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

【００４５】

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

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

【００４６】

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

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

【００４７】

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

【００４８】

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

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

【００４９】

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

【００５０】

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

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

【００５１】

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

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

【００５２】

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

【００５３】

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

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

【００５４】

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

【００５５】

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

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

【００５６】

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

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

【００５７】

＜正電極＞

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

【００５８】

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

【００５９】

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

リチウムマンガン化合物としては、例えば、Li_2MnO_3、$Li_aM_bMn_{1-b}N_cO_4$（０＜ａ≦２、０≦ｂ≦０．５、１≦ｃ≦２、Ｍは２～１３族でかつ第３、４周期に属する元素、Ｎは１４～１６族でかつ第３周期に属する元素）、$Li_{1+x}M_yMn_{2-x-y}O_4$（０≦ｘ≦０．２、０＜ｙ≦０．６、Ｍは２～１３族でかつ第３～４周期に属する元素からなる群から選ばれる少なくとも１種）で表されるリチウムマンガン化合物が挙げられる。ここでの”Ｍ”は、２～１３族でかつ第３～４周期に属する元素から選ばれる少なくとも１種であるが、安定性向上の効果が大きい点から、Ａｌ、Ｍｇ、Ｚｎ、Ｎｉ、Ｃｏ、Ｆｅ、Ｔｉ、Ｃｕ及びＣｒが好ましく、Ａｌ、Ｍｇ、Ｚｎ、Ｎｉ、Ｔｉ、Ｃｕ及びＣｒがより好ましく、Ａｌ、Ｍｇ、Ｚｎ、Ｔｉ、Ｃｕ及びＮｉがさらに好ましい。また、ここでの”Ｎ”は安定性向上の効果が大きい点から、Ｓｉ、Ｐ及びＳが好ましい。

【００６０】

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

【００６１】

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

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

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

【００６２】

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

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

【００６３】

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

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

【００６４】

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

【００６５】

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

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

【００６６】

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

リチウム化合物、マンガン化合物及びＭの化合物の配合比は、リチウム、マンガン及びＭの原子比をそれぞれ１＋ｘ（リチウム）、２－ｘ－ｙ（マンガン）、及びｙ（Ｍ）、但し、０≦ｘ≦０．２、０＜ｙ≦０．６を満たす範囲で選択される。例えば、Ｍｎ／Ｌｉの原子比１．５の正極活物質を作製する場合、原料の性状や加熱条件によって前記配合比１．５前後で多少の幅をもたせてもよい。

【００６７】

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

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

【００６８】

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

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

【００６９】

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

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

【００７０】

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

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

【００７１】

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

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

【００７２】

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

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

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

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

＜非水電解質＞

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

【００７９】

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

【００８０】

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

【００８１】

＜負電極と正電極の好ましい容量比及び面積比＞

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

０．７≦Ｂ／Ａ≦１．３　　（ａ）

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

【００８２】

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

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

【００８３】

１≦Ｄ／Ｃ≦１．２　　（ｂ）

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

例えば、電極作製の際、塗工幅を制御することによって行うことができる。

【００８４】

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

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

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

【実施例】

【００８５】

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

（正電極の製造）

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

【００８６】

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

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

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

【００８７】

（負電極の製造）

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

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

【００８８】
この負極活物質を、導電助材（アセチレンブラック）、及びバインダー（固形分濃度１２ｗｔ％、ＮＭＰ溶液）を８８／６／６の重量比で混合してスラリーを作製した。このスラリーをアルミニウム集電体（厚さ２０μｍ）に塗工し、１２０℃でＮＭＰを除去した後に、１５０℃で真空乾燥することによって負電極（面積６６ｃｍ^2）を作製した。
負電極の容量は次の充放電試験で測定した。前述と同様の条件でアルミニウム箔の片面に電極を塗工し、１６ｍｍΦに打ち抜き動作極を作製した。Ｌｉ金属を１６ｍｍΦに打ち抜き対極とした。これらの電極を用いて、動作極（片面塗工）／セパレータ／Ｌｉ金属の順に試験セル（ＨＳセル、宝泉社製）内に積層し、非水電解質（プロピレンカーボネート／エチルメチルカーボネート＝３０／７０ｖｏｌ％、ＬｉＰＦ６　１ｍｏｌ／Ｌ）を０．１５ｍＬ入れ、半電池を作製した。この半電池を２５℃で一日放置した後、充放電試験装置（ＨＪ１００５ＳＤ８、北斗電工社製）に接続した。この半電池を２５℃、０．４ｍＡで定電流放電（終止電圧：１．０Ｖ）及び定電流充電（終止電圧：２．０Ｖ）を行い、初回の充電容量を負電極の容量とした。その結果、負電極の容量は、１．１ｍＡｈ／ｃｍ２であった。
【００８９】
（非水電解質二次電池の製造）
非水電解質二次電池を次のとおりに作製した。
＜実施例１＞
前記作製した正電極（片面塗工）、負電極（片面塗工）、およびセパレータを、正電極（片面塗工）／セパレータ／負電極（片面塗工）の順に積層し、水素吸蔵合金を含む固定テープにより電極群を固定した。セパレータには、セルロース不織布（２５μｍ）を用いた。
【００９０】
水素吸蔵合金を含む固定テープは、ポリイミドテープの接着樹脂に平均粒子径30μｍのLaMgNi合金系水素吸蔵合金を5wt%混入して作製した。固定テープのサイズは3cmｘ4cmで、これにより極板群を二箇所固定した。
次に、両端の正電極および負電極にアルミニウムタブを振動溶着させた後に、袋状のアルミラミネートフィルムに入れた。非水電解質（プロピレンカーボネート／エチルメチルカーボネート＝３０／７０ｖｏｌ％、ＬｉＰＦ$_6$　１ｍｏｌ／Ｌ）を２ｍＬ入れた後に、減圧しながら封止することによって非水電解質二次電池を作製した。
【００９１】
＜実施例２＞
前記作製した正電極（片面塗工）、負電極（片面塗工）、およびセパレータを、正電極（片面塗工）／セパレータ／負電極（片面塗工）の順に積層し、固定テープにより電極群を固定した。セパレータには、セルロース不織布（２５μｍ）を用いた。次に、正電極及び負電極の集電箔とアルミニウムタブとを振動溶着させた後に、正電極の集電箔とアルミニウムタブとの接合部、及び負電極の集電箔とアルミニウムタブとの接合部に、水素吸蔵合金を含む短絡防止用樹脂を形成した。
【００９２】
短絡防止樹脂にはポリイミドテープを用いた。このポリイミドテープの接着樹脂に平均粒子径30μｍのLaMgNi合金系水素吸蔵合金を5wt％混入させた。このポリイミドテープ（サイズ1.5cmｘ4cm）を用いて、正負極タブリード溶接部の上下に計4枚貼り付けた。
袋状のアルミラミネートフィルムに入れて、非水電解質（プロピレンカーボネート／エチルメチルカーボネート＝３０／７０ｖｏｌ％、ＬｉＰＦ$_6$　１ｍｏｌ／Ｌ）を２ｍＬ入れた後に、減圧しながら封止することによって非水電解質二次電池を作製した。
【００９３】
＜比較例１＞
水素吸蔵合金を用いない以外は実施例１と同様に非水電解質二次電池を作製した。
（ガス量の測定）

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

【００９４】

【表１】

表1

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

【００９５】

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

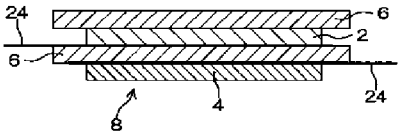
【符号の説明】

【００９６】

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

【図１】

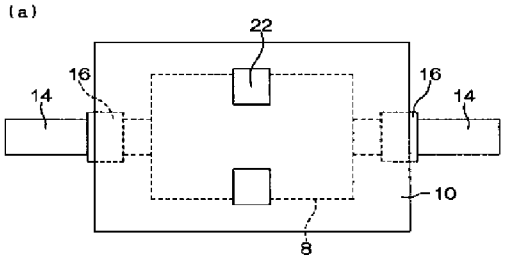
図1



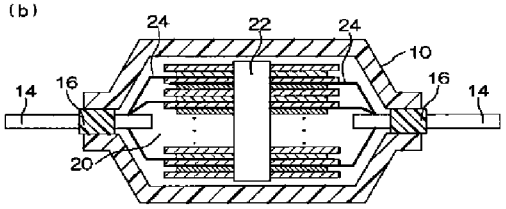
【図２】

図2

(a)



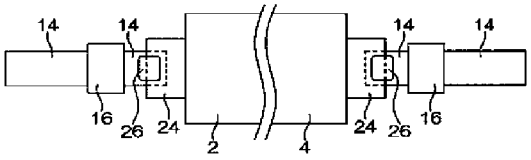
(b)



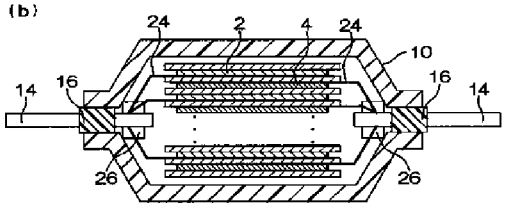
【図３】

図3

(a)



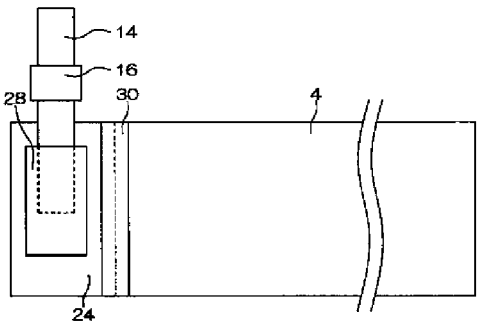
(b)



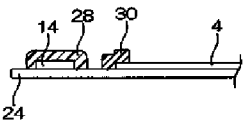
【図４】

図4

(a)



(b)



【図５】

図5

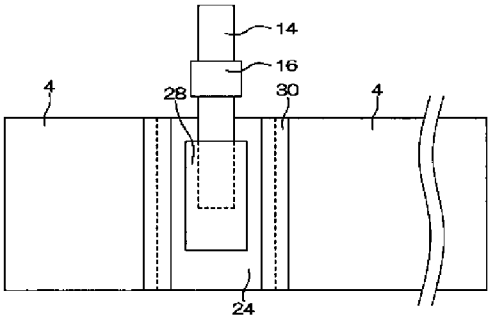


EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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H01M 4/13	***(2010.01)***	H01M	4/13	
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EJ01 EJ03 EJ05 EJ12 HJ18
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5H043 AA04 AA19 BA19 CA08 CA12 CA13 CA21 DA02 DA10 DA13
FA22 FA23 GA22 GA26 GA27 HA13D HA16D HA17D HA22 HA22D
HA32 HA32D JA13D JA15 JA15D JA21 KA07D KA08D KA09 KA09D
KA11 KA13 KA22 KA22D KA24 KA27 KA38 KA38D KA45 KA45D
LA31
5H050 AA07 AA15 BA17 CA07 CA09 CB02 CB03 DA19 DA20 EA02
EA23 FA02 FA05 GA02 GA22 HA18

Espacenet

JP2002141056A BATTERY TERMINAL CAP

Applicants: YAZAKI CORP

Inventors: OGINO YASUSHI

Classifications:

IPC ***H01M2/34; H01R4/70;*** (IPC1-7): H01M2/34; H01R4/70;

CPC Y02E60/10 (EP);

Priorities: JP2000335810A 2000-11-02

Application: JP2002141056A·2000-11-02

Publication: JP2002141056A·2002-05-17

Published as: JP2002141056A

BATTERY TERMINAL CAP

Abstract

PROBLEM TO BE SOLVED: To enable simply performing the installation of the bracket on the terminal on cable side without fitting forcibly. SOLUTION: The battery terminal cap is comprised of a bracket 70 that covers the connection part 58 of the cable side terminal 55 and the cable 10 by being installed on the cable side terminal 55 of L-shape in side view to be connected with the battery terminal 1 and a cap body 40 that covers the battery terminal 1 and the cable side terminal 55 by being installed on the bracket 70. The bracket 70 is formed in a box shape having a right and left both side wall 72 for structuring the receiving part 71 of the cable side terminal, a back side wall 74, and a ceiling wall 73, and is made in free opening and shutting in a right and left half split shape by a hinge 84 provided on the back side wall 74. Further, locking parts 82, 82 that lock the bracket 70 in a closed state are provided, and an engaging part 85 that engages with the engaged part 61 of the cable side terminal 55 inserted into the receiving part 71, when the bracket 70 is closed, is provided on the right and left both side walls 72.

EXHIBIT 1002
Page 1562 of 2306 Petitioner ADC (IPR2024-00671)

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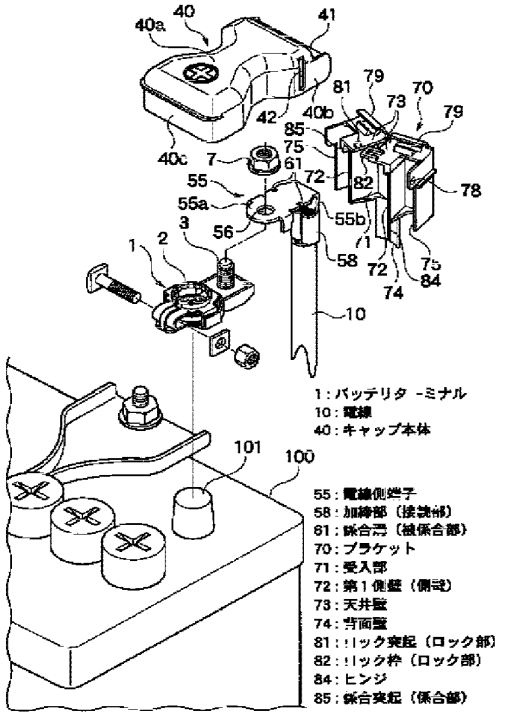
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弁理士　三好　秀和　（外８名）

Ｆターム(参考)　5H022 AA02 BB03 CC10 EE06 KK04

(54)【発明の名称】　バッテリーターミナル用キャップ

(57)【要約】
【課題】　電線側端子に対するブラケットの組み付けを、無理嵌めせずに簡単に行うことができるようにする。
【解決手段】　バッテリーターミナル１に接続される側面視Ｌ形の電線側端子５５に装着されることで当該電線側端子５５と電線１０との接続部５８を覆うブラケット７０と、該ブラケット７０に装着されることでバッテリーターミナル１及び電線側端子５５を覆うキャップ本体４０とからなるバッテリーターミナル用キャップにおいて、ブラケット７０を、電線側端子の受入部７１を構成する左右両側壁７２と背面壁７４と天井壁７３とを有する箱形に形成すると共に、背面壁７４に設けたヒンジ８４により左右半割状に開閉自在となし、更に、ブラケット７０を閉状態でロックするロック部８１，８２を設けると共に、左右両側壁７２に、ブラケット７０を閉じたとき、受入部７１に挿入された電線側端子５５の被係合部６１と係合する係合部８５を設けた。



【特許請求の範囲】
【請求項１】　バッテリターミナルに接続される側面視Ｌ形の電線側端子に装着されることで当該電線側端子と電線との接続部を覆うブラケットと、該ブラケットに装着されることで前記バッテリターミナル及び電線側端子を覆うキャップ本体とからなるバッテリターミナル用キャップにおいて、
前記ブラケットを、前記電線側端子の受入部を構成する左右両側壁と背面壁と天井壁とを有する箱形に形成すると共に、前記背面壁に設けたヒンジにより左右半割状に開閉自在となし、更に、ブラケットを閉状態でロックするロック部を設けると共に、前記左右両側壁に、ブラケットを閉じたとき、前記受入部に挿入された電線側端子の被係合部と係合する係合部を設けたことを特徴とするバッテリターミナル用キャップ。
【請求項２】　請求項１記載のバッテリターミナル用キャップであって、
前記ブラケットの受入部に電線側端子を挿入したとき、電線側端子の後端が前記ヒンジを押すことでブラケットが閉じて、電線側端子の被係合部とブラケットの係合部が係合するように、前記電線側端子の被係合部から後端までの長さを設定したことを特徴とするバッテリターミナル用キャップ。
【請求項３】　請求項１または２記載のバッテリターミナル用キャップであって、
前記キャップ本体とブラケットとに、互いに嵌合することで直線状のヒンジを構成するヒンジ構成部をそれぞれ設けると共に、ブラケット側のヒンジ構成部を前記半割状に開閉するブラケットの左右の天井壁または左右の背面壁に跨って設けることで、ブラケットが適正に閉じたときにのみ、キャップ本体側の直線状のヒンジ構成部をブラケット側のヒンジ構成部に嵌合できるようにしたことを特徴とするバッテリターミナル用キャップ。
【請求項４】　請求項１～３のいずれかに記載のバッテリターミナル用キャップであって、
前記キャップ本体を、前記ブラケットが適正に閉じたときにのみ、ブラケットに嵌合できる大きさに形成すると共に、該キャップ本体に、適正に閉じた状態のブラケットの左右両側壁の開きを阻止する側壁を設けたことを特徴とするバッテリターミナル用キャップ。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、例えば、自動車に搭載されたバッテリの端子接続部を覆うバッテリターミナル用キャップに関する。
【０００２】
【従来の技術】一般に、車載バッテリの陽極側ポストやこれに接続されるターミナルには、車体との短絡を防止するために、絶縁樹脂からなるターミナルキャップを被せている。
【０００３】図７は従来のバッテリターミナル用キャップと、バッテリターミナル及び電線側端子との関係を示す分解斜視図、図８はバッテリターミナル用キャップを構成するブラケットと電線側端子の組み合わせ状態を示す図、図９はブラケットと電線側端子を組み合わせるときの作用説明図である。
【０００４】図７において、符号１は図示しないバッテリポストに接続されるバッテリターミナル、５は電線側端子である。バッテリターミナル１は、バッテリポストに対する嵌合部２と、電線側端子５を接続するためのスタッドボルト３とを有する。電線側端子５は、側面視Ｌ字形に基板を折り曲げ、水平板部５ａにスタッドボルト３に嵌める貫通孔６を形成し、垂直板部５ｂに電線１０に対する加締部８を形成したＬＡ端子であり、水平板部５ａの左右両側縁には、係合溝１１が設けられている。
【０００５】キャップは、これらバッテリターミナル１とバッテリポストの接続部、バッテリターミナル１と電線側端子５のナット７による接合部、電線側端子５と電線１０の加締接合部（電線接続部）、等の金属が露出した部分をすべて覆うように被せられるものであり、別部材として樹脂成形されたブラケット２０とキャップ本体４０とから構成されている。
【０００６】ブラケット２０は、電線側端子５に装着されることで、電線側端子５と電線１０との接続部（加締部８）を主に覆うものである。また、キャップ本体４０は、ブラケット２０に装着されることで、バッテリポストに接続されたバッテリターミナル１、及び、バッテリターミナル１にナット７で接続された電線側端子５を主に覆うものである。
【０００７】ブラケット２０は、電線側端子５の受入部２１を有する箱形のもので、左右の第１側壁２２と、それらの更に外側に配された左右の第２側壁２５と、天井壁２３と、背面壁２４とを有する。電線側端子５の受入部２１は、左右の第１側壁２２の間に確保されている。受入部２１の天井壁２３の下面には、受入部２１に電線側端子５を挿入したとき、電線側端子５の水平板部５ａの両側縁をガイドするスライド溝２６が設けられている。このスライド溝２６には、図９に示すように水平板部５ａがスライドしてきたとき、水平板部５ａの側縁に形成した係合溝１１と係合する係合突起３１が設けられている。
【０００８】また、図７，図８に示すように、ブラケット２０の天井壁２３の上面後端部には、キャップ本体４０の後端部に設けたロッド部４１を嵌合するＣ環部２９が設けられている。このＣ環部２９にロッド部４１を嵌合することで、キャップ本体４０をブラケット２０に回動自在に連結する直線状のヒンジが構成されるようになっている。
【０００９】キャップ本体４０は、天井壁４０ａと側壁４０ｂと前壁４０ｃとを有するもので、側壁４０ｂの後

端には、キャップ本体４０をバッテリターミナル１に被せたとき、ブラケット２０の第２側壁２５に設けたロック突起２８とロックするロック孔４２が設けられている。

【００１０】上記構成のバッテリターミナル用キャップを使用する場合には、まず、図８に示すように、電線側端子５にブラケット２０を組み付ける。即ち、図９（ａ）に示すように、ブラケット２０の受入部２１のスライド溝２６に電線側端子５の水平板部５ａを挿入する。そうすると、挿入するに従い、ブラケット２０の係合突起３１が電線側端子５の水平板部５ａの両側縁に衝合し、更に挿入することにより、係合突起３１の高さｄ分だけブラケット２０の側壁２２が外側に撓み、更に挿入することで、係合突起３１が係合溝１１に到達し、側壁２２が元の位置に弾性復帰して、係合溝１１と係合突起３１が係合する。これにより、電線側端子５とブラケット２０とがロックされる。

【００１１】次いで、図８に示すように電線側端子５と組み合わせたブラケット２０のＣ環部２９に、キャップ本体４０のロッド部４１を嵌合し、キャップ本体４０をブラケット２０に回動可能に取り付ける。

【００１２】あとは、バッテリポストに接合したバッテリターミナル１のスタッドボルト３に電線側端子５を接続し、キャップ本体４０をブラケット２０に被さるように倒して、バッテリターミナル１や電線側端子５を覆う。これにより、バッテリの端子接続部分をすべて絶縁材で覆うことができる。

【００１３】

【発明が解決しようとする課題】ところで、上記従来のキャップの場合、電線側端子５とブラケット２０のロックを、電線側端子５の側縁の係合溝１１にブラケット２０側の係合突起３１を無理嵌めすることで行っている。つまり、係合突起３１を係合溝１１に係合させる際に、ブラケット２０の側壁２２の撓みを利用しながら行っている。従って、ロックさせるために大きな力が必要であり、作業性が悪かった。また、無理嵌めするため、嵌合時に係合突起３１が破損し、ブラケット２０が脱落するおそれもあった。また、ロック及びロック解除するための挿入力や離脱力を、係合突起３１の高さｄで調整することになるため、ブラケット２０を成形する段階での寸法公差を厳しくしなければならず、金型加工費や成形品の管理費が高騰する問題もあった。

【００１４】本発明は、上記事情を考慮し、電線側端子に対するブラケットの組み付けを、無理嵌めせずに簡単に行うことができ、しかも、ブラケットの精度を緩めに設定できて、成形加工コストを抑制することのできるバッテリターミナル用キャップを提供することを目的とする。

【００１５】

【課題を解決するための手段】請求項１の発明は、バッテリターミナルに接続される側面視Ｌ形の電線側端子に装着されることで当該電線側端子と電線との接続部を覆うブラケットと、ブラケットに装着されることでバッテリターミナル及び電線側端子を覆うキャップ本体とからなるバッテリターミナル用キャップにおいて、前記ブラケットを、電線側端子の受入部を構成する左右両側壁と背面壁と天井壁とを有する箱形に形成すると共に、背面壁に設けたヒンジにより左右半割状に開閉自在となし、更に、ブラケットを閉状態でロックするロック部を設けると共に、前記左右両側壁に、ブラケットを閉じたとき、前記受入部に挿入された電線側端子の被係合部と係合する係合部を設けたことを特徴とする。

【００１６】このキャップにおいて、電線側端子にブラケットを組み付けるには、開いた状態のブラケットの受入部に電線側端子を挿入してブラケットを閉じる。そうすると、ブラケットの左右両側壁に設けた係合部が電線側端子の被係合部に係合し、同時に、ブラケットがロック部によって閉ロックされる。

【００１７】請求項２の発明は、請求項１記載のバッテリターミナル用キャップであって、前記ブラケットの受入部に電線側端子を挿入したとき、電線側端子の後端が前記ヒンジを押すことでブラケットが閉じて、電線側端子の被係合部とブラケットの係合部が係合するように、電線側端子の被係合部から後端までの長さを設定したことを特徴とする。

