and switch$3 and microcontrol$3 and input and signal$2).clm.					
N117	0	(vehicle and power and supply and output$2 and isolation and sensor and reverse and polarity and switch$3 and microcontrol$3 and signal$2).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2015/01/29 04:52 PM
N118	0	(vehicle and power and supply and output$2 and isolation and sensor and reverse and polarity and switch$3 and microcontrol$3 and signal$1).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2015/01/29 04:52 PM
N119	0	(power and supply and output$2 and isolation and sensor and reverse and polarity and switch$3 and microcontrol$3 and signal$1).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2015/01/29 04:53 PM
N120	0	(power and supply and output$2 and isolation and sensor and revers$3 and polarity and switch$3 and microcontrol$3 and signal$1).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2015/01/29 04:53 PM
N154	4	(supply and output$2 and isolat$3 and sensor and revers$3 and polarity and switch$3 and microcontrol$3 and signal$1).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2019/07/25 05:23 PM
N155	4	(supply and output$4 and isolat$3 and sensor and revers$3 and polarity and switch$3 and microcontrol$3 and signal$1).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2019/07/25 05:23 PM
N156	4	N154 and N155	(US-PGPUB; USPAT)	OR	OFF	OFF	2019/07/25 05:24 PM
N157	6	(power AND supply AND output$4 AND isolat$3 AND sensor AND revers$3 AND polarity AND switch$3 AND microcontrol$3 AND signal$1 AND USB AND connect$2).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2021/11/15 11:13 AM
N158	6	(power AND supply	(US-PGPUB; USPAT)	OR	OFF	OFF	2022/03/02

		AND output$4 AND sensor AND revers$3 AND polarity AND switch$3 AND microcontrol$3 AND signal$1 AND USB AND connect$2).clm.					10:13 PM
N159	6	(power AND supply AND output$4 AND sens$3 AND revers$3 AND polar$3 AND switch$3 AND microcontrol$3 AND signal$1 AND USB AND connect$2).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2022/06/23 04:54 PM

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-22)
Approved for use through 05/31/2024. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16450422
Filing Date	2019-06-24
First Named Inventor	NOOK
Art Unit	2859
Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-05

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/M.D/	1	5716735		1998-02-10	MUFFOLETTO et al.	
	2	6799993		2004-10-05	KRIEGER	
	3	7015674		2006-03-21	VONDERHAAR	
	4	7017055		2006-03-21	HO	
	5	7893558		2011-02-22	LEE	
	6	7893655		2011-02-22	VESELIC	
	7	9048666		2015-06-02	SU	
	8	9070938		2015-06-30	HASHIMOTO et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.D/

EXHIBIT 1002
Petitioner ADC (IPR2024-00577)

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16450422
Filing Date	2019-06-24
First Named Inventor	NOOK
Art Unit	2859
Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-05

/M.D/	9	9537136		2017-01-03	RYU	
	10	9601800		2017-03-21	NAKAMOTO et al.	
	11	9748541		2017-08-29	BURKE	
	12	9748778		2017-08-29	TOYA	
	13	10084173		2018-09-25	HA	
	14	10128483		2018-11-13	LEE	
	15	10218172		2019-02-26	CHEN et al.	
	16	10328808		2019-06-25	NOOK et al.	
	17	10981452		2021-04-20	NOOK et al.	
	18	6822425		2004-11-23	KRIEGER et al.	
	19	8076900		2011-12-13	BROWN	

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Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-05

/M.D/	20	8376775		2013-02-19	RINHARDT	
	21	8493021		2013-07-23	RICHARDSON et al.	
	22	6215273		2001-04-10	SHY	
	23	5637978		1997-06-10	KELLETT	
	24	9608294		2017-03-28	KO	
	25	4142771		1979-03-06	BARNES	
	26	7679317		2010-03-16	VASELIC	
	27	8736227		2014-05-27	CHADBOURNE et al.	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020155752		2002-10-24	WINKLE et al.	

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/M.D/	2	20040106038		2004-06-03	SHIMAMURA et al.	
	3	20060071631		2006-04-06	CHEUNG et al.	
	4	20070132537		2007-06-14	OSBUN	
	5	20080157732		2008-07-03	WILLIAMS	
	6	20090026837		2009-01-29	LEE	
	7	20100173182		2010-07-08	BAXTER	
	8	20100052620		2010-03-04	WONG	
	9	20110268996		2011-11-03	LEE	
	10	20110308856		2011-12-22	PARK	
	11	20120187897		2012-07-26	LENK et al.	
	12	20120295150		2012-11-22	GAO et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	NOOK
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	Attorney Docket Number	054985-000055-US-05