【００１８】このキャップにおいて、電線側端子にブラケットを組み付けるには、開いた状態のブラケットの受入部に電線側端子を挿入し、電線側端子の後端でブラケットの背面壁のヒンジを押す。そうすると、受入部の空間内に出っ張った状態にあったヒンジが押されることで、自動的にブラケットが閉じ、ブラケットの左右両側壁に設けた係合部が電線側端子の被係合部に係合し、同時に、ブラケットがロック部によって閉ロックされる。

【００１９】請求項３の発明は、請求項１または２記載のバッテリターミナル用キャップであって、前記キャップ本体とブラケットとに、互いに嵌合することで直線状のヒンジを構成するヒンジ構成部をそれぞれ設けると共に、ブラケット側のヒンジ構成部を前記半割状に開閉するブラケットの左右の天井壁または左右の背面壁に跨って設けることで、ブラケットが適正に閉じたときにのみ、キャップ本体側の直線状のヒンジ構成部をブラケット側のヒンジ構成部に嵌合できるようにしたことを特徴とする。

【００２０】このキャップでは、ブラケット側のヒンジ構成部を、左右半割状に開閉するブラケットの天井壁または背面壁に跨って設けているので、ブラケットが適正に閉じた状態にないと、左右のヒンジ構成部が直線状とならない。つまり、ブラケットが適正に閉じたときにのみ、天井壁または背面壁に設けた左右のヒンジ構成部が直線状となり、キャップ本体側のヒンジ構成部を嵌合で

きる状態となる。そして、その状態で、ブラケット側のヒンジ構成部にキャップ本体側のヒンジ構成部を嵌合することにより、キャップ本体をブラケットに対して開閉自在に連結するヒンジを構成することができる。

【００２１】従って、ヒンジを構成するために、ブラケット側のヒンジ構成部とキャップ本体側のヒンジ構成部とを互い嵌合した際の嵌合拘束力によって、ブラケットを閉状態でロックすることができる。また、ブラケット側のヒンジ構成部に対してキャップ本体側のヒンジ構成部を嵌合できない場合には、ブラケットが適正に閉じていないとみなすことができ、それにより、電線側端子とブラケットとが半嵌合状態にあることを簡単に発見することができる。

【００２２】請求項４の発明は、請求項１～３のいずれかに記載のバッテリターミナル用キャップであって、前記キャップ本体を、前記ブラケットが適正に閉じたときにのみ、ブラケットに嵌合できる大きさに形成すると共に、該キャップ本体に、適正に閉じた状態のブラケットの左右両側壁の開きを阻止する側壁を設けたことを特徴とする。

【００２３】このキャップでは、ブラケットが適正に閉じた状態でないと、キャップ本体をブラケットに嵌合できない。従って、キャップ本体をブラケットに嵌合できないことをもって、ブラケットと電線側端子の組み付け不良を簡単に発見することができる。また、適正に閉じた状態のブラケットに対してキャップ本体を嵌合した場合には、キャップ本体の側壁でブラケットの左右側壁の開きを阻止することができる。従って、ブラケットのロックを強化することができる。

【００２４】

【発明の実施の形態】以下、本発明の実施形態を図面に基づいて説明する。なお、図７～図９に示した従来例と同じ構成要素には同一符号を付して説明を簡略化する。

【００２５】図１は実施形態のバッテリターミナル用キャップと、バッテリポスト、バッテリターミナル、及び電線側端子との関係を示す分解斜視図である。

【００２６】図１において、１００はバッテリ、１０１はバッテリポスト、１はバッテリターミナル、５５は電線側端子である。

【００２７】電線側端子５５は、側面視Ｌ字形に基板を折り曲げ、水平板部５５ａにスタッドボルト３に嵌める貫通孔５６を形成し、垂直板部５５ｂに電線１０に対する加締部５８を形成したＬＡ端子であり、水平板部５５ａの左右両側縁には係合溝（被係合部）６１が設けられている。

【００２８】キャップは、バッテリターミナル１とバッテリポストの接続部、バッテリターミナル１と電線側端子５５のナット７による接合部、電線側端子５５と電線１０の加締接合部（電線接続部）、等の金属が露出した部分をすべて覆うように被せられるものであり、別部材として樹脂成形されたブラケット７０とキャップ本体４０とから構成されている。

【００２９】ブラケット７０は、電線側端子５５に装着されることで、電線側端子５５と電線１０との接続部（加締部５８）を主に覆うものである。また、キャップ本体４０は、ブラケット７０に装着されることで、バッテリポスト１０１に接続されたバッテリターミナル１、及び、バッテリターミナル１にナット７で接続された電線側端子５５を主に覆うものである。

【００３０】ブラケット７０は、図２，図３に示すように、電線側端子５５の受入部７１を有する箱形のもので、左右の第１側壁７２と、それらの更に外側に配された左右の第２側壁７５と、天井壁７３と、背面壁７４とを有している。電線側端子５５の受入部７１は、左右の第１側壁７２の間に確保されている。

【００３１】このブラケット７０は、背面壁７４に設けた上下に延びるヒンジ８４（本例では、樹脂の肉を局部的に薄くすることでヒンジが構成されている）により、左右半割状に開閉自在に構成されている。図２（ａ），図３は成形したままの開いた状態を示している。

【００３２】ブラケット７０は、このように左右に開閉できるものであり、開いたときに左右に分かれ且つ閉じたときに一つに合わさる天井壁７３の前部には、ブラケット７０を閉じた状態でロックするためのロック部として、互いに係合するロック突起８１とロック枠８２が設けられている。

【００３３】また、左右の両第１側壁７２の前端には、ブラケット７０を閉じたときに、受入部７１に挿入された電線側端子５５の係合溝６１と係合する係合突起８５が設けられている。この係合突起８５は、天井壁７３の下面側に設けられているスライド溝７６の前端に位置している。

【００３４】この場合、ヒンジ８４から係合突起８５までの長さと、電線側端子の後端から係合溝６１までの長さとの関係は、ブラケット７０の受入部７１に電線側端子５５を挿入したとき、電線側端子５５の後端がヒンジ８４を押すことで、ブラケット７０が閉じて、電線側端子５５の係合溝６１とブラケット７０の係合突起８５が係合するように設定されている。

【００３５】また、キャップ本体４０とブラケット７０には、互いに嵌合することで直線状のヒンジを構成するロッド部４１とＣ環部（ヒンジ構成部）７９がそれぞれ設けられている。この場合、Ｃ環部７９は、半割状に開閉するブラケット７０の左右の天井壁７３に跨って設けられている。それにより、ブラケット７０が適正に閉じたときにのみ、左右の天井壁７３のＣ環部７９が直線状になって、キャップ本体４０側の直線状のロッド４１を嵌合できるようになっている。そして、直線状になったＣ環部７９にキャップ本体４０のロッド部４１を嵌合することで、キャップ本体４０をブラケット７０に回動自

在に連結する直線状のヒンジが構成されるようになっている。

【００３６】キャップ本体４０は、図７の従来例に示したものと同様に、天井壁４０ａと側壁４０ｂと前壁４０ｃとを有し、側壁４０ｂの後端部に、キャップ本体４０をバッテリターミナル１に被せたときに、ブラケット７０の第２側壁７５に設けたロック突起７８とロックするロック孔４２が設けられている。この場合、キャップ本体４０は、ブラケット７０が適正に閉じたときにのみ、ブラケット７０に嵌合できる大きさに形成されており、キャップ本体４０の側壁４０ｂによって、適正に閉じた状態のブラケット７０の左右両第２側壁７５の開きを阻止するようになっている。

【００３７】以上の構成のバッテリターミナル用キャップを使用する場合には、まず、図４に示すように、電線側端子５５にブラケット７０を組み付ける。即ち、図５（ａ）に示すように、開いた状態のブラケット７０の受入部７１に電線側端子５５を矢印Ｐで示すように挿入し、電線側端子５５の後端でブラケット７０の背面壁７４のヒンジ８４の部分を押す。そうすると、受入部７１の空間内に出っ張った状態にあったヒンジ８４が押されることで、図５（ｂ）に示すように自動的にブラケット７０が閉じ、ブラケット７０の左右両第１側壁７２に設けた係合突起８５が電線側端子５５の係合溝６１に係合し、電線側端子５５の水平板部５５ａがスライド溝７６に嵌まる。同時に、図２（ｂ）及び図４（ａ），（ｂ）に示すように、ブラケット７０がロック突起８１とロック枠８２の係合によって閉ロックされる。

【００３８】このように、電線側端子５５を、開いた状態のブラケット７０の受入部７１に挿入し、電線側端子５５の後端でヒンジ８４を押すだけで、電線側端子５５に対してブラケット７０をロックすることができる。従って、従来のようにブラケットを電線側端子に無理嵌めしなくてよく、組み付け作業性が向上する。また、無理な力を加えながら組み付ける必要がないから、ブラケット７０の係合突起８５が破損するおそれもなく、破損によるブラケット７０の脱落や紛失の心配も全くない。また、ブラケット７０は閉状態で確実にロック突起８１及びロック枠８２によりロックされるので、電線側端子５５とブラケット７０の係合が外れるおそれもない。また、従来のようにブラケットの撓みを利用しながら電線側端子とブラケットをスライド係合させるのではないから、係合突起８１と係合溝６１の係合代を厳しく管理する必要がなく、寸法公差を緩めに設定することができる。

【００３９】次に、図６に示すように、電線側端子５５と組み合わせたブラケット７０のＣ環部７９に対して、キャップ本体４０のロッド部４１を嵌合し、キャップ本体４０をブラケット７０に回動可能に取り付ける。

【００４０】あとは、バッテリポスト１０１に接合したバッテリターミナル１のスタッドボルト３に電線側端子５５を接続し、キャップ本体４０を倒して、バッテリターミナル１や電線側端子５５を覆う。このとき、キャップ本体４０の側壁４０ｂに設けたロック孔４２が、ブラケット７０の第２側壁７５に設けたロック突起７８に嵌まり、キャップ本体４０がロックされる。これにより、バッテリの端子接続部分をすべて絶縁材で覆うことができる。

【００４１】上記のようにキャップ本体４０をブラケット７０に装着する際に、ブラケット７０側のＣ環部７９をブラケット７０の左右の天井壁７３に跨って設けているので、ブラケット７０が適正に閉じた状態にないと、左右のＣ環部７９が直線状とならない。つまり、ブラケット７０が適正に閉じたときにのみ、Ｃ環部７９が直線状となり、キャップ本体４０側のロッド部４１を嵌合できる状態となる。従って、ヒンジを構成するために、ブラケット７０側のＣ環部７９とキャップ本体４０側のロッド部４１とを互い嵌合した際の嵌合拘束力によって、ブラケット７０を閉状態でロックすることができる。

【００４２】また、適正に閉じた状態のブラケット７０に対してキャップ本体４０を嵌合した場合には、キャップ本体４０の側壁４０ｂでブラケット７０の左右両第２側壁７５の開きを阻止することができる。従って、ブラケット７０のロックを強化することができる。

【００４３】このように、ロック突起８１とロック枠８２によるロックと、Ｃ環部７９とロッド部４１によるロックと、キャップ本体４０の側壁４０ｂによるロックの三重のロックによって、ブラケット７０を閉状態に保持しておくことができるので、電線側端子５５とブラケット７０の組み付け強度を極めて高く維持することができ、組み付け信頼性が向上する。

【００４４】また、キャップ本体４０のロッド部４１は、ブラケット７０が適正に閉じた状態にないと、Ｃ環部７９に嵌まらない上、キャップ本体４０も、ブラケット７０が適正に閉じた状態にないと、ブラケット７０に嵌まらないので、それらのことをもって、ブラケット７０と電線側端子５５の組み付け状態が半嵌合であることを簡単に発見することができ、不良品の発生を未然に防止することができる。

【００４５】なお、上記実施形態では、キャップ本体４０のロッド部４１を嵌合するＣ環部７９を、ブラケット７０の天井壁７３に設けているが、背面壁７４に設けてもよい。その場合も、左右の背面壁７４に跨ってＣ環部を設けることで、上記と同様の作用効果を奏することができる。

【００４６】また、上記実施形態では、キャップ本体４０をブラケット７０に対してヒンジ結合するようにした場合を示したが、必ずしもヒンジ結合する必要はない。

【００４７】

【発明の効果】以上説明したように、請求項１の発明に

よれば、ブラケットを左右に開閉可能に構成し、開いた状態のブラケットに電線側端子を入れてブラケットを閉じるだけで、電線側端子に対してブラケットを係止状態に組み付けることができるようにしたので、従来のようにブラケットを電線側端子に無理嵌めしなくてよく、組み付け作業性が向上する。また、無理な力を加えながら組み付ける必要がないから、ブラケットの係合部が破損するおそれもなく、破損によるブラケットの脱落や紛失の心配がない。また、ブラケットは閉状態で確実にロックされるので、電線側端子とブラケットの係合が外れるおそれもない。また、従来のようにブラケットの撓みを利用しながら電線側端子とブラケットをスライド係合させるのではないから、係合部と被係合部の係合代を厳しく管理する必要がなく、寸法公差を緩めに設定することができる。従って、ブラケットを成形する場合の金型の精度や成形品の管理を緩やかにすることができ、その分、ブラケットの成形コストの低減が図れる。

【００４８】請求項２の発明によれば、電線側端子をブラケットの受入部に挿入し、電線側端子の後端でヒンジを押すだけで、電線側端子に対してブラケットを組み付けることができるので、組み付け作業性が一層向上する。

【００４９】請求項３の発明によれば、ブラケット側のヒンジ構成部とキャップ本体側のヒンジ構成部とを互い嵌合することにより、ブラケットを閉状態でロックすることができる。従って、ロック部に加えたヒンジによる二重ロックが可能となることで、電線側端子とブラケットの組み付け信頼性が向上する。また、ブラケット側のヒンジ構成部に対してキャップ本体側のヒンジ構成部を嵌合できないことにより、電線側端子とブラケットの半嵌合を簡単に発見することができるので、不良品の発生を未然に防止することができる。

【００５０】請求項４の発明によれば、適正に閉じた状態にあるブラケットにキャップ本体を嵌合することにより、ブラケットをロックすることができ、ロック部に加えたロックの強化により、電線側端子とブラケットの組み付け信頼性を向上させることができる。また、キャップ本体をブラケットに嵌合できないことをもって、ブラケットと電線側端子の組み付け不良を簡単に発見することができるので、不良品の発生を未然に防止することができる。

【図面の簡単な説明】

【図１】本発明の実施形態のバッテリターミナル用キャップと、バッテリポスト、バッテリターミナル、及び電線側端子との関係を示す分解斜視図である。

【図２】前記バッテリターミナル用キャップを構成するブラケットと電線側端子の関係を示す斜視図で、（ａ）はブラケットを電線側端子に組み付ける前の状態を示す図、（ｂ）は組み付けた後の状態を示す図である。

【図３】前記ブラケットの構成図で、（ａ）は正面図、（ｂ）は平面図、（ｃ）は側面図、（ｄ）は（ａ）図のＩＩＩｄ－ＩＩＩｄ矢視断面図である。

【図４】前記ブラケットを電線側端子に組み付けた後の状態を示す図で、（ａ）は平面図、（ｂ）は側面図で、（ａ）図は（ｂ）図のＩＶａ－ＩＶａ矢視図である。

【図５】前記ブラケットと電線側端子の組み付け時の作用説明図で、（ａ）はロックする前の状態を示す要部断面図、（ｂ）はロックした後の状態を示す要部断面図である。

【図６】前記電線側端子にブラケットを組み付けた上で更にブラケットにキャップ本体を組み付けた状態を示す図であり、（ａ）は要部平面図、（ｂ）は要部側面図、（ｃ）は（ｂ）図のＶｃ－Ｖｃ矢視断面図である。

【図７】従来のバッテリターミナル用キャップと、バッテリターミナル及び電線側端子との関係を示す分解斜視図である。

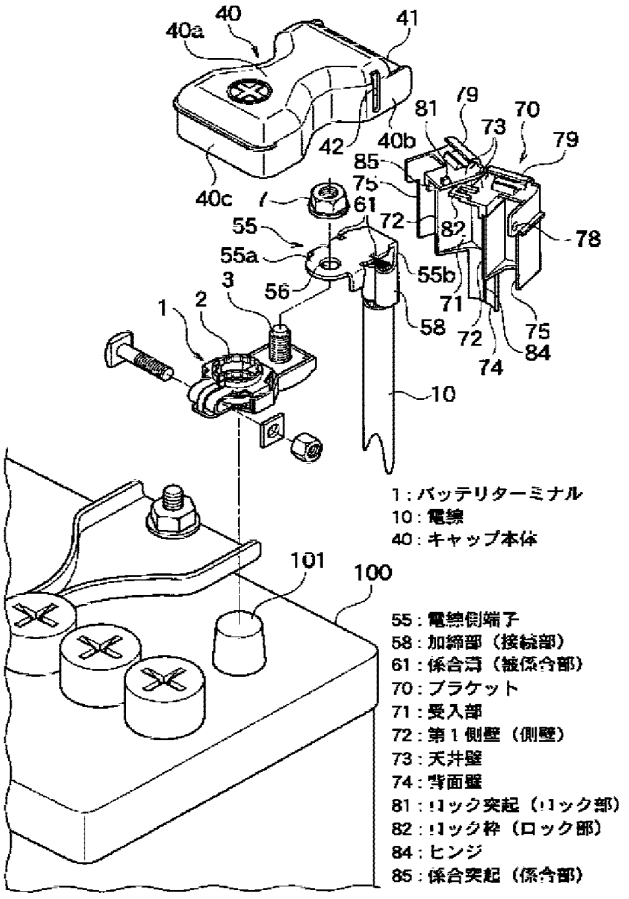
【図８】従来のバッテリターミナル用キャップのブラケットを電線側端子に組み付けた後の状態を示す図で、（ａ）は平面図、（ｂ）は側面図で、（ａ）図は（ｂ）図のＶＩＩＩａ－ＶＩＩＩａ矢視図である。

【図９】従来のバッテリターミナル用キャップのブラケットを電線側端子に組み付ける時の作用説明図で、（ａ）はロックする直前の状態を示す要部断面図、（ｂ）はロックした後の状態を示す要部断面図である。

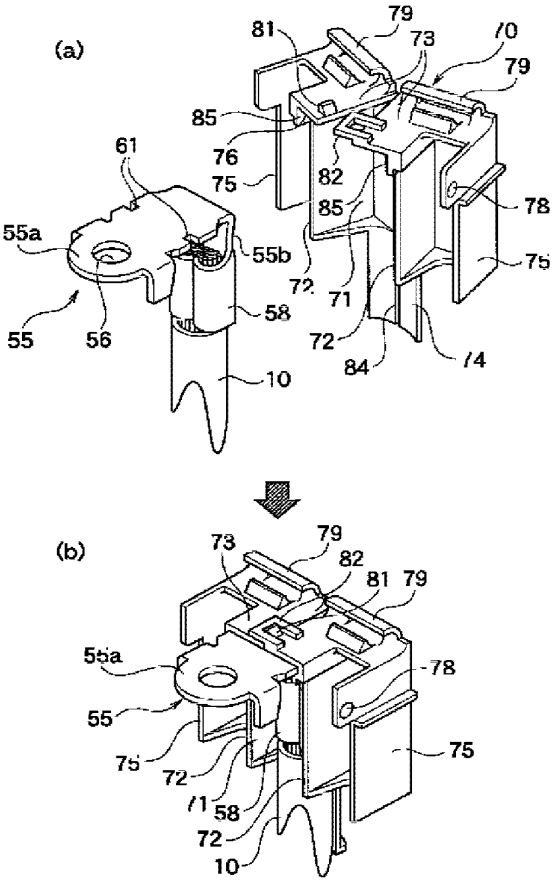
【符号の説明】

１　バッテリターミナル
１０　電線
４０　キャップ本体
４０ｂ　側壁
４１　ロッド部（ヒンジ構成部）
５５　電線側端子
５８　加締部（接続部）
６１　係合溝（被係合部）
７０　ブラケット
７１　受入部
７２　第１側壁（側壁）
７３　天井壁
７４　背面壁
７９　Ｃ環部（ヒンジ構成部）
８１　ロック突起（ロック部）
８２　ロック枠（ロック部）
８４　ヒンジ
８５　係合突起（係合部）

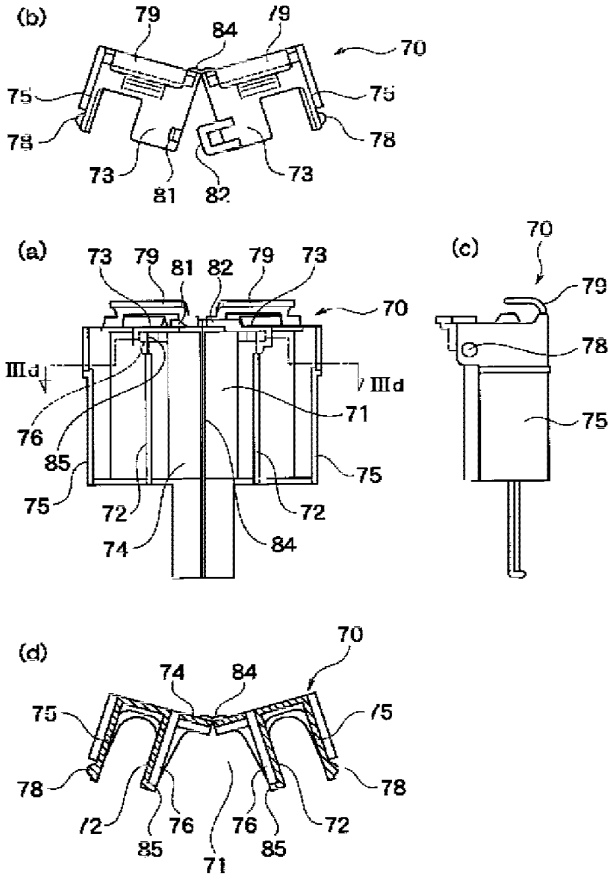
【図1】


40
40a
41
42
40b
40c
81
79
73
70
85
75
61
72
82
78
55
55a
55b
56
3
2
1
71
58
72
75
84
74
10
101
100
1：バッテリーターミナル
10：電線
40：キャップ本体
55：電線側端子
58：加締部（接続部）
61：係合凸（被係合部）
70：ブラケット
71：受入部
72：第１側壁（側壁）
73：天井壁
74：背面壁
81：ロック突起（ロック部）
82：ロック枠（ロック部）
84：ヒンジ
85：係合突起（係合部）

【図2】


(a)
81
79
73
70
85
61
76
75
82
78
55a
55b
72
71
58
55
56
10
74
84
(b)
73
79
82
81
55a
78
55
75
72
71
58
10

【図3】



【図4】

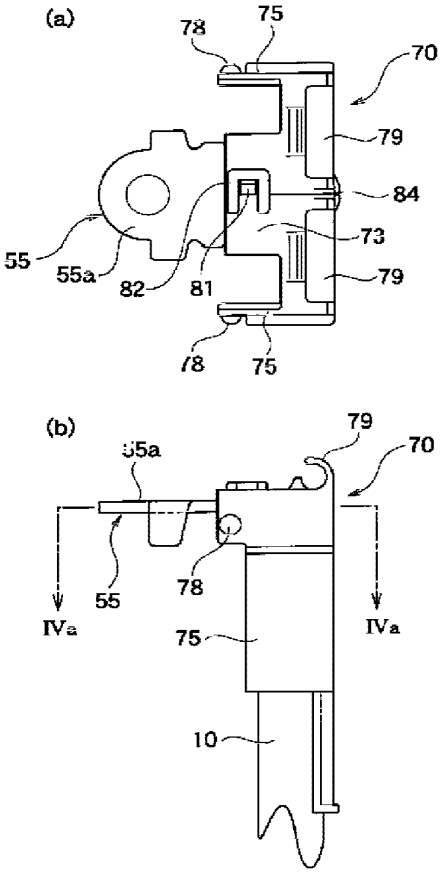
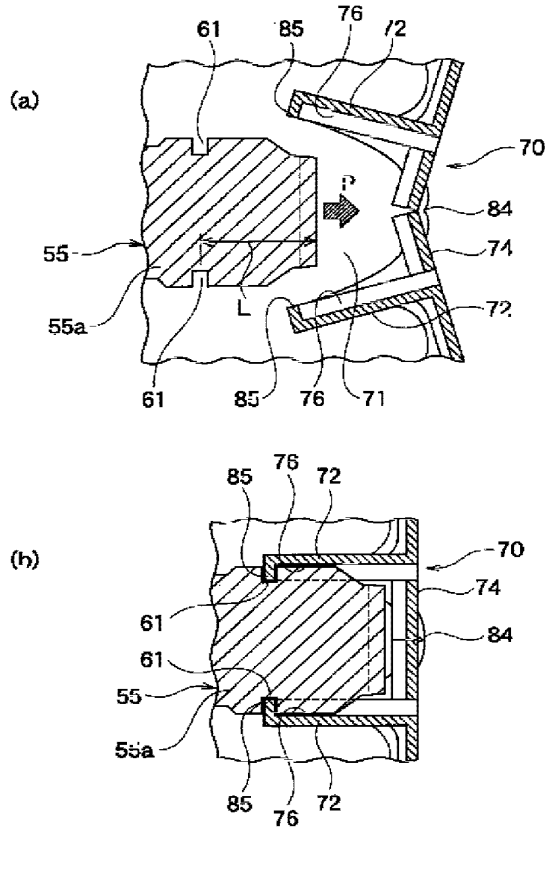


EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

【図5】



【図6】

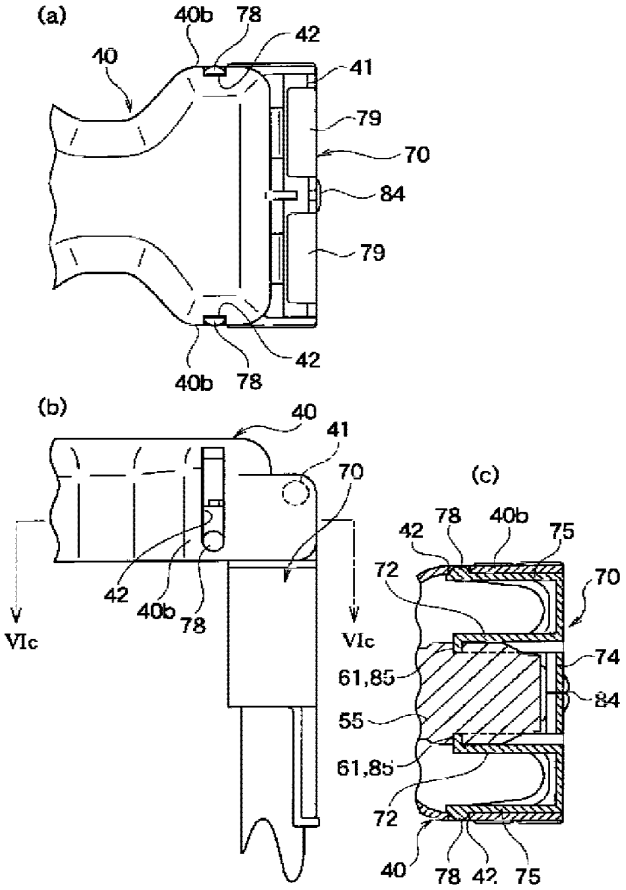
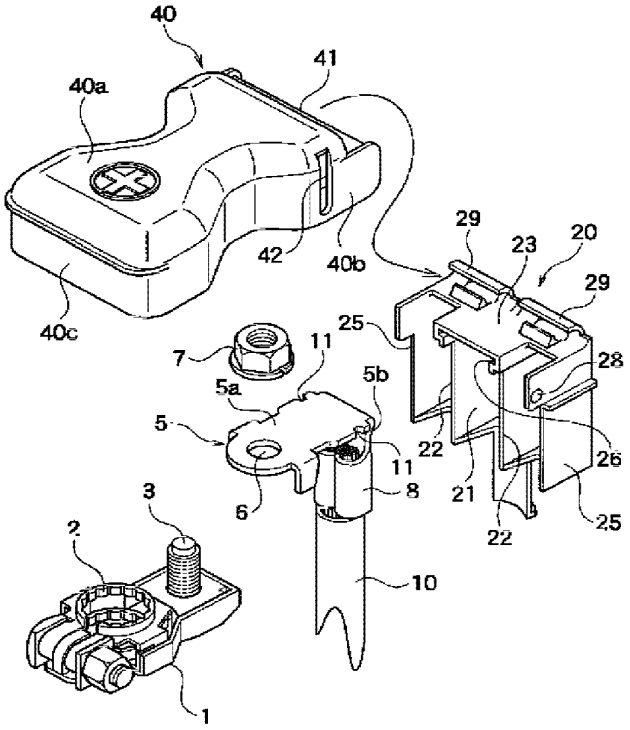
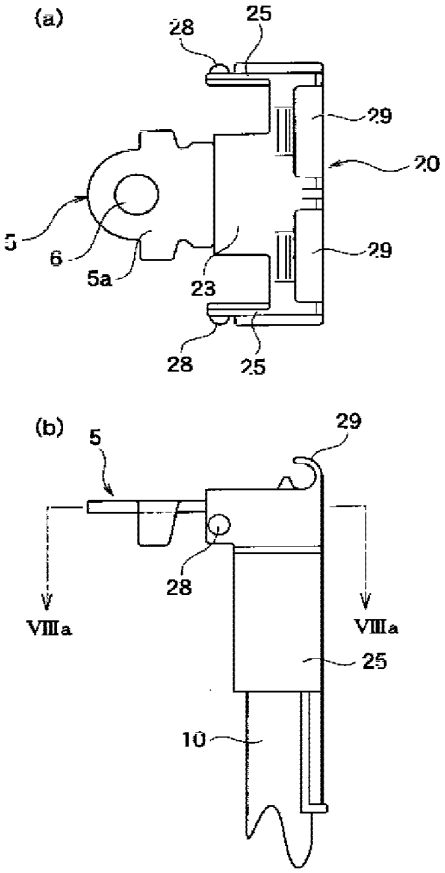


EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

【図7】



【図8】



【図9】

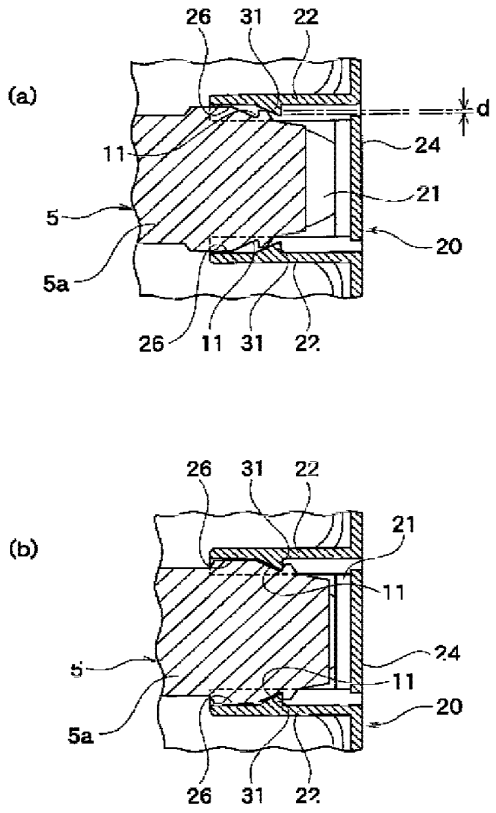


EXHIBIT 1002
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Published:

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

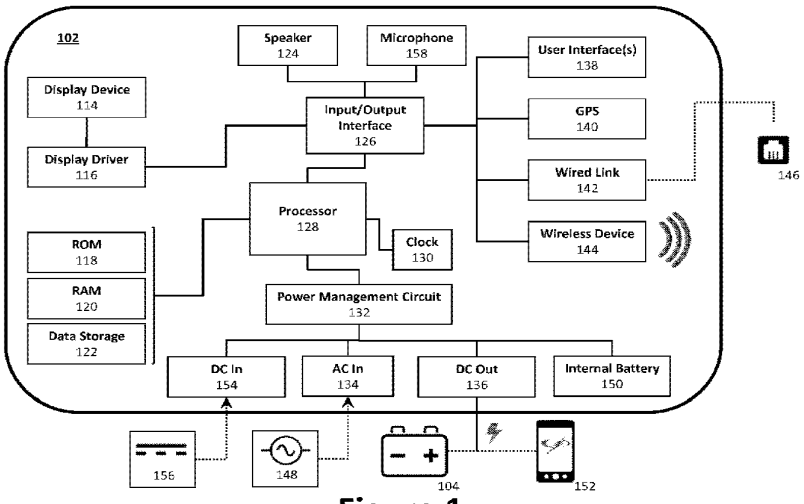


Figure 1

(57) **Abstract**: A compact battery charger for charging a battery comprising: a microprocessor; a set of terminals operatively coupled to said microprocessor and configured to electrically couple with an automotive battery; and an internal lithium ion battery, wherein the internal lithium ion battery is a lithium ion battery, wherein a single-ended primary-inductor converter may be configured to receive an input voltage of 5VDC to 20VDC and output a predetermined DC charge voltage to said internal lithium ion battery.

WO 2016/025869 A1

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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.

[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.

[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

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,

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

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

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

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.

[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.

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

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

	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

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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.

[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.

[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

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

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

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

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

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.

[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

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.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

[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

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

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

EXHIBIT 1002
Page 1598 of 2306 Petitioner ADC (IPR2024-00671)

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.

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;

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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.

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.

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.

Claim 21. The compact battery charger of claim 19, further comprising a removable data storage device.

EXHIBIT 1002
Page 1604 of 2306 Petitioner ADC (IPR2024-00671)

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

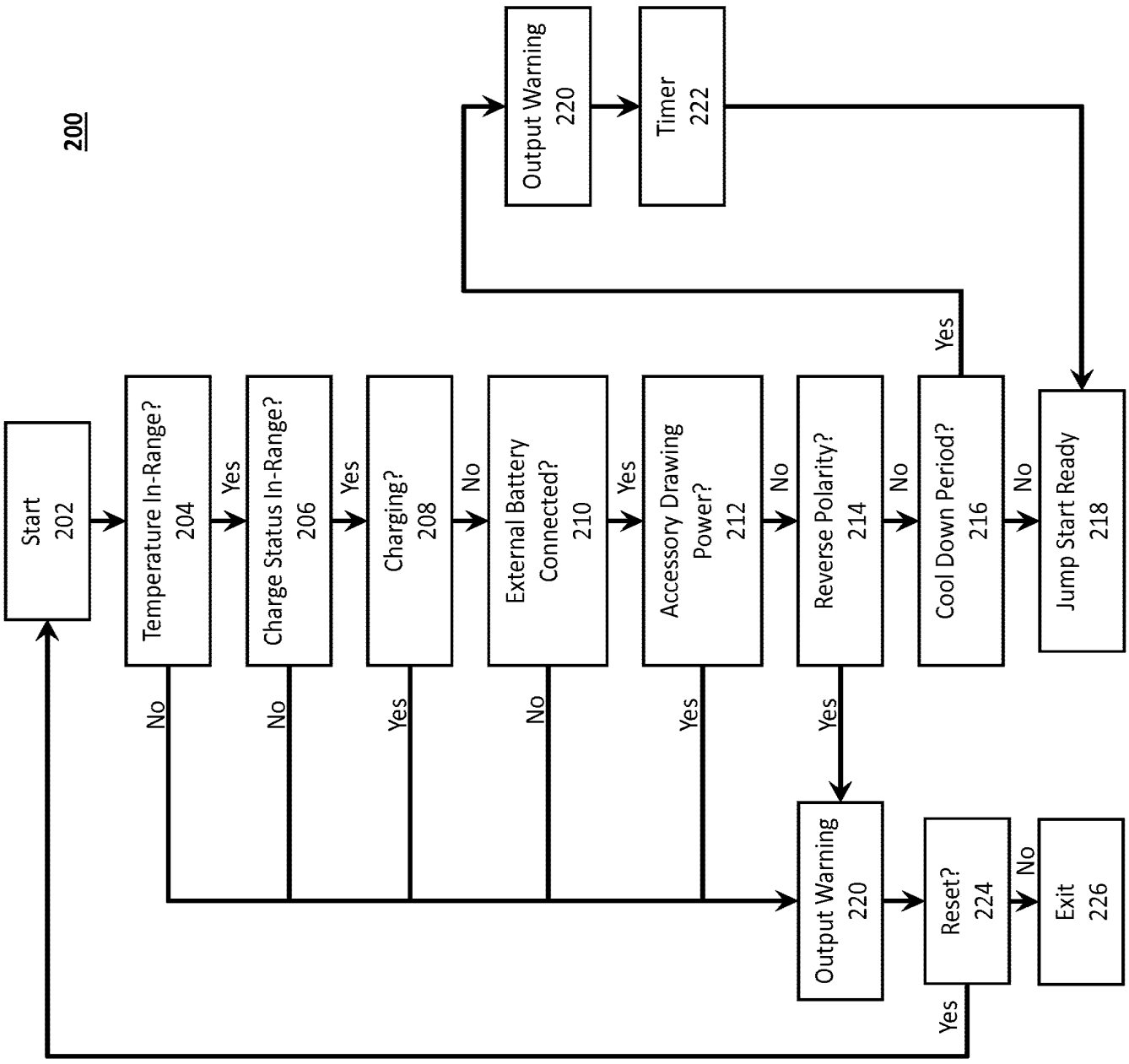


Figure 2

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

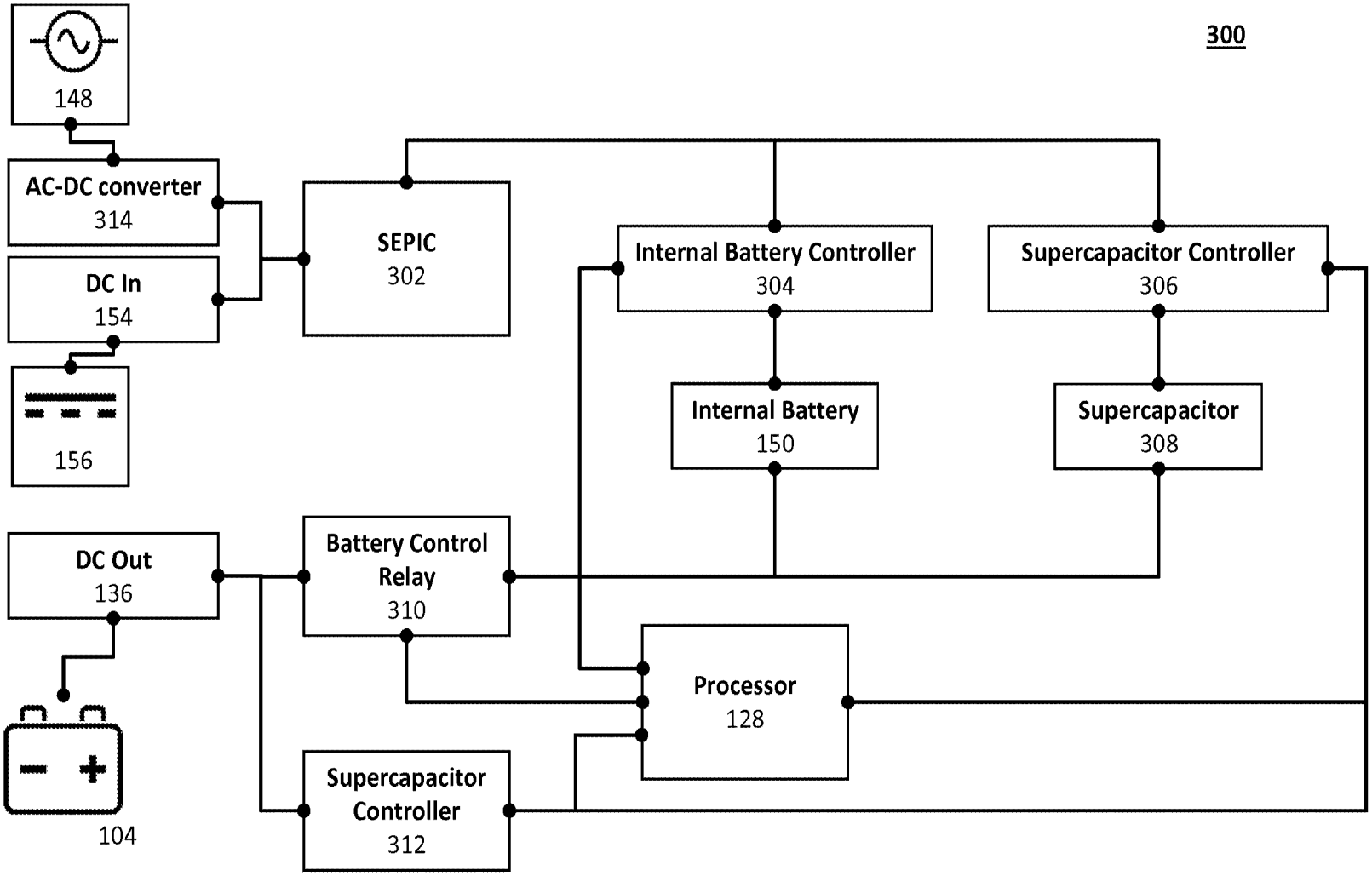


Figure 3

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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)

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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
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US 2013264875 A1	10 Oct 2013	US 2013264875 A1	10 Oct 2013
		CN 104285336 A	14 Jan 2015
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		US 2013266824 A1	10 Oct 2013
		US 2013266825 A1	10 Oct 2013
		US 2013266826 A1	10 Oct 2013
		WO 2013138380 A2	19 Sep 2013
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		WO 2011056998 A3	13 Oct 2011
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EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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
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US 2008246443 A1	09 Oct 2008	US 2008246443 A1	09 Oct 2008
		US 8179103 B2	15 May 2012
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		TW 200847580 A	01 Dec 2008
		WO 2008124510 A1	16 Oct 2008

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

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

(12) 特許協力条約に基づいて公開された国際出願

(19) 世界知的所有権機関
国際事務局

(43) 国際公開日
2012 年 6 月 21 日(21.06.2012)

WIPO | PCT

(10) 国際公開番号
WO 2012/081140 A1

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H01M 2/10 (2006.01) *H01M 2/20* (2006.01)

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(22) 国際出願日: 2011 年 7 月 26 日(26.07.2011)

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(26) 国際公開の言語: 日本語

(30) 優先権データ:
特願 2010-276485 2010 年 12 月 13 日(13.12.2010) JP

(71) 出願人 (米国を除く全ての指定国について): パナソニック株式会社 (PANASONIC CORPORATION) [JP/JP]; 〒5718501 大阪府門真市大字門真１００６番地 Osaka (JP).

(72) 発明者; および
(75) 発明者/出願人 (米国についてのみ): 安井 俊介 (YASUI, Shunsuke). 高崎 裕史 (TAKASAKI, Hiroshi).

(74) 代理人: 前田 弘, 外 (MAEDA, Hiroshi et al.); 〒5410053 大阪府大阪市中央区本町２丁目５番７号 大阪丸紅ビル Osaka (JP).

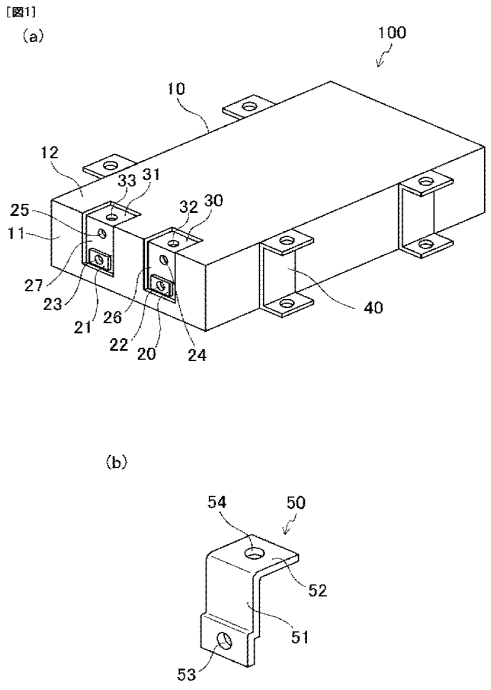
(81) 指定国 (表示のない限り、全ての種類の国内保護が可能): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, 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.

(84) 指定国 (表示のない限り、全ての種類の広域保護が可能): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), ユーラシア (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), ヨーロッパ (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

[続葉有]

(54) **Title**: BATTERY MODULE AND BATTERY PACK

(54) 発明の名称 : 電池モジュール及び電池パック



(57) **Abstract**: A battery module (100) in which a plurality of unit cells are arranged and housed within a case (10), wherein: a positive electrode external terminal (20) and a negative electrode external terminal (21) connected to the electrodes in the plurality of unit cells are arranged in parallel at a prescribed interval on the first side surface (11) of the case (10); a pair of grooves (30, 31) are formed at the same prescribed interval from one another on the second side surface (12), adjacent to the first side surface (11) of the case (10); and the first part (51) of an L-shaped electrode piece (50) is selectively attachable to the positive electrode external terminal (20) or the negative electrode external terminal (21), and the second part (52) is selectively attachable to either one of the grooves (30, 31) in the pair thereof.