/M.D/	13	20120270097		2012-10-25	YASUI et al.	
	14	20130154550		2013-06-20	BALMEFRIZOL et al.	
	15	20130295444		2013-11-07	KIM et al.	
	16	20140127550		2014-05-08	ROH et al.	
	17	20150015184		2015-01-15	SU	
	18	20150037662		2015-02-05	PINON et al.	
	19	20150236329		2015-08-20	OKUDA et al.	
	20	20160111914		2016-04-21	WILLARD et al.	
	21	20160155996		2016-06-02	DAI	
	22	20170309872		2017-10-26	KUBOKI et al.	
	23	20180369599		2018-12-27	SMITH	

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/M.D/	24	20190081472		2019-03-14	GUO et al.	
	25	20160181587		2016-06-23	KOEBLER	
	26	20070132427		2007-06-14	VESELIC	
	27	20090108814		2009-04-30	WILKINS	
	28	20070182363		2007-08-09	YANG	
	29	20130104817		2013-05-02	MILLER	
	30	20140077755		2014-03-20	ZHANG	
	31	20140139175		2014-05-22	GONZALEZ	
	32	20150380697		2015-12-31	OSBORNE et al.	
	33	20080150473		2008-06-26	WISE	
	34	20120038365		2012-02-16	NAGATA et al.	

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/M.D/	35	20150222060	2015-08-06	KIM et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2012/081140	WO	A1	2012-06-21	PANASONIC CORP		
	2	2015/195321	WO	A1	2015-12-23	IOXUS INC		
	3	2 265 267	GB	A	1993-09-22	CYBER ELECTRONICS CO. LTD.		
	4	20 2014 011 413	DE	U1	2020-04-27	NOCO CO	English Abstract from corresponding WO2016003471A1	☒
	5	2003-112586	JP	A	2003-04-15	DENSO CORP	English Abstract attached	☒
	6	2008-146998	JP	A	2008-06-26	NISSAN MOTOR	English Abstract attached	☒
	7	2012-004106	JP	A	2012-01-05	SAMSUNG SDI CO LTD	English Abstract attached	☒
	8	2012-230962	JP	A	2012-11-22	JM ENERGY CORP	English Abstract attached	☒

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/M.D/	9	2014-523623	JP	A	2014-09-11	LG CHEMICAL LTD	English Abstract from corresponding WO2013015539A1	☒
	10	102447288	CN	A	2012-05-09	SANMENXIA SUDA TRAFFIC ENERGY SAVING TECHNOLOGY CO	English Abstract attached	☒
	11	103715737	CN	A	2014-04-09	UNIV HANGZHOU DIANZI	English Abstract attached	☒
	12	104442429	CN	A	2015-03-25	KE GUOPING	English Abstract attached	☒
	13	1440892	CN	A	2003-09-10	TOYOTA AUTOCAR LTD	English Abstract attached	☒
	14	202058834	CN	U	2011-11-30	HAIRISHENG ELECTRICAL APPLIANCE PRODUCTS SHENZHEN	English Abstract attached	☒
	15	2012/068635	WO	A1	2012-05-31	CLIPSAL AUSTRALIA PTY LTD	publication of AU2011334615	☐
	16	1/2013/500793	PH		2017-01-31	CLIPSAL AUSTRALIA PTY LTD		☐
	17	3182855	JP	U	2013-04-11	ASIA BRIGHT INDUSTRIAL (HONG KONG) CO. LTD		☐
	18	2002141056	JP	A	2002-05-17	YAZAKI CORP	English Abstract attached	☒
	19	102414923	CN	A	2012-04-11	TOYOTA MOTOR CO LTD; YAZAKI CORP	English Abstract attached	☒

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Attorney Docket Number	054985-000055-US-05

/M.D/	20	104488111	CN	A	2015-04-01	SK INNOVATION CO LTD	English Abstract attached	☒
	21	2020201223	AU	A1	2020-03-12	NOCO CO		☐

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1	Copy of Australian Office Action for AU Patent Application No.: AU2020201224, mailed October 26, 2021.	
	2	DECLARATION by Cory Seligman (30 Pages) and ANNEXURE marked CS-1 (137 Pages), in the matter of AU 2019201559 and Opposition by Brown & Watson; 2020-Nov-23	
	3	Copy of Petition for Inter Partes Review of US Patent No. 9007015 for Shenzhen Mediatek Tong Technology v. Noco Company (69 Pages); IPR2020-01387; 2020-Jul-29	
	4	Copy of Petition for Inter Partes Review of US Patent No. 9007015 for Guangdong Boltpower Energy Co., Ltd. v. Noco Company (106 Pages); IPR2021-00309; 2020-Dec-11	
	5	Exhibit 1004 from IPR2021-00309; PTAB Decision Denying Institution of Inter Partes Review of the '015 patent in Case IPR2018-00503	
	6	Exhibit 1016 from IPR2020-01387; The NOCO Company, Inc. v. Shenzhen Lianfa Tong Technology Co. Ltd., et al., Case No. 1:19-cv-01855, (N.D. Ohio) First Amended Complaint for Patent Infringement	

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