(57) 要約: 複数の素電池が配列されてケース１０内に収容された電池モジュール１００であって、ケース１０の第１の側面１１に、複数の素電池の各電極に接続された正極外部端子２０及び負極外部端子２１が、所定の間隔で並列に配設されており、ケース１０の第１の側面１１に隣接する第２の側面１２に、所定の間隔と同じ間隔で一対の溝部３０、３１が形成されており、Ｌ字型の電極片５０の第１の片５１が、正極外部端子２０又は負極外部端子２１と、電極片５０の第２の片５２が、一対の溝部３０、３１のいずれか一方と、それぞれ選択的に取付可能になっている。

WO 2012/081140 A1

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

(BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

添付公開書類:

— 国際調査報告（条約第 21 条(3)）

明　細　書

発明の名称 ： 電池モジュール及び電池パック

技術分野

[0001] 本発明は、複数の電池を備えた電池モジュール、及びそれを積層した電池パックに関する。

背景技術

[0002] 複数の電池をケースに収容して、所定の電圧及び容量を出力できるようにした電池パックは、種々の機器、車両等の電源として広く使用されている。中でも、汎用的な電池を並列・直列接続して、所定の電圧及び容量を出力する組電池をモジュール化し、この電池モジュールを種々組み合わせることによって、多種多様な用途に対応可能とする技術が採用され始めている。このモジュール化技術は、電池モジュールに収容する電池を高性能化することによって、電池モジュール自身の小型・軽量化が図られるため、電池パックを組み立てる際の作業性が向上するとともに、車両等の限られた空間へ搭載する際の自由度が向上するなど、様々なメリットと有する。

[0003] 一般的に、電池モジュールは、複数の電池が電池ケース内に収容され、各電池の電極を電気的に直列又は並列接続した配線が、電池ケースの一側面に取り付けられた外部端子に接続された構成になっている（例えば、特許文献１を参照）。そして、複数の電池モジュールを配列して電池パックを構成するとき、各電池モジュールの一側面に配設された外部端子同士を電気的に直列又は並列に接続して、所定の電圧及び容量を備えた電池パックを得ることができる。

先行技術文献

特許文献

[0004] 特許文献1：特開２００７－０２６８９４号公報

発明の概要

発明が解決しようとする課題

[0005] 電池モジュールは、その外形寸法や外部端子が、所定の大きさや位置に定まっているために、必要な個数の電池モジュールを配列することによって、容易に電池パックを組み立てることができる。そのとき、電池モジュールを、その外部端子が同じ方向を向くように配列することによって、各電池モジュール間の電気的接続も容易となる。

[0006] また、このように組み立てられた電池パックは、通常、パックケースに収容されて、所定の空間に設置されるが、外部端子が同じ方向を向いて配列しているため、電池パックが所定の空間に設置された状態でも、外部端子が配列した側のパックケースの一側面を開口することによって、外部端子の接続等のメンテナンスを行うことができる。

[0007] しかしながら、電池パックが収容されたパックケースを、一旦、所定の空間に設置した後は、空間の制約等から、外部端子が配列した側のパックケースの側面を開口することができない場合がある。この場合、パックケースを設置した状態ではメンテナンス等の作業をすることができないため、一旦、パックケースを設置場所から取り出して、作業を行う必要がある。

[0008] また、電池パックを設置した状態でも、メンテナンス等の作業ができるようにするためには、予め、パックケースの開口可能な側面に外部端子が向くように、電池モジュールを配置しなければならず、電池モジュールの配置自由度が制限されてしまうという問題もある。

[0009] 本発明は、かかる課題に鑑みなされたもので、その主な目的は、メンテナンス性が高く、配置自由度の高い電池モジュール、及びそれを積層した電池パックを提供することにある。

課題を解決するための手段

[0010] 上記の課題を解決するために、本発明は、複数の素電池（以下、電池モジュールに使用する電池を、「素電池」と呼ぶ）がケースに収容された電池モジュールにおいて、ケースの一側面に外部端子を配設し、これに隣接する側面に溝部を形成し、Ｌ字型の電極片の一片を外部端子に、他片を溝部に、それぞれ取付可能にした構成を採用する。

[0011] このような構成により、電池モジュールを積層して電池パックを構成したとき、最上段の電池モジュールには、電極片の一片を外部端子に取り付け、他片を溝部に取り付けることによって、電池モジュールの外部端子を、ケースの隣接する２つの側面に配設させることができる。これにより、外部端子を接続するための作業面を、ケースの２つの側面に確保することができるため、メンテナンス性が向上するとともに、電池パックを構成する際の電池モジュールの配置自由度を向上させることができる。

[0012] 本発明に係る電池モジュールは、複数の素電池が配列されてケース内に収容された電池モジュールであって、ケースの第１の側面に、複数の素電池の各電極に接続された正極外部端子及び負極外部端子が、所定の間隔で並列に配設されており、ケースの第１の側面に隣接する第２の側面に、所定の間隔と同じ間隔で一対の溝部が形成されており、Ｌ字型の電極片の第１の片が、正極外部端子又は負極外部端子と、電極片の第２の片が、一対の溝部のいずれか一方と、それぞれ選択的に取付可能になっていることを特徴とする。

[0013] また、本発明に係る電池パックは、上記電池モジュールが複数個、第２の側面に垂直な方向に積層された電池パックであって、最上段の電池モジュールにおいて、電極片の第１の片は、ケースの第１の側面に配設された正極外部端子又は負極外部端子の一方の外部端子に取り付けられ、電極片の第２の片は、ケースの第２の側面に形成された一対の溝部の一方に取り付けられており、電極片の第２の片は、電池パックの一方の極の外部端子を構成していることを特徴とする。

発明の効果

[0014] 本発明によれば、メンテナンス性が高く、配置自由度の高い電池モジュールが実現でき、これを積層した電池パックのメンテナンス性が向上できるとともに、電池パックを構成する際の電池モジュールの配置自由度が向上できる。

図面の簡単な説明

[0015] [図1]（ａ）は、本発明の一実施形態における電池モジュールの構成を模式的

に示した斜視図で、（ｂ）は、Ｌ字型の電極片の構成を示した斜視図である。

[図2]図１の電池モジュールにＬ字型の電極片を取り付けた状態の構成を示した斜視図である。

[図3]電池モジュールを複数個積層された電池パックの構成を模式的に示した斜視図である。

[図4]電池モジュールが電気的に接続された状態の電池パックの構成を示した図で、（ａ）は上面図、は正面図である。

[図5]図１（ａ）に示した電池モジュールを複数個積層した電池パックを配列して構成した電源ユニットの例を示した正面図である。

[図6]図５の電源ユニットに、Ｌ字型の電極片及び第２の電極片を取り付けた状態の電源ユニットの構成を示した図で、（ａ）は平面図、（ｂ）は正面図である。

[図7]電池モジュールを並列に配置して電池パックを構成した例を示した図で、（ａ）は平面図、（ｂ）は正面図である。

発明を実施するための形態

[0016] 以下、本発明の実施形態を図面に基づいて詳細に説明する。なお、本発明は、以下の実施形態に限定されるものではない。また、本発明の効果を奏する範囲を逸脱しない範囲で、適宜変更は可能である。さらに、他の実施形態との組み合わせも可能である。

[0017] 図１（ａ）は、本発明の一実施形態における電池モジュール１００の構成を模式的に示した斜視図である。電池モジュール１００は、複数の素電池（不図示）が配列されてケース１０内に収容されている。なお、本発明の電池モジュールに使用する素電池の種類は、特に制限されないが、例えば、リチウムイオン電池やニッケル水素電池等を用いることができる。また、ノート型パソコン等の携帯用電子機器の電源として単体でも使用できる電池であってもよい。この場合、高性能の汎用電池を、電池モジュールの素電池として使用することができるため、電池モジュールの高性能化、低コスト化をより

容易に図ることができる。

[0018] 図１（ａ）に示すように、ケース１０の第１の側面１１には、複数の素電池の各電極に接続された正極外部端子２０及び負極外部端子２１が、所定の間隔で並列に配設されている。なお、素電池間の電気的な接続は、直列でも並列でもよい。また、素電池間の電気的な接続構造は、特に制限されないが、例えば、並列接続する場合には、素電池の極性を揃えて配置し、素電池の各極性をそれぞれバスバーで接続すればよい。

[0019] ケース１０の第１の側面１１に隣接する第２の側面１２には、外部端子２０、２１と同じ間隔で、一対の溝部３０、３１が形成されている。そして、図１（ｂ）に示すようなＬ字型の電極片５０の第１の片５１が、正極外部端子２０又は負極外部端子２１と、電極片５０の第２の片５２が、一対の溝部３０，３１のいずれか一方と、それぞれ選択的に取付可能になっている。

[0020] すなわち、図２に示すように、Ｌ字型の電極片５０の第１の片５１を、例えば、正極外部端子２０に、第２の片５２を、溝部３０に取り付けた場合、正極外部端子は、ケース１０の互いに隣接する２つの側面１１，１２に配されることになる。

[0021] ここで、Ｌ字型の電極片５０は、必ずしも直角に曲がった形状である必要はなく、外部端子２０、２１、及び溝部３０、３１の形状に合わせて適宜変形されたものであってもよい。また、電極片５０の材料は特に制限されないが、例えば、銅、アルミニウム、ニッケル、または銅とニッケルのクラッド材等を好適に用いることができる。

[0022] なお、図２に示すように、電極片５０の第２の片５２は、溝部３０，３１に埋設して取り付けられるため、溝部３０，３１の深さを、電極片５０の厚みと同じ大きさにしておけば、溝部３０，３１に取り付けられた電極片５０の第２の片５２は、ケース１０の第２の側面１２から突出することはない。従って、電池モジュール１００を、ケース１０の第２の側面１２に垂直な方向に積層した場合、安定して積層することができる。

[0023] また、ケース１０の第１の側面１１にも、電極片５０の第１の片５１を埋

設する一対の第２の溝部２６、２７を形成しておけば、電極片５０の第１の片５１も、溝部２６、２７に埋設して取り付けることができる。

[0024] また、一対の溝部３０、３１及び電極片５０の第２の片５２に、それぞれボルト孔（又はネジ孔）３２、３３及び５４を設けておくことによって、電極片５０の第２の片５２を、ボルト（又はネジ）で、一対の溝部３０、３１に取り付けることができる。なお、電極片５０の取付方法はこれに限定されず、着脱可能な取付方法であれば、他の方法を用いてもよい。

[0025] 同様に、外部端子２０，２１及び電極片５０の第１の片５１にも、それぞれボルト孔（又はネジ孔）２２、２３及び５３を設けておくことによって、電極片５０の第１の片５１を、ボルト（又はネジ）で、外部端子２０，２１に取り付けることができる。

[0026] また、ケース１０に、連結部４０を設けておくことによって、電池モジュール１００を積層したとき、連結部４０で、隣り合う電池モジュール１００同士を連結することができる。

[0027] 図３は、電池モジュール１００が複数個（図では３個）、ケース１０の第２の側面１２に垂直な方向に積層された電池パック２００の構成を模式的に示した斜視図である。

[0028] 図３に示すように、まず、最上段の電池モジュール１００ａにおいては、電極片５０の第１の片５１が、ケース１０の第１の側面１１に配設された正極外部端子２０ａ又は負極外部端子２１ａのいずれか一方（ここでは、正極外部端子２０ａ）に取り付けられ、電極片５０の第２の片５２が、ケース１０の第２の側面１２に形成された一対の溝部３０，３１の一方（ここでは、溝部３０）に取り付けられる。これにより、電極片５０の第２の片５２は、電池パック２００の一方の極（ここでは正極）の外部端子を構成している。

[0029] また、一対の溝部３０，３１の他方（ここでは溝部３１）には、Ｌ字型の第２の電極片６０の第２の片６２が取り付けられており、第２の電極片６０の第１の片６１は、ケース１０の第１の側面１１に形成された一対の第２の溝部２６、２７の一方（ここでは、溝部２７）に取り付けられている。さら

に、第２の電極片６０の第１の片６１は、ケース１０の第１の側面１１側に配設されたバスバー７０ａによって、最下段の電池モジュール１００ｃの負極外部端子２１ｃに接続されている。これにより、第２の電極片６０の第２の片６２は、電池パック２００の他方の極（ここでは負極）の外部端子を構成している。

[0030] ここで、電極片５０と第２の電極片６０とを比較すると、一対の溝部３０、３１に埋設する側の第２の片５２、６２は、ほぼ同じ大きさであるのに対し、第２の電極片６０の片６１の長さは、電極片５０の第１の片５１の長さよりも短い。すなわち、第２の電極片６０は、外部端子２０、２１を、ケース１０の互いに隣接する２つの側面１１、１２に配設するような機能はない。

[0031] なお、第２の電極片６０の第１及び第２の片６１，６２及び一対の第２の溝部２４，２５にも、それぞれボルト孔（又はネジ孔）６３、６４及び２４、２５を設けておくことによって、第２の電極片６０の第１及び第２の片６１、６２を、ボルト（又はネジ）で、一対の溝部３０、３１又は一対の第２の溝部２６、２７に取り付けることができる。

[0032] また、積層された複数の電池モジュール１００ａ、１００ｂ、１００ｃは、ケース１０の第１の側面１１側に配設された複数のバスバー７０ｂ、７０ｃによって、各電池モジュール１００ａ、１００ｂ、１００ｃの正極外部端子２０ａ、２０ｂ、２０ｃ又は負極外部端子２１ａ、２１ｂ、２１ｃと、それぞれ接続されている。

[0033] 例えば、図３に示した例では、最下段の電池モジュール１００ｃの正極外部端子２０ｃは、バスバー７０ｂによって、中段の電池モジュール１００ｂの負極外部端子２１ｂに接続されている。また、中段の電池モジュール１００ｂの正極外部端子２０ｂは、バスバー７０ｃによって、最上段の電池モジュール１００ａの負極外部端子２１ａに接続されている。

[0034] 図４は、このように接続された電池パック２００の構成を示した図で、図４（ａ）は上面図、図４（ｂ）は正面図である。

[0035] 図４（ｂ）に示すように、電池モジュール１００ａ、１００ｂ、１００ｃは、電気的に直列接続されている。そして、最上段の電池モジュール１００ａの正極外部端子２０ａと、最下段の電池モジュール１００ｃの負極外部端子２１ｃとが、それぞれ、電池パック２００の正負の外部端子となる。

[0036] また、図４（ａ）に示すように、ケース１０の第２の側面１２に取り付けられた電極片５０の第２の片５２は、Ｌ字型の電極片５０によって、電池モジュール１００ａの正極外部端子２０ａと接続されている。また、ケース１０の第２の側面１２に取り付けられた第２の電極片６０の第２の片６２は、Ｌ字型の第２の電極片６０及びバスバー７０ａによって、電池モジュール１００ｃの負極外部端子２１ｃと接続されている。従って、ケース１０の第２の側面１２に配設された電極片５０の第２の片５２、及び第２の電極片６０の第２の片６２は、それぞれ、電池パック２００の正負の外部端子となる。

[0037] すなわち、このように構成された電池パック２００は、ケース１０の第１の側面１１側だけでなく、それに隣接する第２の側面１２側にも、正負の外部端子を配設することが可能となる。

[0038] なお、下段の電池モジュール１００ｂ、１００ｃには、電極片５０及び第２の電極片６０は取り付けられていない。このため、電池モジュール１００ｂ、１００ｃを積層する前に、予め、電極片５０及び第２の電極片６０の取付作業は不要となり、電池パック２００の組立工程が複雑になることはない。また、電池モジュール１００ａ、１００ｂ、１００ｃ間には、電極片５０及び第２の電極片６０がないため、安定して積層することができる。

[0039] 図５は、図１（ａ）に示した電池モジュール１００を複数個積層した電池パック２００Ａ、２００Ｂ、２００Ｃを配列して構成した電源ユニット３００の例を示した正面図である。

[0040] 電池パック２００Ａ、２００Ｂは、電池モジュール１００ａ、１００ｂ、１００ｃを積層して、電気的に直列接続したもので、電池パック２００Ｃは、電池モジュール１００ｂ、１００ｃを積層して電気的に直列接続したものである。従って、電池パック２００Ａ、２００Ｂ、２００Ｃの正極外部端子

は、それぞれ、２０Ａａ、２０Ｂａ、２０Ｃａ、負極外部端子は、それぞれ、２１Ａｃ、２１Ｂｃ、２１Ｃｃとなる。

[0041] ここで、電池パック２００Ａ、２００Ｂ、２００Ｃを、電気的に直列接続して電源ユニット３００を構成しようとする場合、図５に示すように、電池パック２００Ａの正極外部端子２０Ａａと、電池パック２００Ｂの負極外部端子２１Ｂｃとを、バスバー８０ａで接続し、電池パック２００Ｂの正極外部端子２０Ｂａと、電池パック２００Ｃの負極外部端子２１Ｃｃとを、バスバー８０ｂで接続すればよい。すなわち、これらの接続は、全て、ケース１０の第１の側面１１側において行うことができる。

[0042] 図６は、図５に示した電源ユニット３００に対して、各電池パック２００Ａ、２００Ｂ、２００Ｃの最上段の電池モジュール１００ａ、１００ａ、１００ｂに、図４（ａ）、（ｂ）に示したような、Ｌ字型の電極片５０、及び第２の電極片６０を取り付けした電源ユニット３００の構成を示した図で、図６（ａ）は平面図、図６（ｂ）は正面図である。

[0043] 例えば、電池パック２００Ａでは、ケース１０の第２の側面１２に取り付けられた電極片５０ａの第２の片５２ａは、第１の片５０ａによって、電池モジュール１００ａの正極外部端子２０Ａａと接続されている。また、ケース１０の第２の側面１２に取り付けられた第２の電極片６０ａの第２の片６２ａは、第１の片６１ａ及びバスバー７０Ａａによって、電池モジュール１００ｃの負極外部端子２１Ａｃと接続されている。従って、ケース１０の第２の側面１２に配設された電極片５０ａの第２の片５２ａ、及び第２の電極片６０ａの第２の片６２ａは、それぞれ、電池パック２００Ａの正負の外部端子となる。

[0044] 同様の接続を行うことによって、ケース１０の第２の側面１２に配設された電極片５０ｂ、５０ｃ及び第２の電極片６０ｂ、６０ｃの第２の片５２ｂ、６２ｂ、並びに、５２ｃ、６２ｃは、それぞれ、電池パック２００Ｂ、並びに電池パック２００Ｃの正負の外部端子となる。

[0045] すなわち、電池パック２００Ａ、２００Ｂ、２００Ｃは、ケース１０の第

１の側面１１側だけでなく、それに隣接する第２の側面１２側にも、正負の外部端子が配設されている。従って、電池パック２００Ａ、２００Ｂ、２００Ｃを、電気的に直列接続して電源ユニット３００を構成しようとする場合、図６（ａ）に示すように、電池モジュール２００Ａの第２の側面１２に配設された電極片５０ａの第２の片５２ａと、電池モジュール２００Ｂの第２の側面１２に配設された第２の電極片６０ｂの第２の片６２ｂとをバスバー８０ａで接続し、さらに、電池モジュール２００Ｂの第２の側面１２に配設された電極片５０ｂの第２の片５２ｂと、電池モジュール２００Ｃの第２の側面１２に配設された第２の電極片６０ｃの第２の片６２ｃとを、バスバー８０ｂで接続すればよい。

[0046] このように、電池パック２００Ａ、２００Ｂ、２００Ｃの外部電極を、ケース１０の隣接する２つの側面１１、１２に配設することができるため、電池パック２００Ａ、２００Ｂ、２００Ｃを配列して電源ユニットを構成する場合、外部端子を接続するための作業面を、ケース１０の２つの側面１１、１２に確保することができる。そのため、電源ユニットをパックケースに収容して、所定の空間に設置した後でも、パックケースの２つ面のいずれか一方を開口することができれば、電源ユニットを設置した状態でも、メンテナンス等の作業を行うことができる。また、外部端子を接続する作業面を、ケース１０の２つの側面１１、１２に確保することができるため、電池パックを構成する際の電池モジュールの配置自由度を向上させることができる。

[0047] 図３及び図４では、電池モジュール１００を積層して電池パック２００を構成した例を説明したが、電池モジュール１００を並列に配置して電池パックを構成した場合でも、本発明の効果を得ることができる。

[0048] 図７は、電池モジュール１００ａ、１００ｂ、１００ｃ、１００ｄを並列に配置して電池パック２１０を構成した例を示した図で、図７（ａ）は平面図、図７（ｂ）は正面図である。

[0049] 図７（ａ）、（ｂ）に示すように、全ての電池モジュール１００ａ、１００ｂ、１００ｃ、１００ｄにおいて、図１（ｂ）に示したＬ字型の電極片５

０ａ、５０ｂ、５０ｃ、５０ｄが、各正負の外部端子２０ａ、２１ａ、２０ｂ、２１ｂ、２０ｃ、２１ｃ、２０ｄ、２１ｄ、及びケース１０の第２の側面１２に形成された一対の溝部（不図示）に、それぞれ取り付けられている。従って、電池モジュール１００ａ、１００ｂ、１００ｃ、１００ｄの第２の側面１２に配設された一対の電極片の第２の片５２ａ、５２ｂ、５２ｃ、５２ｄは、電池モジュール１００ａ、１００ｂ、１００ｃ、１００ｄの正負の外部端子となる。

[0050] 従って、電池モジュール１００ａ、１００ｂ、１００ｃ、１００ｄを電気的に直列接続して電池パック２１０を構成しようとする場合、図７（ｂ）に示すように、第２の側面１２側において、隣接する電池モジュールの第２の片５２ａ、５２ｂ間、５２ｂ、５２ｃ間、及び５２ｃ、５２ｄ間を、それぞれバスバー８０ａ、８０ｂ、８０ｃで接続すればよい。もちろん、第１の側面１１側においても、隣接する電池モジュールの正負の外部端子２０ａ、２１ｂ間、２０ｂ、２１ｃ間、及び２０ｃ、２１ｄ間を、バスバー（不図示）で接続することは可能である。

[0051] 以上、本発明を好適な実施形態により説明してきたが、こうした記述は限定事項ではなく、もちろん、種々の改変が可能である。例えば、上記実施形態においては、電池パック２００間を電気的に直列接続する例を説明したが、電気的に並列接続する場合にも、本発明を適用し得る。また、電気的な接続を、第１の側面１１側、又は第２の側面１２側でそれぞれ行った例を説明したが、第１の側面１１側及び第２の側面１２側の両方で、電気的な接続を行うことも、もちろん可能である。

産業上の利用可能性

[0052] 本発明は、自動車、電動バイク又は電動遊具等の駆動用電源として有用である。

符号の説明

[0053] １０ ケース

１１ 第１の側面

１２　　第２の側面

２０　　正極外部端子

２１　　負極外部端子

２４、２５　　ボルト孔（又はネジ孔）

２６、２７　　一対の溝部（第１の側面側）

３０、３１　　一対の溝部（第２の側面側）

３２、３３　　ボルト孔（又はネジ孔）

４０　　連結部

５０　　Ｌ字型の電極片

５１　　第１の片

５２　　第２の片

５３、５４　　ボルト孔（又はネジ孔）

６０　　第２の電極片

６１　　第１の片

６２　　第２の片

６３、６４　　ボルト孔（又はネジ孔）

７０ａ、７０ｂ、７０ｃ　　バスバー

８０ａ、８０ｂ、８０ｃ　　バスバー

１００　　電池モジュール

２００、２１０　　電池パック

３００　　電源ユニット

請求の範囲

[請求項1] 複数の素電池が配列されてケース内に収容された電池モジュールであって、

前記ケースの第１の側面に、前記複数の素電池の各電極に接続された正極外部端子及び負極外部端子が、所定の間隔で並列に配設されており、

前記ケースの第１の側面に隣接する第２の側面に、前記所定の間隔と同じ間隔で一対の溝部が形成されており、

Ｌ字型の電極片の第１の片が、前記正極外部端子又は前記負極外部端子と、前記電極片の第２の片が、前記一対の溝部のいずれか一方と、それぞれ選択的に取付可能になっている、電池モジュール。

[請求項2] 前記電極片の第２の片は、前記溝部に埋設して取り付けられる、請求項１に記載の電池モジュール。

[請求項3] 前記一対の溝部には、前記電極片の第２の片をボルト又はネジで固定するボルト孔又はネジ孔が設けられている、請求項１に記載の電池モジュール。

[請求項4] 前記ケースの第１の側面にも、前記電極片の第１の片を埋設する一対の第２の溝部が形成されている、請求項１に記載の電池モジュール。

[請求項5] 前記一対の第２の溝部にも、前記電極片の第１の片をボルト又はネジで固定するボルト孔又はネジ孔が設けられている、請求項４に記載の電池モジュール。

[請求項6] 請求項１に記載の電池モジュールが複数個、前記第２の側面に垂直な方向に積層された電池パックであって、

最上段の前記電池モジュールにおいて、

前記電極片の第１の片は、前記ケースの第１の側面に配設された前記正極外部端子又は前記負極外部端子の一方の外部端子に取り付けられ、

前記電極片の第２の片は、前記ケースの第２の側面に形成された前記一対の溝部の一方に取り付けられており、

前記電極片の第２の片は、前記電池パックの一方の極の外部端子を構成している、電池パック。

[請求項7] 前記一対の溝部の他方には、Ｌ字型の第２の電極片の第２の片が取り付けられており、

前記第２の電極片の第１の片は、下段の前記電池モジュールのいずれかの外部端子に、前記ケースの第１の側面側に配設されたバスバーで接続されており、

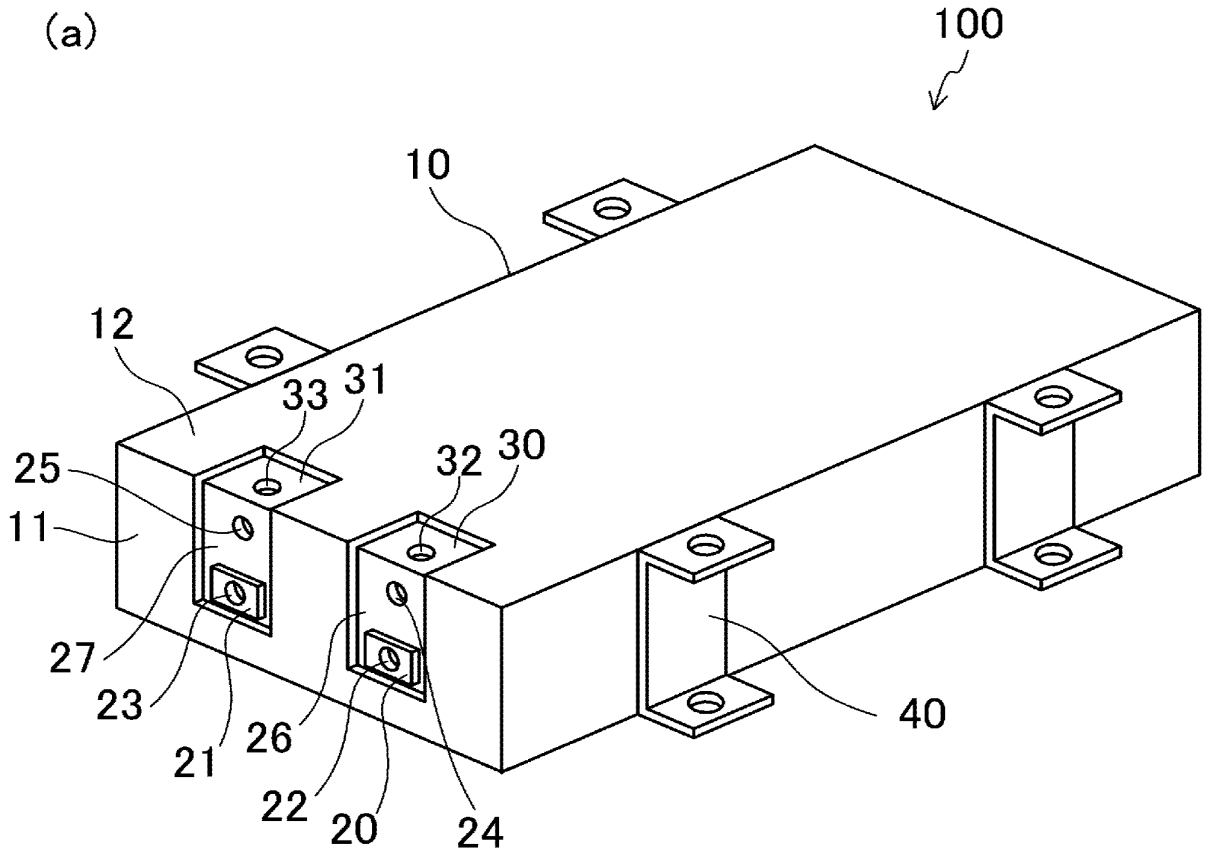
前記第２の電極片の第２の片は、前記電池パックの他方の極の外部端子を構成している、請求項６に記載の電池パック。

[請求項8] 前記積層された複数の電池モジュールは、前記ケースの第１の側面側に配設された複数のバスバーによって、各電池モジュールの前記正極外部端子又は前記負極外部端子と、それぞれ接続されている、請求項６に記載の電池パック。

[請求項9] 下段の前記電池モジュールには、前記電極片及び第２の電極片は取り付けられていない、請求項６に記載の電池パック。

[図1]

(a)



(b)

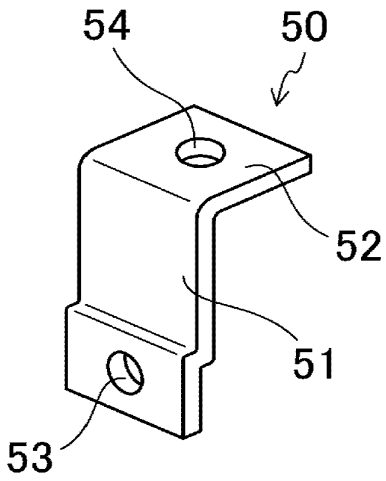


EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

[図2]

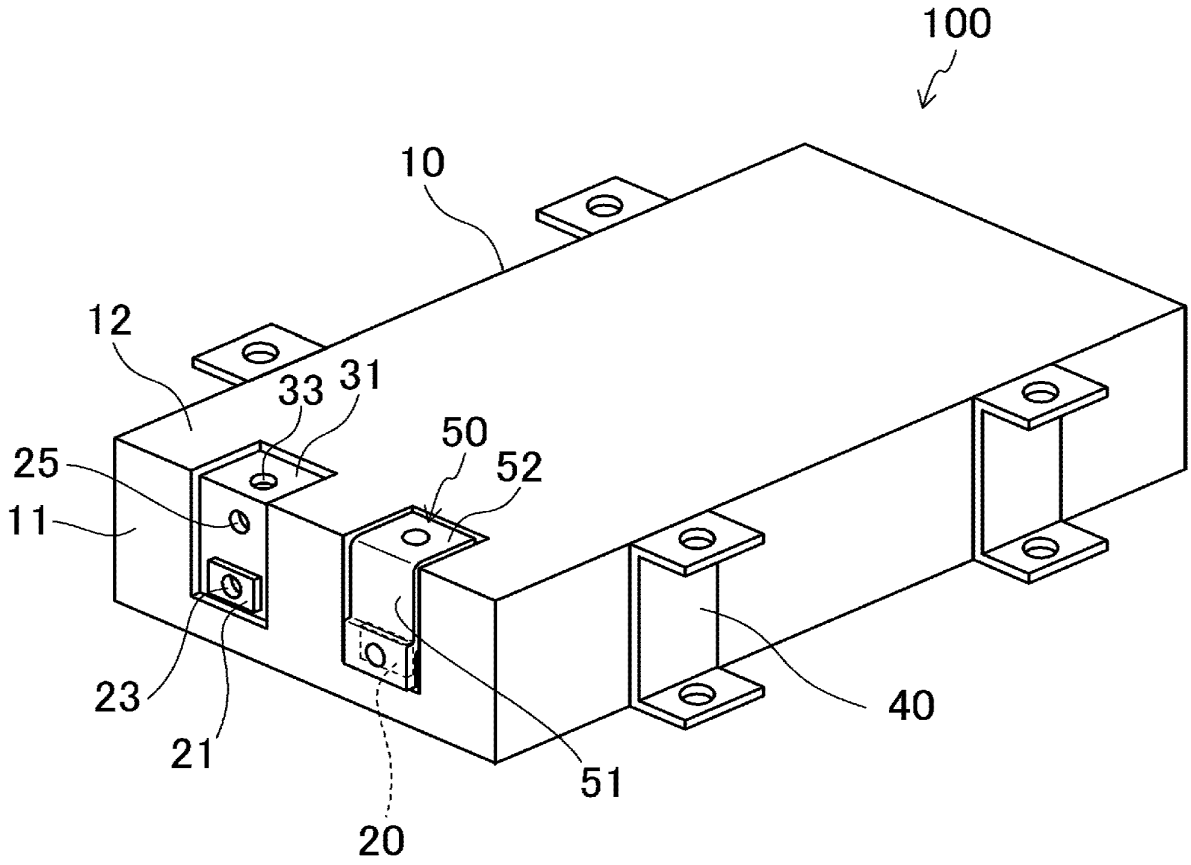


EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

[図3]

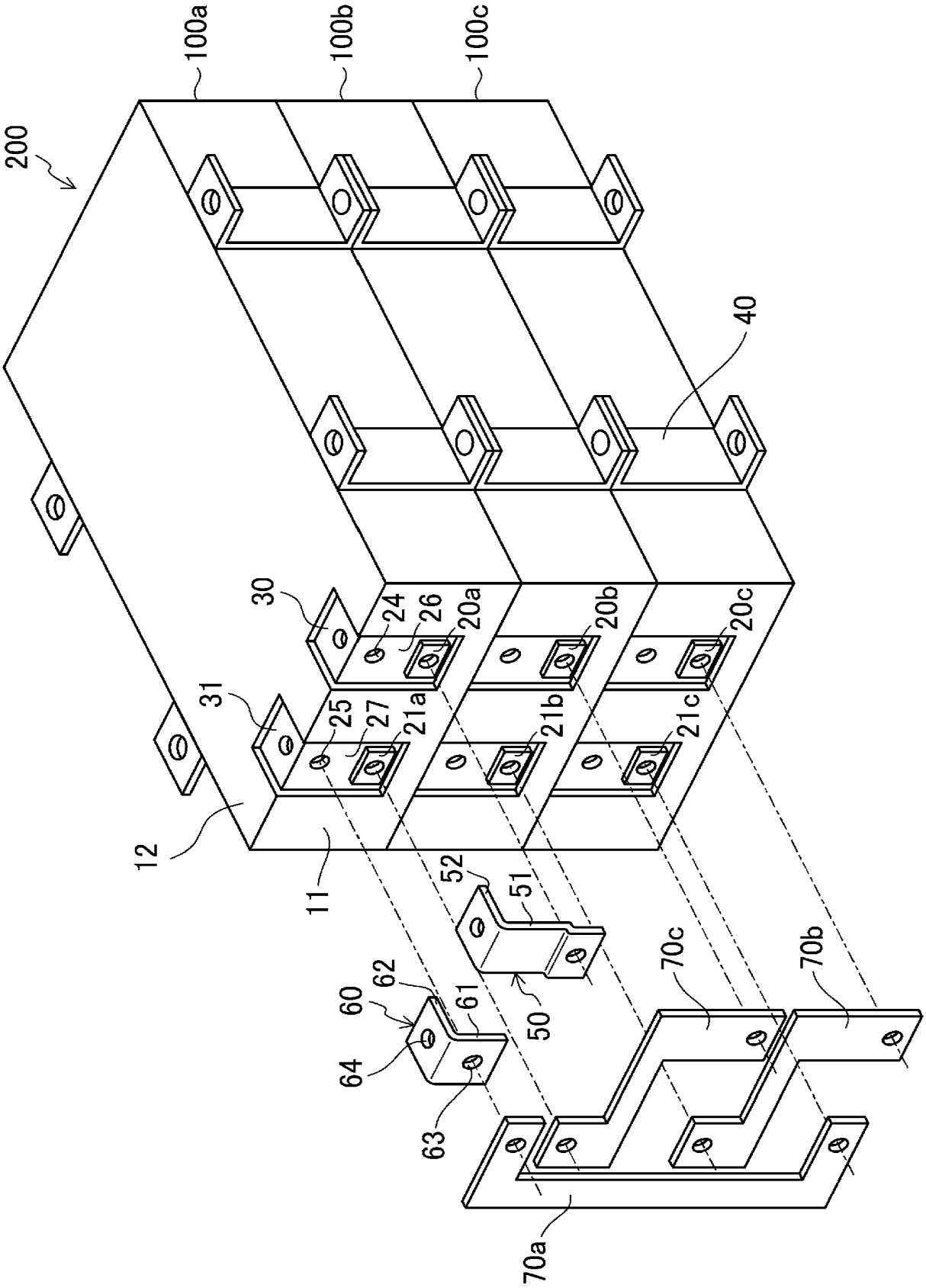


EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

[図4]

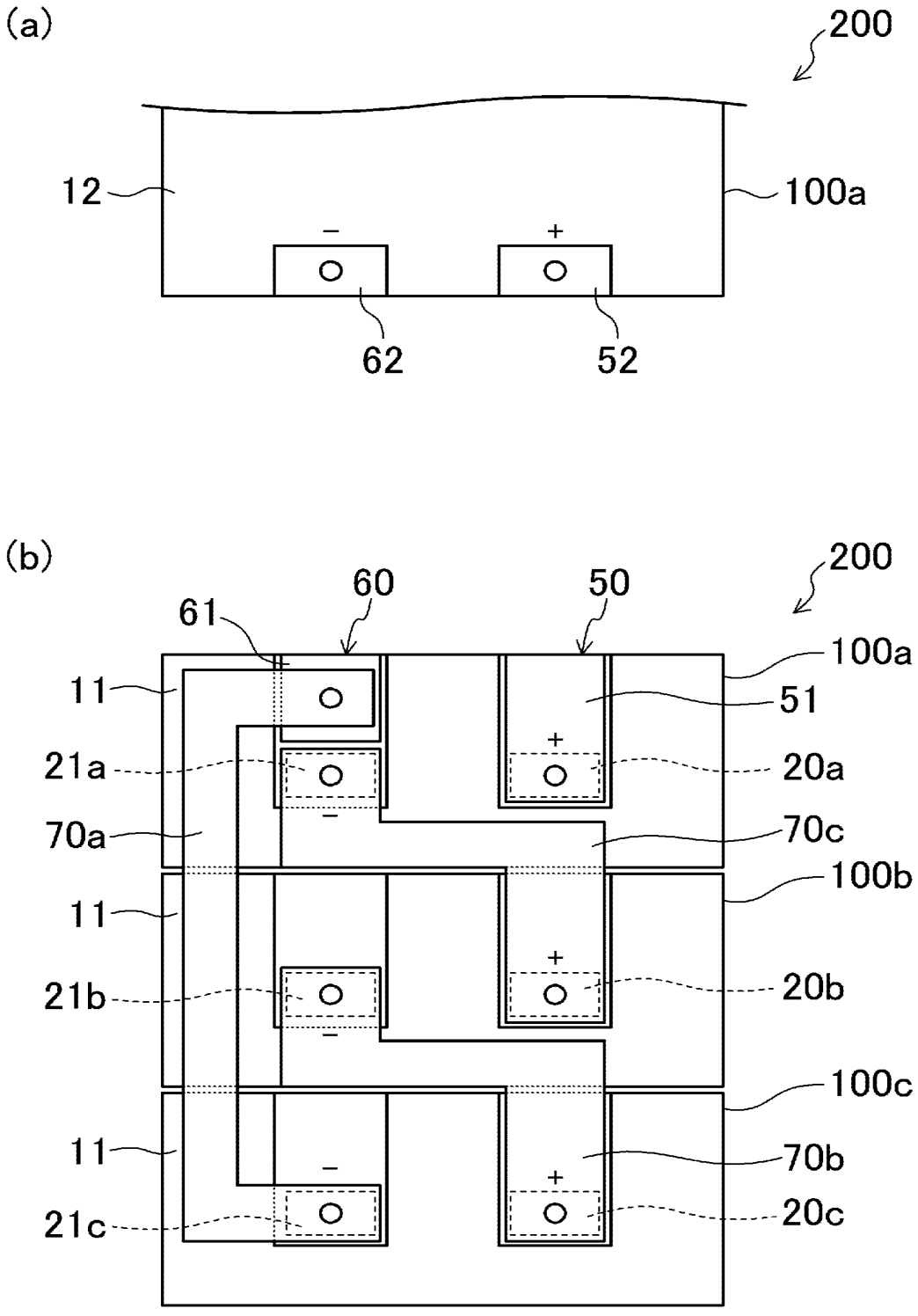


EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

[図5]

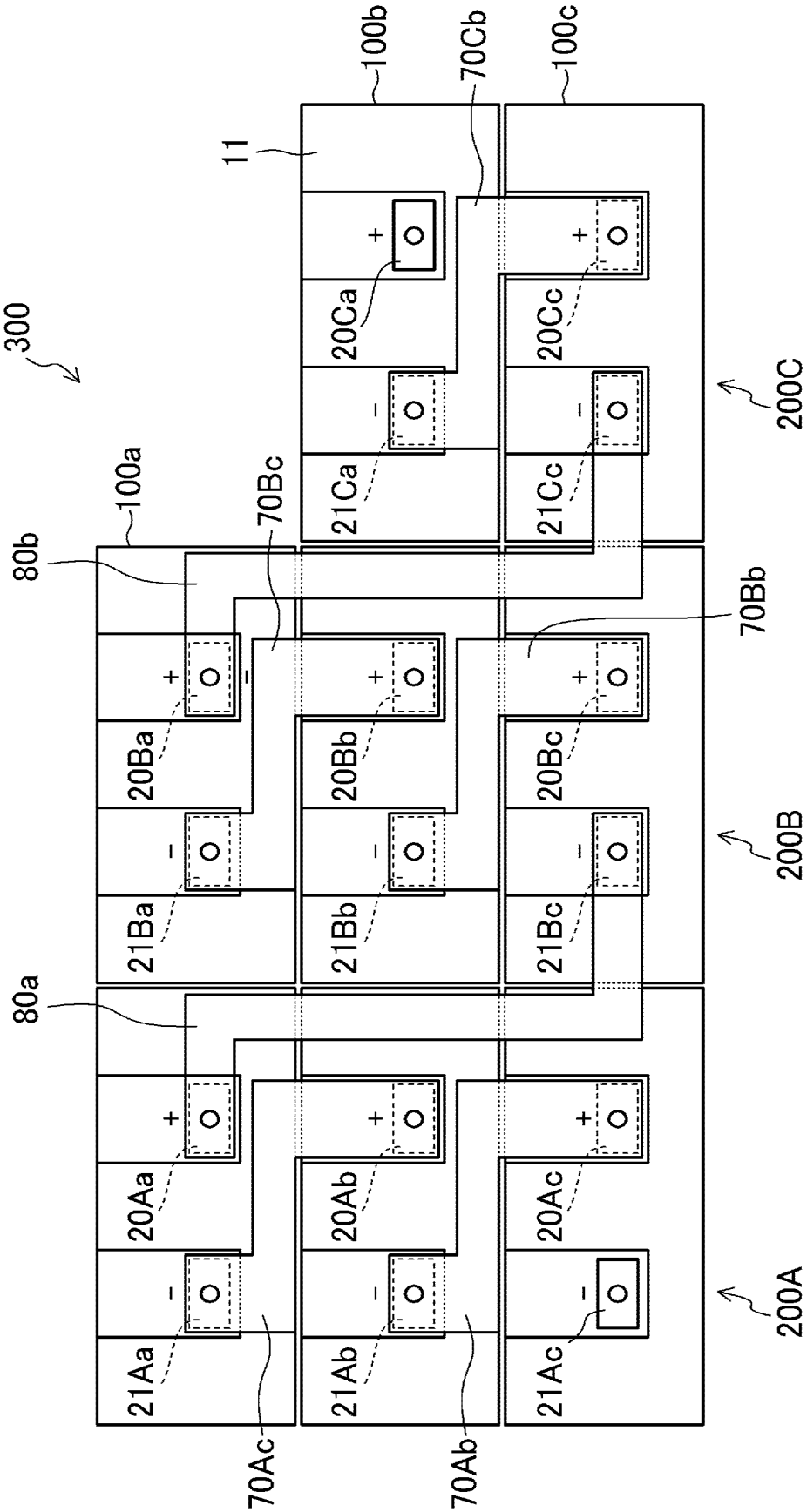


EXHIBIT 1002
Petitioner ADC (IPR2024-00671)
Page 1631 of 2306

[図6]

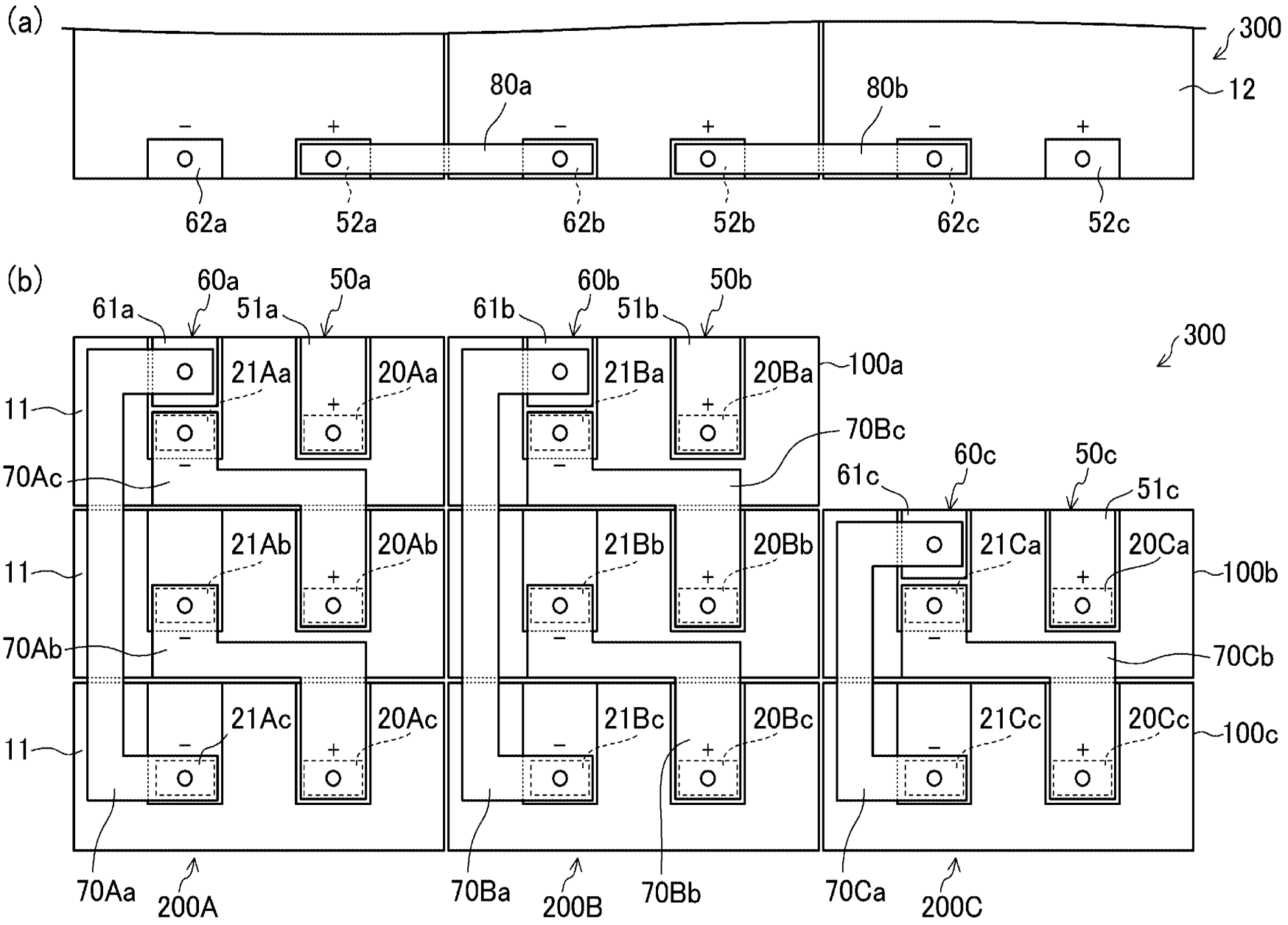


EXHIBIT 1002
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[図7]

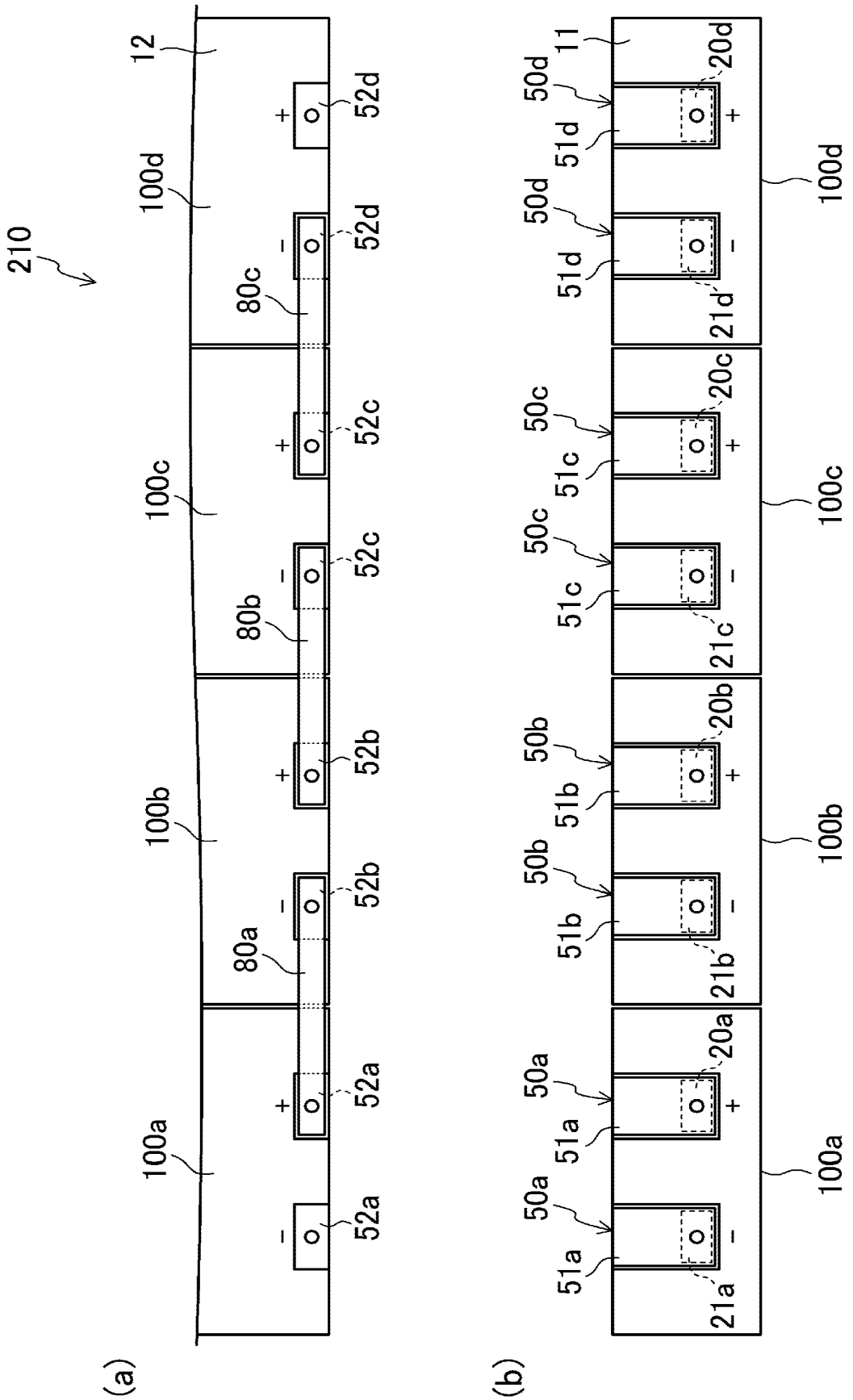


EXHIBIT 1002
Petitioner ADC (IPR2024-00671)
Page 1633 of 2306

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/004202

A. CLASSIFICATION OF SUBJECT MATTER
H01M2/10(2006.01)i, *H01M2/20*(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01M2/10, H01M2/20-2/34

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2011
Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2009-021048 A (Panasonic Corp.), 29 January 2009 (29.01.2009), claims; fig. 1 to 4 & US 2009/0017367 A1	1-9
A	JP 2008-300083 A (Sanyo Electric Co., Ltd.), 11 December 2008 (11.12.2008), claims; fig. 1 to 20 (Family: none)	1-9
A	JP 2007-26894 A (Nissan Motor Co., Ltd.), 01 February 2007 (01.02.2007), claims; fig. 1 to 8 (Family: none)	1-9

☒ 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
12 August, 2011 (12.08.11)	30 August, 2011 (30.08.11)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/004202

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2006-313733 A (Nissan Motor Co., Ltd.), 16 November 2006 (16.11.2006), claims; fig. 1, 4 & US 2006/0246350 A1 & EP 1710859 A1	1-9
A	JP 2006-120489 A (Yazaki Corp.), 11 May 2006 (11.05.2006), claims; fig. 1 to 7 (Family: none)	1-9

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

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

国際調査報告

国際出願番号　ＰＣＴ／ＪＰ２０１１／００４２０２

Ａ．　発明の属する分野の分類（国際特許分類（ＩＰＣ））

Int.Cl.　H01M2/10(2006.01)i, H01M2/20(2006.01)i

Ｂ．　調査を行った分野

調査を行った最小限資料（国際特許分類（ＩＰＣ））

Int.Cl.　H01M2/10, H01M2/20～2/34

最小限資料以外の資料で調査を行った分野に含まれるもの

日本国実用新案公報	１９２２－１９９６年
日本国公開実用新案公報	１９７１－２０１１年
日本国実用新案登録公報	１９９６－２０１１年
日本国登録実用新案公報	１９９４－２０１１年

国際調査で使用した電子データベース（データベースの名称、調査に使用した用語）

Ｃ．　関連すると認められる文献

引用文献のカテゴリー＊	引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示	関連する請求項の番号
A	JP 2009-021048 A（パナソニック株式会社）2009.01.29, 特許請求の範囲、図１～４ & US 2009/0017367 A1	1-9
A	JP 2008-300083 A（三洋電機株式会社）2008.12.11, 特許請求の範囲、図１～２０（ファミリーなし）	1-9
A	JP 2007-26894 A（日産自動車株式会社）2007.02.01, 特許請求の範囲、図１～８（ファミリーなし）	1-9

☑　Ｃ欄の続きにも文献が列挙されている。

☐　パテントファミリーに関する別紙を参照。

＊　引用文献のカテゴリー

「Ａ」特に関連のある文献ではなく、一般的技術水準を示すもの

「Ｅ」国際出願日前の出願または特許であるが、国際出願日以後に公表されたもの

「Ｌ」優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献（理由を付す）

「Ｏ」口頭による開示、使用、展示等に言及する文献

「Ｐ」国際出願日前で、かつ優先権の主張の基礎となる出願の日の後に公表された文献

「Ｔ」国際出願日又は優先日後に公表された文献であって出願と矛盾するものではなく、発明の原理又は理論の理解のために引用するもの

「Ｘ」特に関連のある文献であって、当該文献のみで発明の新規性又は進歩性がないと考えられるもの

「Ｙ」特に関連のある文献であって、当該文献と他の１以上の文献との、当業者にとって自明である組合せによって進歩性がないと考えられるもの

「＆」同一パテントファミリー文献

国際調査を完了した日	国際調査報告の発送日
１２．０８．２０１１	３０．０８．２０１１

国際調査機関の名称及びあて先
日本国特許庁（ＩＳＡ／ＪＰ）
郵便番号１００－８９１５
東京都千代田区霞が関三丁目４番３号

特許庁審査官（権限のある職員）　４Ｘ　３１２２
井上　能宏

電話番号　０３－３５８１－１１０１　内線　３４７７

様式ＰＣＴ／ＩＳＡ／２１０（第２ページ）（２００９年７月）

Ｃ（続き）．　関連すると認められる文献

引用文献のカテゴリー＊	引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示	関連する請求項の番号
A	JP 2006-313733 A（日産自動車株式会社）2006.11.16，特許請求の範囲、図１、４ & US 2006/0246350 A1 & EP 1710859 A1	1-9
A	JP 2006-120489 A（矢崎総業株式会社）2006.05.11，特許請求の範囲、図１～７（ファミリーなし）	1-9

(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

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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

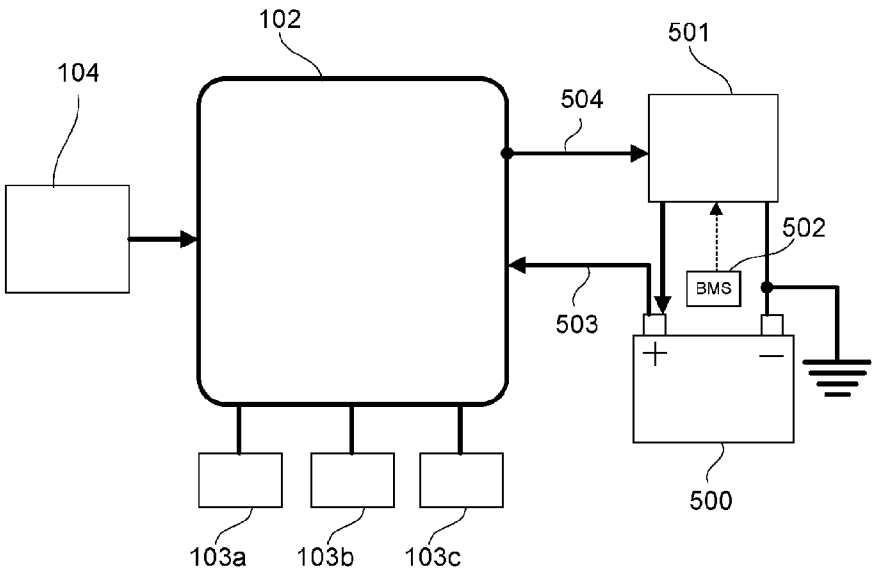


Figure 5

(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.

WO 2019/021007 A1

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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.

- 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

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

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.

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.

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.

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

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

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.

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

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.

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.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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.

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

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").

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.

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.

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.

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.

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.

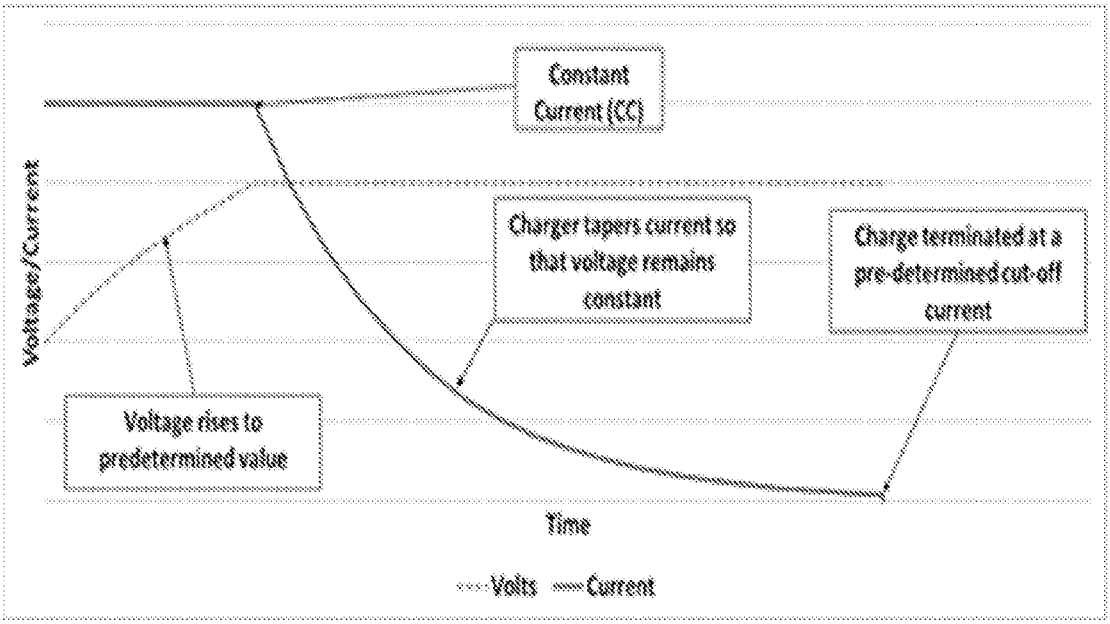


Figure 1

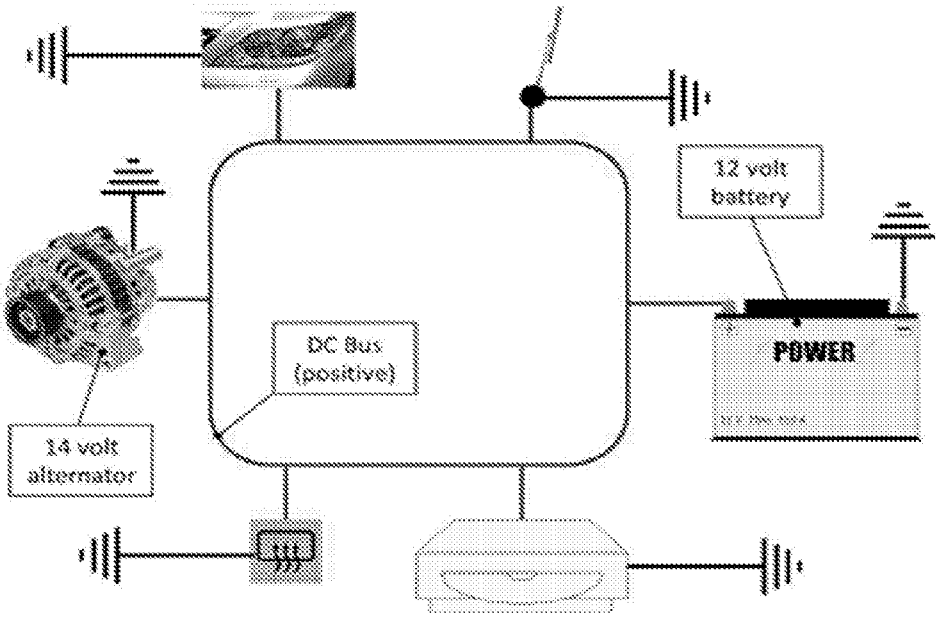


Figure 2

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

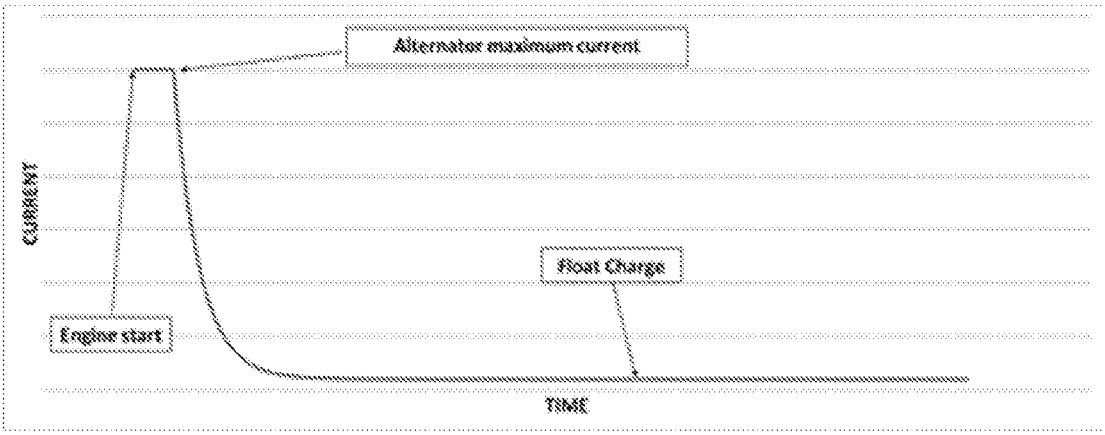


Figure 3

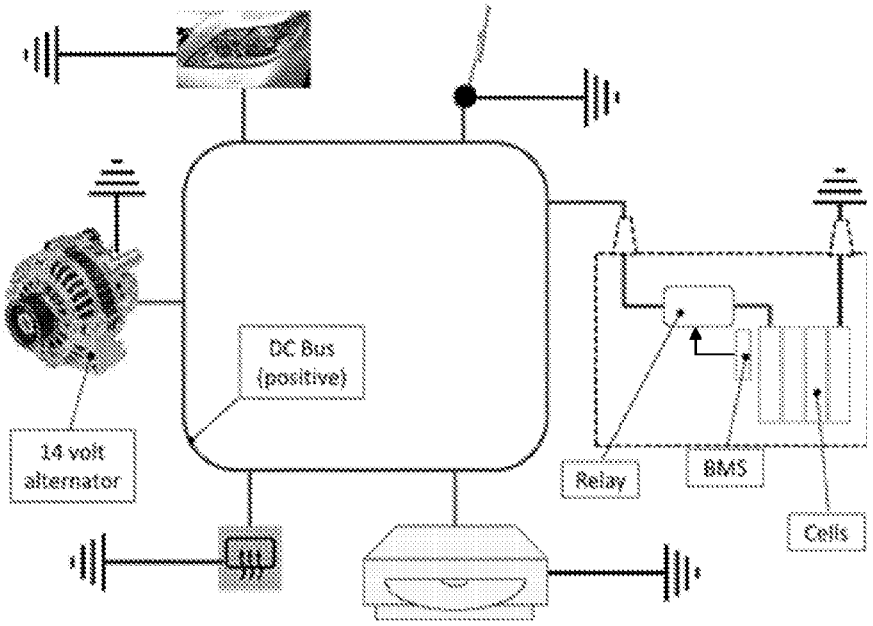


Figure 4

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

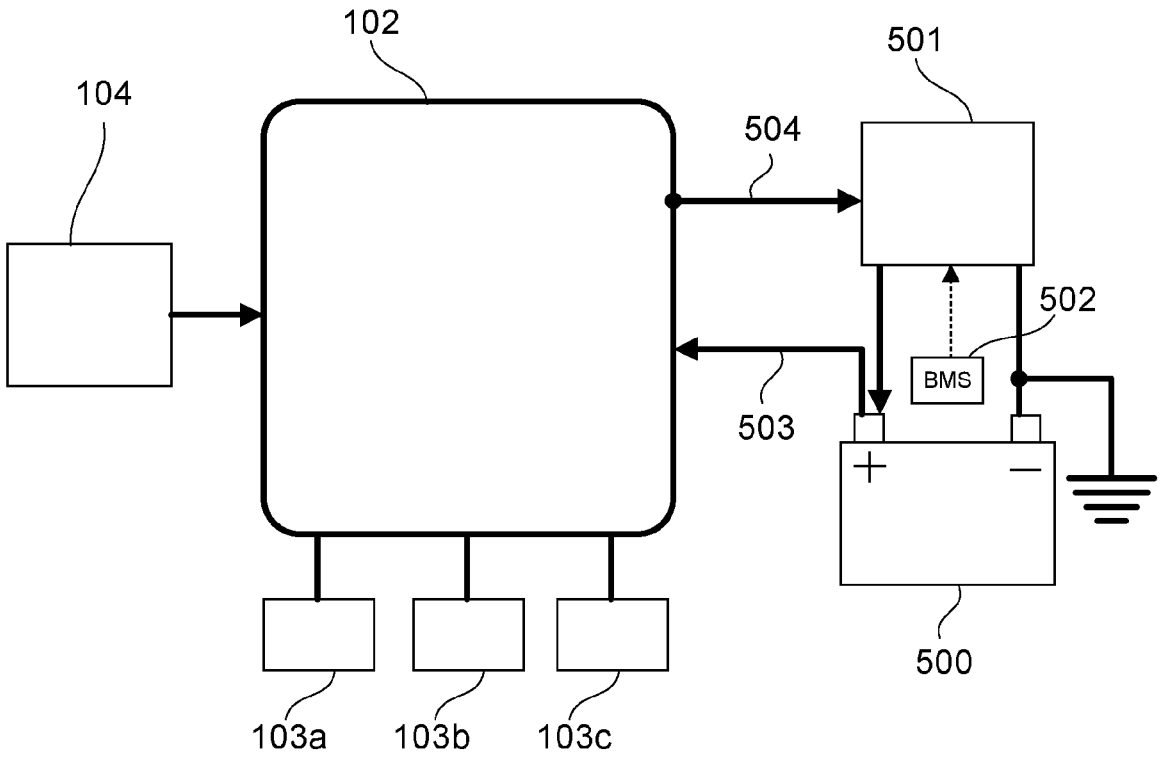


Figure 5

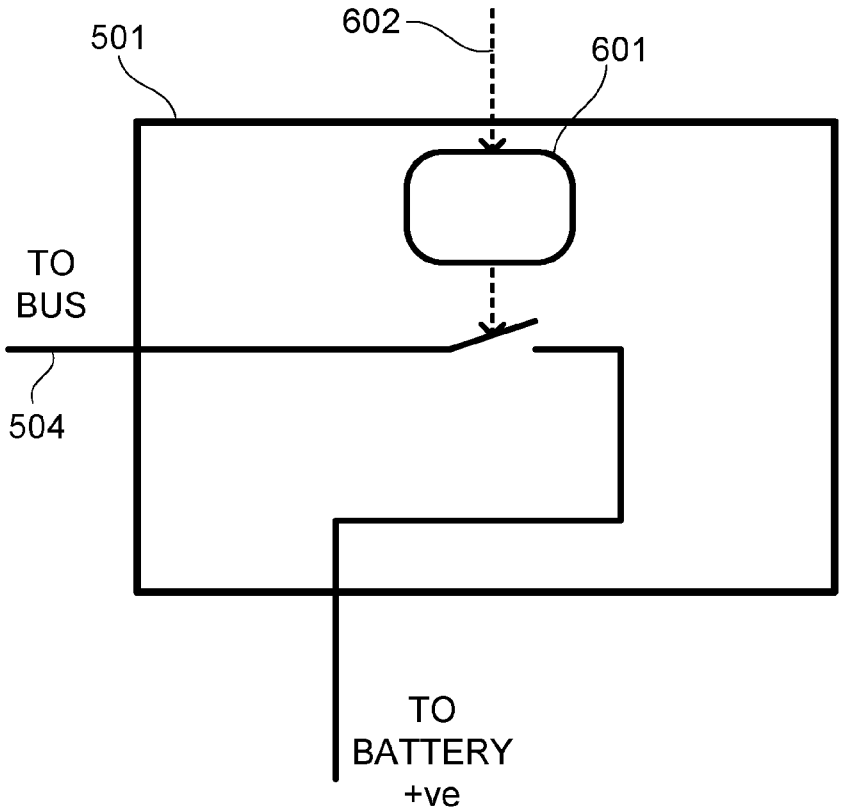


Figure 6

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

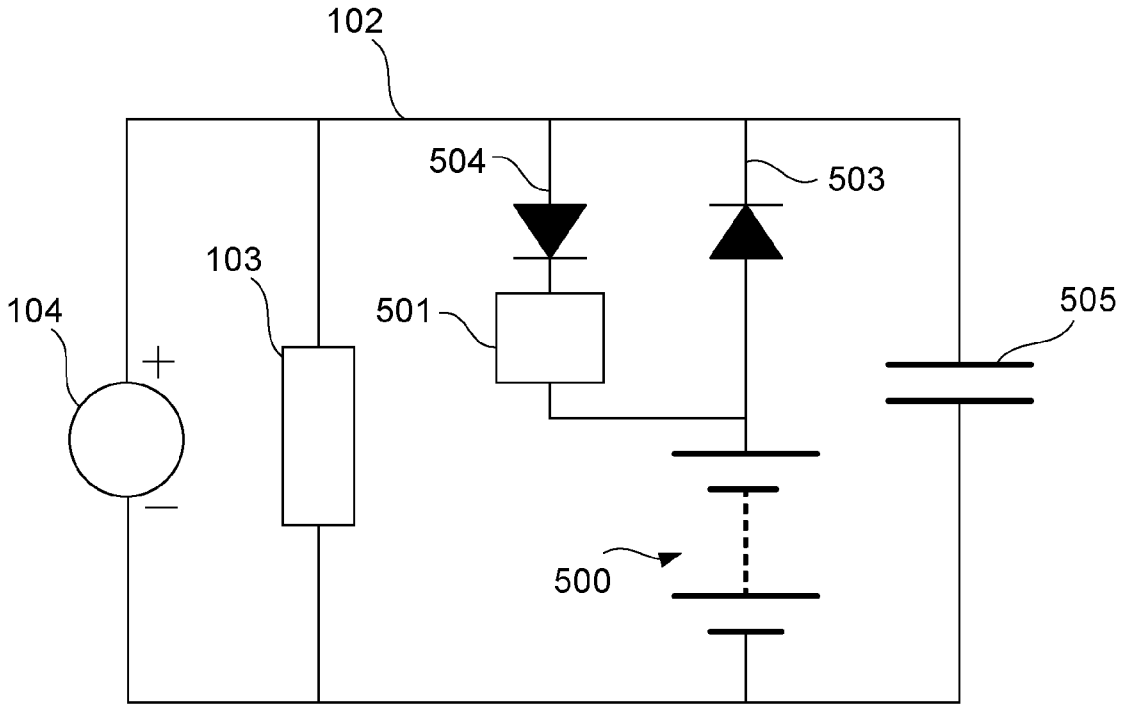


Figure 7

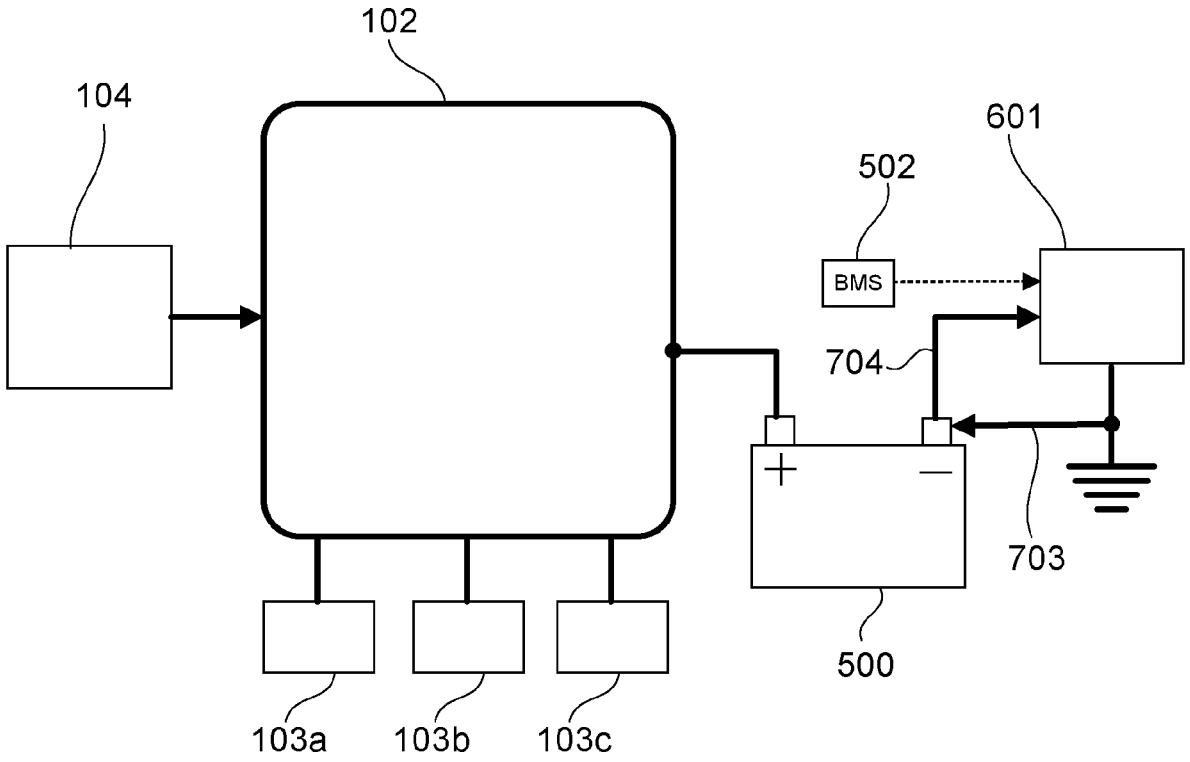


Figure 8

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

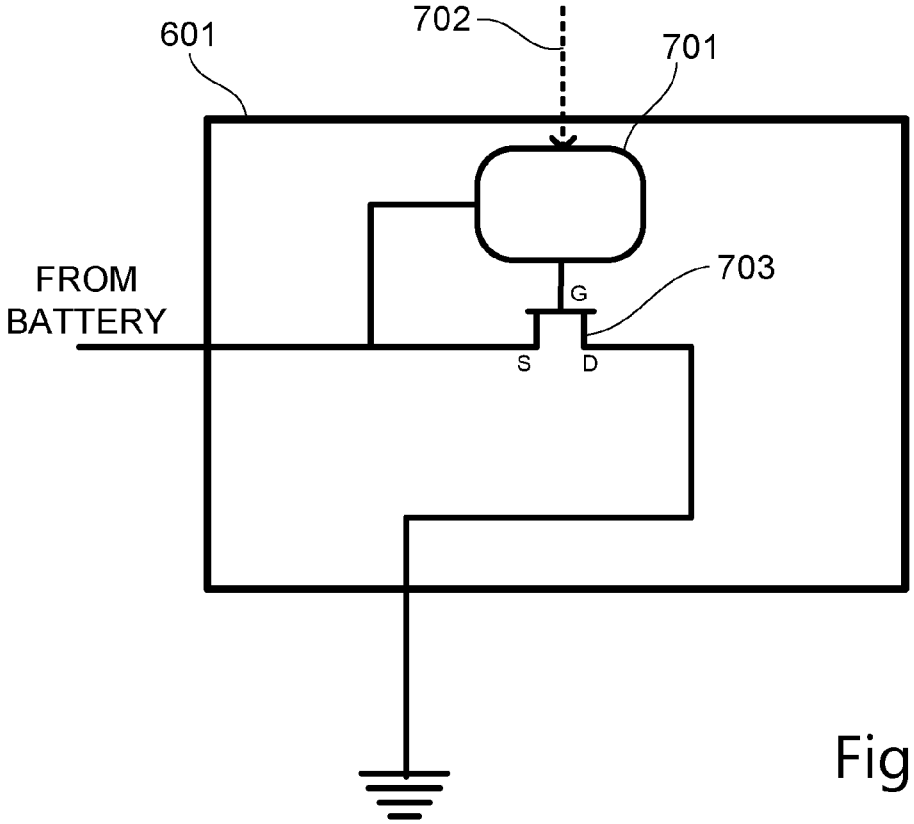


Figure 9

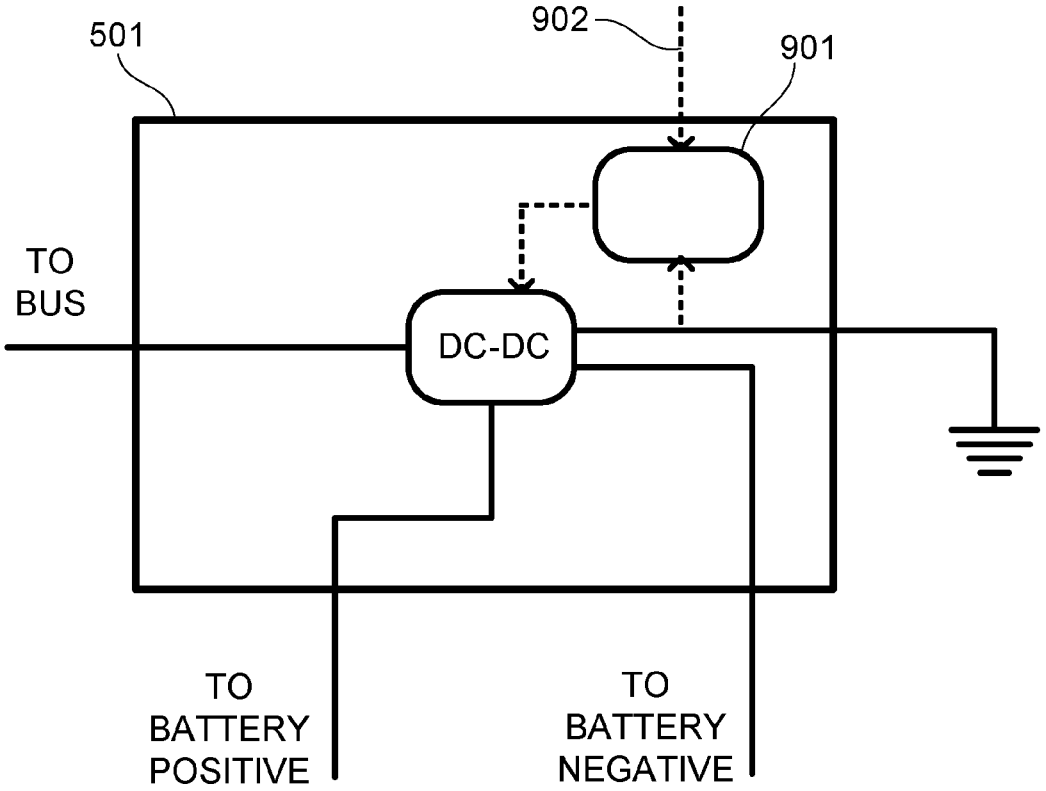


Figure 10

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

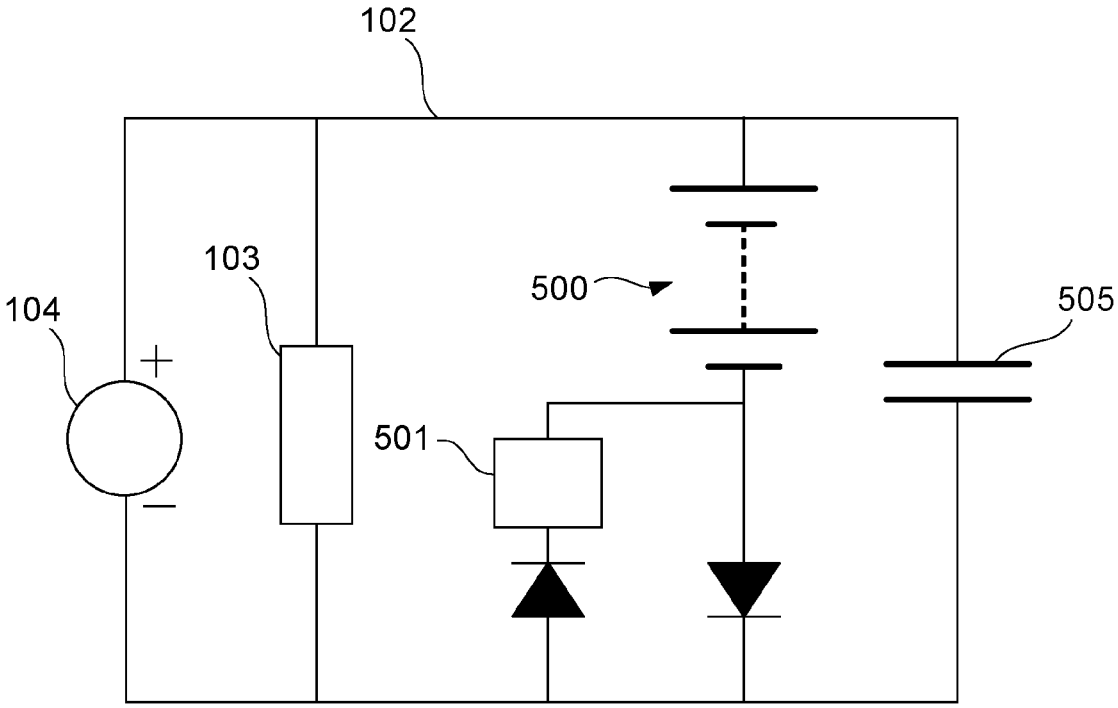


Figure 11

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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)

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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
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US 8203810 B2	19-06-2012	CA 2647732 A1	11-10-2007
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		JP 5311670 B2	09-10-2013
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		TW 200803110 A	01-01-2008
		US 2007230229 A1	04-10-2007
		WO 2007114929 A2	11-10-2007

Form PCT/ISA/210 (patent family annex) (April 2005)

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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(54) Connecting contact leads to lithium-based electrodes

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

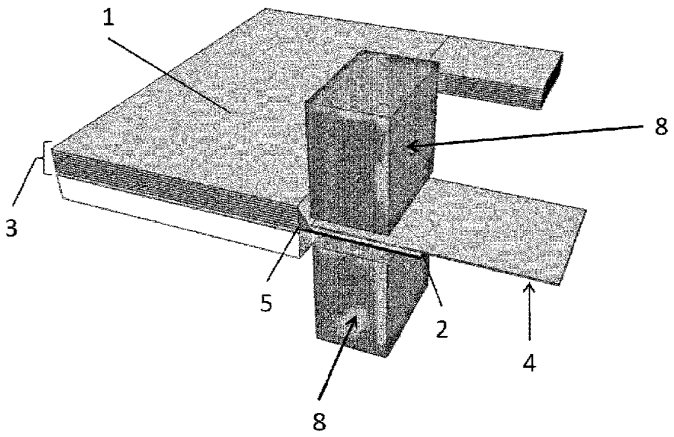


Figure 3

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EP 2 605 313 A1

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

Description

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

BACKGROUND

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

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

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

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

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

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

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

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

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

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

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

EXHIBIT 1002
Page 1668 of 2306 Petitioner ADC (IPR2024-00671)

BRIEF SUMMARY OF THE DISCLOSURE

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

EXHIBIT 1002
Page 1669 of 2306 Petitioner ADC (IPR2024-00671)

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

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

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

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

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

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

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

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

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

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

BRIEF DESCRIPTION OF THE DRAWINGS

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

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

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

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

DETAILED DESCRIPTION

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

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

EXHIBIT 1002
Page 1670 of 2306 Petitioner ADC (IPR2024-00671)

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

EXAMPLE 1

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

Table 1 - The welder setting used in Example 1.

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

EXAMPLE 2

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

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

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

Table 2 - The welder settings used in Example 2

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

EXAMPLE 3

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

EXHIBIT 1002
Page 1671 of 2306 Petitioner ADC (IPR2024-00671)

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

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

Table 3 - The welder settings used in Example 3

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

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

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

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

Claims

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

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

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

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

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

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

EXHIBIT 1002
Page 1672 of 2306 Petitioner ADC (IPR2024-00671)

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

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

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

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

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

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

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

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

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

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

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

EXHIBIT 1002
Page 1673 of 2306 Petitioner ADC (IPR2024-00671)

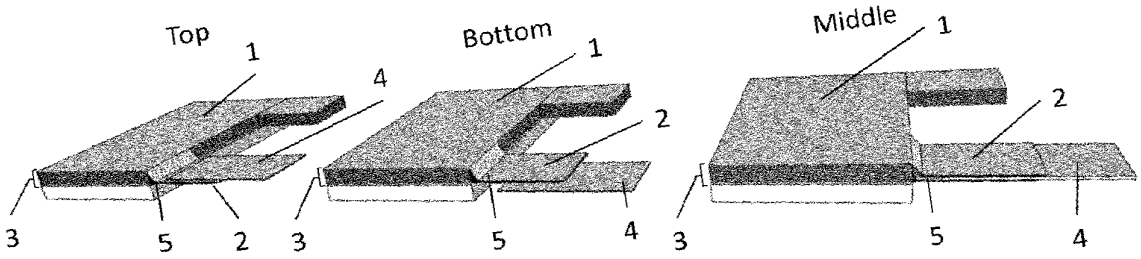


Fig 1a

Fig 1b

Fig 1c

Figure 1

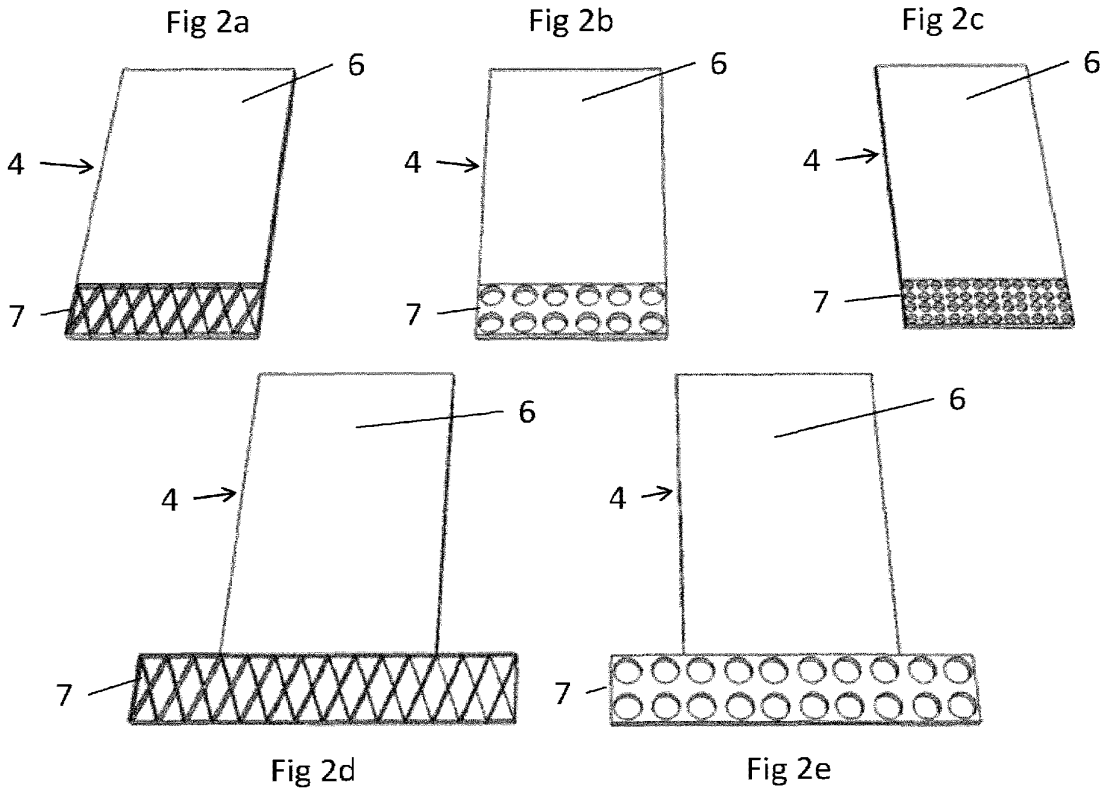


Figure 2

EXHIBIT 1002
Page 1675 of 2306 Petitioner ADC (IPR2024-00671)

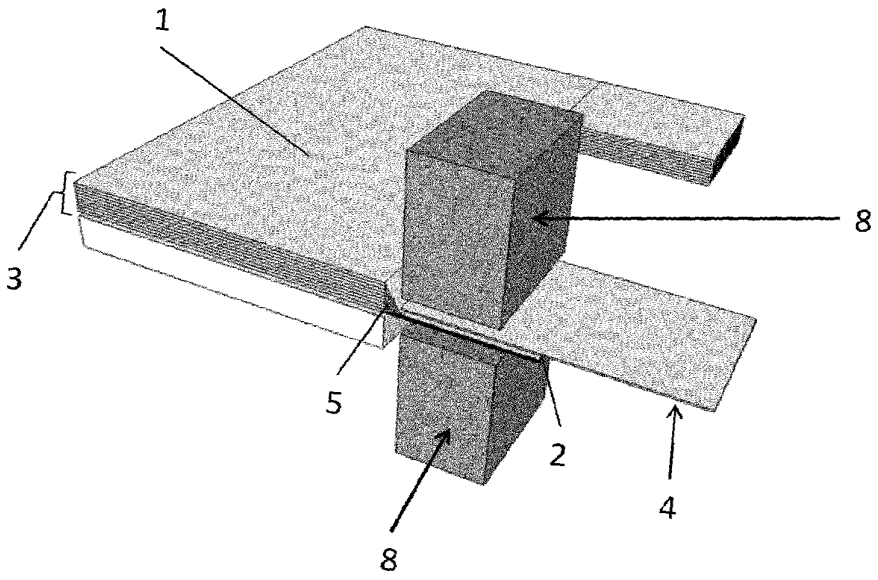


Figure 3

EXHIBIT 1002
Page 1676 of 2306 Petitioner ADC (IPR2024-00671)

Europäisches Patentamt
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EUROPEAN SEARCH REPORT

Application Number
EP 11 19 3678

DOCUMENTS CONSIDERED TO BE RELEVANT

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

The present search report has been drawn up for all claims

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

CATEGORY OF CITED DOCUMENTS

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

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 19 3678

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

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EXHIBIT 1002
Page 1678 of 2306 Petitioner ADC (IPR2024-00671)

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EXHIBIT 1002
Page 1679 of 2306 Petitioner ADC (IPR2024-00671)

(12) STANDARD PATENT APPLICATION (11) Application No. **AU 2020201223 A1**
(19) AUSTRALIAN PATENT OFFICE

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Portable vehicle battery jump start apparatus with safety protection

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B60R 16/00 (2006.01) ***H02J 7/00*** (2006.01)
B60R 16/03 (2006.01)

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EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

20202012223 20 Feb 2020

ABSTRACT

A handheld device for jump starting a vehicle engine includes a power supply such as a rechargeable lithium ion battery pack (32) and a microcontroller (1). The power supply is coupled to power output connectors of the device through a power switch circuit (15) actuated by the microcontroller. A first sensor (12) connected in circuit with positive and negative polarity outputs detects the presence of a vehicle battery (72) connected between the positive and negative polarity outputs. A second sensor (10) connected in circuit with the positive and negative polarity outputs detects the polarity of a vehicle battery connected between the positive and negative polarity outputs, such that the microcontroller will enable power to be delivered from the power supply to the output connectors only when a good battery is connected to the output connectors and only when the battery is connected with proper polarity of positive and negative terminals.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

20202012223 20 Feb 2020

PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION

FIELD OF THE INVENTION

[0001] The present invention relates generally to apparatus for jump-starting a vehicle having a depleted or discharged battery.

BACKGROUND TO THE INVENTION

[0002] Prior art devices are known for jump-starting a vehicle, which provide either a pair of electrical connector cables that connect a fully-charged battery of another vehicle to the engine start circuit of the dead battery vehicle, or portable booster devices which include a fully-charged battery which can be connected in circuit with the vehicle's engine starter through a pair of cables.

[0003] Problems with the prior art arose when either the jumper terminals or clamps of the cables were inadvertently brought into contact with each other while the other ends were connected to a charged battery, or when the positive and negative terminals were connected to the opposite polarity terminals in the vehicle to be jumped, thereby causing a short circuit resulting in sparking and potential damage to batteries and/or bodily injury.

[0004] Various attempts to eliminate these problems have been made in the prior art. U.S. Patent No. 6,212,054 issued April 3, 2001, discloses a battery booster pack that is polarity sensitive and can detect proper and improper connections before providing a path for electric current flow. The device uses a set of LEDs connected to optical couplers oriented by a control circuit. The control circuit controls a solenoid assembly controlling the path of power current. The control circuit causes power current to flow through the solenoid assembly only if the points of contact of booster cable clamp connections have been properly made.

20202012223 20 Feb 2020

[0005] U.S. Patent No. 6,632,103 issued October 14, 2003, discloses an adaptive booster cable connected with two pairs of clips, wherein the two pairs of clips are respectively attached to two batteries to transmit power from one battery to the other battery. The adaptive booster cable includes a polarity detecting unit connected to each clip, a switching unit and a current detecting unit both provided between the two pairs of clips. After the polarity of each clip is sensed by the polarity detecting unit, the switching unit generates a proper connection between the two batteries. Therefore, the positive and negative terminals of the two batteries are correctly connected based on the detected result of the polarity detecting unit.

[0006] U.S. Patent No. 8,493,021 issued July 23, 2013, discloses apparatus that monitors the voltage of the battery of a vehicle to be jump started and the current delivered by the jump starter batteries to determine if a proper connection has been established and to provide fault monitoring. Only if the proper polarity is detected can the system operate. The voltage is monitored to determine open circuit, disconnected conductive clamps, shunt cable fault, and solenoid fault conditions. The current through the shunt cable is monitored to determine if there is a battery explosion risk, and for excessive current conditions presenting an overheating condition, which may result in fire. The system includes an internal battery to provide the power to the battery of the vehicle to be jump started. Once the vehicle is started, the unit automatically electrically disconnects from the vehicle's battery.

[0007] U.S. Patent No. 5,189,359 issued February 23, 1993, discloses a jumper cable device having two bridge rectifiers for developing a reference voltage, a four-input decoder for determining which terminals are to be connected based on a comparison of the voltage at each of the four terminals to the reference voltage, and a pair of relays for effecting the correct connection depending on the determination of the decoder. No connection will be made unless only one terminal of each battery has a higher voltage than the reference voltage, indicating "positive" terminals, and one has a lower voltage than the reference voltage, indicating "negative" terminals, and that, therefore, the two

20 Feb 2020 20202012223

high voltage terminals may be connected and the two lower voltage terminals may be connected. Current flows once the appropriate relay device is closed. The relay device is preferably a MOSFET combined with a series array of photodiodes that develop MOSFET gate-closing potential when the decoder output causes an LED to light.

[0008] U.S. Patent No. 5,795,182 issued August 18, 1998, discloses a polarity independent set of battery jumper cables for jumping a first battery to a second battery. The apparatus includes a relative polarity detector for detecting whether two batteries are configured cross or parallel. A three-position high current capacity crossbar pivot switch is responsive to the relative polarity detector for automatically connecting the plus terminals of the two batteries together and the minus terminals of the two batteries together regardless of whether the configuration detected is cross or parallel, and an undercurrent detector and a delay circuit for returning the device to its ready and unconnected state after the device has been disconnected from one of the batteries. The crossbar pivot switch includes two pairs of contacts, and a pivot arm that pivots about two separate points to ensure full electrical contact between the pairs of contacts. The invention can also be used to produce a battery charger that may be connected to a battery without regard to the polarity of the battery.

[0009] U.S. Patent No. 6,262,492 issued July 17, 2001, discloses a car battery jumper cable for accurately coupling an effective power source to a failed or not charged battery, which includes a relay switching circuit connected to the power source and the battery by two current conductor pairs. First and second voltage polarity recognition circuits are respectively connected to the power source and the battery by a respective voltage conductor pair to recognize the polarity of the power source and the battery. A logic recognition circuit produces a control signal subject to the polarity of the power source and the battery, and a driving circuit controlled by the control signal from the logic recognition circuit drives the relay switching circuit, enabling the two poles of the power source to be accurately coupled to the two poles of the battery.

20202012223 20 Feb 2020

[0010] U.S. Patent No. 5,635,817 issued June 3, 1997, discloses a vehicle battery charging device that includes a control housing having cables including a current limiting device to prevent exceeding of a predetermined maximum charging current of about 40 to 60 amps. The control housing includes a polarity detecting device to verify the correct polarity of the connection of the terminals of the two batteries and to electrically disconnect the two batteries if there is an incorrect polarity.

[0011] U.S. Patent No. 8,199,024 issued June 12, 2012, discloses a safety circuit in a low-voltage connecting system that leaves the two low-voltage systems disconnected until it determines that it is safe to make a connection. When the safety circuit determines that no unsafe conditions exist and that it is safe to connect the two low-voltage systems, the safety circuit may connect the two systems by way of a "soft start" that provides a connection between the two systems over a period of time that reduces or prevents inductive voltage spikes on one or more of the low-voltage systems. When one of the low-voltage systems has a completely-discharged battery incorporated into it, a method is used for detection of proper polarity of the connections between the low-voltage systems. The polarity of the discharged battery is determined by passing one or more test currents through it and determining whether a corresponding voltage rise is observed.

[0012] U.S. Patent No. 5,793,185 issued August 11, 1998, discloses a hand-held jump starter having control components and circuits to prevent overcharging and incorrect connection to batteries.

[0013] While the prior art attempted solutions to the abovementioned problems as discussed above, each of the prior art solutions suffers from other shortcomings, either in complexity, cost or potential for malfunction. Accordingly, there exists a need in the art for further improvements to vehicle jump start devices.

20202012223 20 Feb 2020

SUMMARY OF THE INVENTION

[0014] In accordance with an aspect of the invention, an apparatus is provided for jump starting a vehicle engine, comprising: an internal power supply; an output port having positive and negative polarity outputs; a vehicle battery isolation sensor connected in circuit with said positive and negative polarity outputs, configured to detect presence of a vehicle battery connected between said positive and negative polarity outputs; a reverse polarity sensor connected in circuit with said positive and negative polarity outputs, configured to detect polarity of a vehicle battery connected between said positive and negative polarity outputs and to provide an output signal indicating whether positive and negative terminals of said vehicle battery are properly connected with said positive and negative polarity outputs of said output port; a power switch connected between said internal power supply and said output port; and a microcontroller configured to receive input signals from said vehicle isolation sensor and said reverse polarity sensor, and to provide an output signal to said power switch, such that said power switch is turned on to cause said internal power supply to be connected to said output port in response to signals from said sensors indicating the presence of a vehicle battery at said output port and proper polarity connection of positive and negative terminals of said vehicle battery with said positive and negative polarity outputs, and is not turned on when signals from said sensors indicate either the absence of a vehicle battery at said output port or improper polarity connection of positive and negative terminals of said vehicle battery with said positive and negative polarity outputs.

[0015] In accordance with an embodiment of the invention, the internal power supply is a rechargeable lithium ion battery pack.

[0016] A jumper cable device may also be provided, having a plug configured to plug into said output port; a pair of cables integrated with the plug at one respective end thereof; said pair of cables being configured to be separately connected to terminals of a battery at another respective end thereof.

2020201223 20 Feb 2020

[0017] Comprises/comprising and grammatical variations thereof when used in this specification are to be taken to specify the presence of stated features, integers, steps or components or groups thereof, but do not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] Fig. 1 is a functional block diagram of a handheld vehicle battery boost apparatus in accordance with one aspect of the present invention;

[0019] Figs. 2A – 2C are schematic circuit diagrams of an example embodiment of a handheld vehicle battery boost apparatus in accordance with an aspect of the invention;

[0020] Fig. 3 is a perspective view of a handheld jump starter booster device in accordance with one example embodiment of the invention; and

[0021] Fig. 4 is a plan view of a jumper cable usable with the handheld jump starter booster device in accordance with another aspect of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0022] FIG. 1 is a functional block diagram of a handheld battery booster according to one aspect of the invention. At the heart of the handheld battery booster is a lithium polymer battery pack 32, which stores sufficient energy to jump start a vehicle engine served by a conventional 12 volt lead-acid or valve regulated lead-acid battery. In one example embodiment, a high-surge lithium polymer battery pack includes three 3.7V, 2666 mAh lithium polymer batteries in a 3S1P configuration. The resulting battery pack provides 11.1V, 2666Ah (8000Ah at 3.7V, 29.6Wh). Continuous discharge current is 25C (or 200 amps), and burst discharge current is 50C (or 400 amps). The maximum charging current of the battery pack is 8000mA (8 amps).

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

20202012223 20 Feb 2020

[0023] A programmable microcontroller unit (MCU) 1 receives various inputs and produces informational as well as control outputs. The programmable MCU 1 further provides flexibility to the system by allowing updates in functionality and system parameters, without requiring any change in hardware. According to one example embodiment, an 8 bit microcontroller with 2K x 15 bits of flash memory is used to control the system. One such microcontroller is the HT67F30, which is commercially available from Holtek Semiconductor Inc.

[0024] A car battery reverse sensor 10 monitors the polarity of the vehicle battery 72 when the handheld battery booster device is connected to the vehicle's electric system. As explained below, the booster device prevents the lithium battery pack from being connected to the vehicle battery 72 when the terminals of the battery 72 are connected to the wrong terminals of the booster device. A car battery isolation sensor 12 detects whether or not a vehicle battery 72 is connected to the booster device, and prevents the lithium battery pack from being connected to the output terminals of the booster device unless there is a good (e.g. chargeable) battery connected to the output terminals.

[0025] A smart switch FET circuit 15 electrically switches the handheld battery booster lithium battery to the vehicle's electric system only when the vehicle battery is determined by the MCU 1 to be present (in response to a detection signal provided by isolation sensor 12) and connected with the correct polarity (in response to a detection signal provided by reverse sensor 10). A lithium battery temperature sensor 20 monitors the temperature of the lithium battery pack 32 to detect overheating due to high ambient temperature conditions and overextended current draw during jump starting. A lithium battery voltage measurement circuit 24 monitors the voltage of the lithium battery pack 32 to prevent the voltage potential from rising too high during a charging operation and from dropping too low during a discharge operation.

[0026] Lithium battery back-charge protection diodes 28 prevent any charge current being delivered to the vehicle battery 72 from flowing back to the lithium battery pack 32 from the vehicle's electrical system. Flashlight LED circuit 36 is

20202012223 20 Feb 2020

provided to furnish a flashlight function for enhancing light under a vehicle's hood in dark conditions, as well as providing SOS and strobe lighting functions for safety purposes when a vehicle may be disabled in a potentially dangerous location. Voltage regulator 42 provides regulation of internal operating voltage for the microcontroller and sensors. On/Off manual mode and flashlight switches 46 allow the user to control power-on for the handheld battery booster device, to control manual override operation if the vehicle has no battery, and to control the flashlight function. The manual button functions only when the booster device is powered on. This button allows the user to jump-start vehicles that have either a missing battery, or the battery voltage is so low that automatic detection by the MCU is not possible. When the user presses and holds the manual override button for a predetermined period time (such as three seconds) to prevent inadvertent actuation of the manual mode, the internal lithium ion battery power is switched to the vehicle battery connect port. The only exception to the manual override is if the car battery is connected in reverse. If the car battery is connected in reverse, the internal lithium battery power shall never be switched to the vehicle battery connect port.

[0027] USB charge circuit 52 converts power from any USB charger power source, to charge voltage and current for charging the lithium battery pack 32. USB output 56 provides a USB portable charger for charging smartphones, tablets, and other rechargeable electronic devices. Operation indicator LEDs 60 provide visual indication of lithium battery capacity status as well as an indication of smart switch activation status (indicating that power is being provided to the vehicle's electrical system).

[0028] Detailed operation of the handheld booster device will now be described with reference to the schematic diagrams of Figs. 2A-2C. As shown in Fig. 2A, the microcontroller unit 1 is the center of all inputs and outputs. The reverse battery sensor 10 comprises an optically coupled isolator phototransistor (4N27) connected to the terminals of vehicle battery 72 at input pins 1 and 2 with a diode D8 in the lead conductor of pin 1 (associated with the negative terminal CB-), such that if the battery 72 is connected to the terminals of the booster

20202012223 20 Feb 2020

device with the correct polarity, the optocoupler LED 11 will not conduct current, and is therefore turned off, providing a "1" or high output signal to the MCU 1. The car battery isolation sensor 12 comprises an optically coupled isolator phototransistor (4N27) connected to the terminals of vehicle battery 72 at input pins 1 and 2 with a diode D7 in the lead conductor of pin 1 (associated with the positive terminal CB+), such that if the battery 72 is connected to the terminals of the booster device with the correct polarity, the optocoupler LED 11A will conduct current, and is therefore turned on, providing a "0" or low output signal to the MCU, indicating the presence of a battery across the jumper output terminals of the handheld booster device.

[0029] If the car battery 72 is connected to the handheld booster device with reverse polarity, the optocoupler LED 11 of the reverse sensor 10 will conduct current, providing a "0" or low signal to microcontroller unit 1. Further, if no battery is connected to the handheld booster device, the optocoupler LED 11A of the isolation sensor 12 will not conduct current, and is therefore turned off, providing a "1" or high output signal to the MCU, indicating the absence of any battery connected to the handheld booster device. Using these specific inputs, the microcontroller software of MCU 1 can determine when it is safe to turn on the smart switch FET 15, thereby connecting the lithium battery pack to the jumper terminals of the booster device. Consequently, if the car battery 72 either is not connected to the booster device at all, or is connected with reverse polarity, the MCU 1 can keep the smart switch FET 15 from being turned on, thus prevent sparking/short circuiting of the lithium battery pack.

[0030] As shown in Fig. 2B, the FET smart switch 15 is driven by an output of the microcontroller 1. The FET smart switch 15 includes three FETs (Q15, Q18, and Q19) in parallel, which spreads the distribution of power from the lithium battery pack over the FETs. When that microcontroller output is driven to a logic low, FETs 16 are all in a high resistance state, therefore not allowing current to flow from the internal lithium battery negative contact 17 to the car battery 72 negative contact. When the microcontroller output is driven to a logic high, the FETs 16 (Q15, Q18, and Q19) are in a low resistant state, allowing current to flow

20 Feb 2020 20202012223

freely from the internal lithium battery pack negative contact 17 (LB-) to the car battery 72 negative contact (CB-). In this way, the microcontroller software controls the connection of the internal lithium battery pack 32 to the vehicle battery 72 for jumpstarting the car engine.

[0031] Referring back to Fig. 2A, the internal lithium battery pack voltage can be accurately measured using circuit 24 and one of the analog-to-digital inputs of the microcontroller 1. Circuit 24 is designed to sense when the main 3.3V regulator 42 voltage is on, and to turn on transistor 23 when the voltage of regulator 42 is on. When transistor 23 is conducting, it turns on FET 22, thereby providing positive contact (LB+) of the internal lithium battery a conductive path to voltage divider 21 allowing a lower voltage range to be brought to the microcontroller to be read. Using this input, the microcontroller software can determine if the lithium battery voltage is too low during discharge operation or too high during charge operation, and take appropriate action to prevent damage to electronic components.

[0032] Still referring to Fig. 2A, the temperature of the internal lithium battery pack 32 can be accurately measured by two negative temperature coefficient (NTC) devices 20. These are devices that reduce their resistance when their temperature rises. The circuit is a voltage divider that brings the result to two analog-to-digital (A/D) inputs on the microcontroller 1. The microcontroller software can then determine when the internal lithium battery is too hot to allow jumpstarting, adding safety to the design.

[0033] The main voltage regulator circuit 42 is designed to convert internal lithium battery voltage to a regulated 3.3 volts that is utilized by the microcontroller 1 as well as by other components of the booster device for internal operating power. Three lithium battery back charge protection diodes 28 (see Fig. 2B) are in place to allow current to flow only from the internal lithium battery pack 32 to the car battery 72, and not from the car battery to the internal lithium battery. In this way, if the car electrical system is charging from its alternator, it

20202012223 20 Feb 2020

cannot back-charge (and thereby damage) the internal lithium battery, providing another level of safety.

[0034] The main power on switch 46 (Fig. 2A) is a combination that allows for double pole, double throw operation so that with one push, the product can be turned on if it is in the off state, or turned off if it is in the on state. This circuit also uses a microcontroller output 47 to "keep alive" the power when it is activated by the on switch. When the switch is pressed the microcontroller turns this output to a high logic level to keep power on when the switch is released. In this way, the microcontroller maintains control of when the power is turned off when the on/off switch is activated again or when the lithium battery voltage is getting too low. The microcontroller software also includes a timer that turns the power off after a predefined period of time, (such as, e.g. 8 hours) if not used.

[0035] The flashlight LED circuit 45 shown in Fig. 2B controls the operation of flashlight LEDs. Two outputs from the microcontroller 1 are dedicated to two separate LEDs. Thus, the LEDs can be independently software-controlled for strobe and SOS patterns, providing yet another safety feature to the booster device. LED indicators provide the feedback the operator needs to understand what is happening with the product. Four separate LEDs 61 (Fig. 2A) are controlled by corresponding individual outputs of microcontroller 1 to provide indication of the remaining capacity of the internal lithium battery. These LEDs are controlled in a "fuel gauge" type format with 25%, 50%, 75% and 100% (red, red, yellow, green) capacity indications. An LED indicator 63 (Fig. 2B) provides a visual warning to the user when the vehicle battery 72 has been connected in reverse polarity. "Boost" and on/off LEDs 62 provide visual indications when the booster device is provide jump-start power, and when the booster device is turned on, respectively.

[0036] A USB output 56 circuit (Fig. 2C) is included to provide a USB output for charging portable electronic devices such as smartphones from the internal lithium battery pack 32. Control circuit 57 from the microcontroller 1 allows the USB Out 56 to be turned on and off by software control to prevent the internal

20202012223 20 Feb 2020

lithium battery getting too low in capacity. The USB output is brought to the outside of the device on a standard USB connector 58, which includes the standard voltage divider required for enabling charge to certain smartphones that require it.

[0037] The USB charge circuit 52 allows the internal lithium battery pack 32 to be charged using a standard USB charger. This charge input uses a standard micro-USB connector 48 allowing standard cables to be used. The 5V potential provided from standard USB chargers is up-converted to the 12.4VDC voltage required for charging the internal lithium battery pack using a DC-DC converter 49. The DC-DC converter 49 can be turned on and off via circuit 53 by an output from the microcontroller 1.

[0038] In this way, the microcontroller software can turn the charge off if the battery voltage is measured to be too high by the A/D input 22. Additional safety is provided for helping to eliminate overcharge to the internal lithium battery using a lithium battery charge controller 50 that provides charge balance to the internal lithium battery cells 51. This controller also provides safety redundancy for eliminating over discharge of the internal lithium battery.

[0039] Fig. 3 is a perspective view of a handheld device 300 in accordance with an exemplary embodiment of the invention. 301 is a power on switch. 302 shows the LED "fuel gauge" indicators 61. 303 shows a 12 volt output port connectable to a cable device 400, described further below. 304 shows a flashlight control switch for activating flashlight LEDs 45. 305 is a USB input port for charging the internal lithium battery, and 306 is a USB output port for providing charge from the lithium battery to other portable devices such as smartphones, tablets, music players, etc. 307 is a "boost on" indicator showing that power is being provided to the 12V output port. 308 is a "reverse" indicator showing that the vehicle battery is improperly connected with respect to polarity. 309 is a "power on" indicator showing that the device is powered up for operation.

20202012223 20 Feb 2020

[0040] Fig. 4 shows a jumper cable device 400 specifically designed for use with the handheld device 300. Device 400 has a plug 401 configured to plug into 12 volt output port 303 of the handheld device 300. A pair of cables 402a and 402b are integrated with the plug 401, and are respectively connected to battery terminal clamps 403a and 403b via ring terminals 404a and 404b. The port 303 and plug 401 may be dimensioned so that the plug 401 will only fit into the port 303 in a specific orientation, thus ensuring that clamp 403a will correspond to positive polarity, and clamp 403b will correspond to negative polarity, as indicated thereon. Additionally, the ring terminals 404a and 404b may be disconnected from the clamps and connected directly to the terminals of a vehicle battery. This feature may be useful, for example, to permanently attach the cables 302a-302b to the battery of a vehicle. In the event that the battery voltage becomes depleted, the handheld booster device 300 could be properly connected to the battery very simply by plugging in the plug 401 to the port 303.

[0041] The invention having been thus described, it will be apparent to those skilled in the art that the same may be varied in many ways without departing from the spirit or scope of the invention. Any and all such variations are intended to be encompassed within the scope of the following claims.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

2020201223 20 Feb 2020

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Apparatus for jump starting a vehicle engine, comprising:

an internal power supply;

an output port having positive and negative polarity outputs;

a vehicle battery isolation sensor connected in circuit with said positive and negative polarity outputs, configured to detect presence of a vehicle battery connected between said positive and negative polarity outputs;

a reverse polarity sensor connected in circuit with said positive and negative polarity outputs, configured to detect polarity of a vehicle battery connected between said positive and negative polarity outputs and to provide an output signal indicating whether positive and negative terminals of said vehicle battery are properly connected with said positive and negative polarity outputs of said output port;

a power switch connected between said internal power supply and said output port; and

a microcontroller configured to receive input signals from said vehicle isolation sensor and said reverse polarity sensor, and to provide an output signal to said power switch, such that said power switch is turned on to cause said internal power supply to be connected to said output port in response to signals from said sensors indicating the presence of a vehicle battery at said output port and proper polarity connection of positive and negative terminals of said vehicle battery with said positive and negative polarity outputs, and is not turned on when signals from said sensors indicate either the absence of a vehicle battery at said output port or improper polarity connection of positive and negative terminals of said vehicle battery with said positive and negative polarity outputs.

2. The apparatus of claim 1, wherein said internal power supply comprises a lithium ion battery.

3. The apparatus of claim 2, wherein said lithium ion battery comprises a battery pack of multiple lithium ion batteries.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

20 Feb 2020 2020201223

4. The apparatus of claim 1, wherein said power switch comprises a plurality of FETs in parallel.

5. The apparatus of claim 1, wherein said vehicle isolation sensor and reverse polarity sensor comprise optically coupled isolator phototransistors.

6. The apparatus of claim 1, further comprising a plurality of power diodes coupled between said output port and said internal power supply to prevent back-charging of said internal power supply from an electrical system connected to said output port.

7. The apparatus of claim 1, further comprising a temperature sensor configured to detect temperature of said internal power supply and to provide a temperature signal to said microcontroller.

8. The apparatus of claim 1, further comprising a voltage measurement circuit configured to measure output voltage of said internal power supply and to provide a voltage measurement signal to said microcontroller.

9. The apparatus of claim 1, further comprising a voltage regulator configured to convert output voltage of said internal power supply to a voltage level appropriate to provide operating power to internal components of the apparatus.

10. The apparatus of claim 1, further comprising a USB output port configured to provide charging power from said internal power supply to a USB-chargeable device.

11. The apparatus of claim 1, further comprising a USB charging port configured to provide charging power from an external power source to said internal power supply.

20 Feb 2020 20202012223

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

13. The apparatus of claim 12, wherein said source of light is at least one LED.

14. The apparatus of claim 13, wherein said microcontroller is configured to control said at least one LED to provide a visual alarm indicating an emergency situation.

15. The apparatus of claim 1, further comprising a plurality of visual indicators configured to display remaining capacity status of said internal power supply.

16. The apparatus of claim 15, wherein said plurality of visual indicators comprises a plurality of LEDs providing output light of different colors.

17. The apparatus of claim 1, further comprising a visual indicator configured to warn a user when a vehicle battery is connected with reverse polarity.

18. The apparatus of claim 1, further comprising separate visual indicators configured to display the power on status of the apparatus, and the jump start boost power status of power supplied to said output port.

19. 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 said output port when said vehicle battery isolation sensor is unable to detect presence of a vehicle battery.

20. The apparatus of claim 19, wherein said microcontroller is configured to detect actuation of said manual override switch for at least a predetermined period of time before activation of said manual override mode.

2020201223 20 Feb 2020

21. The apparatus of claim 1, further comprising a jumper cable device including a plug configured to plug into said output port, a pair of cables integrated with the plug at one respective end thereof and being configured to be connected to terminals of a battery at another respective end thereof.

22. The apparatus of claim 21, wherein said jumper cable device further comprises a pair of ring terminals configured to respectively connect said pair of cables at said another end thereof with one of a battery terminal and a battery terminal clamp.

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

THE NOCO COMPANY

WATERMARK PATENT AND TRADE MARKS ATTORNEYS

P41255AU04

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

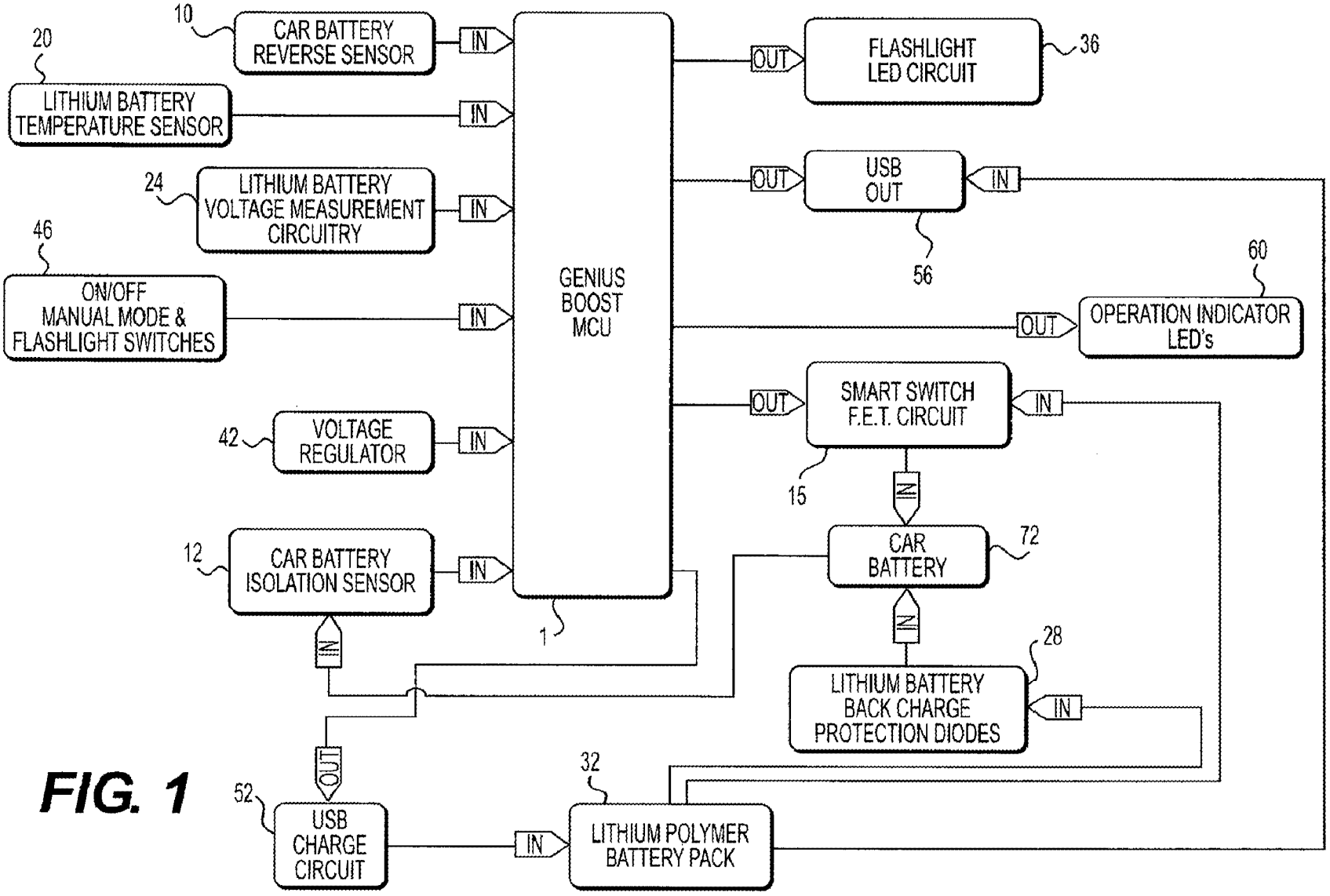


FIG. 1

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EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

20202012223 20 Feb 2020

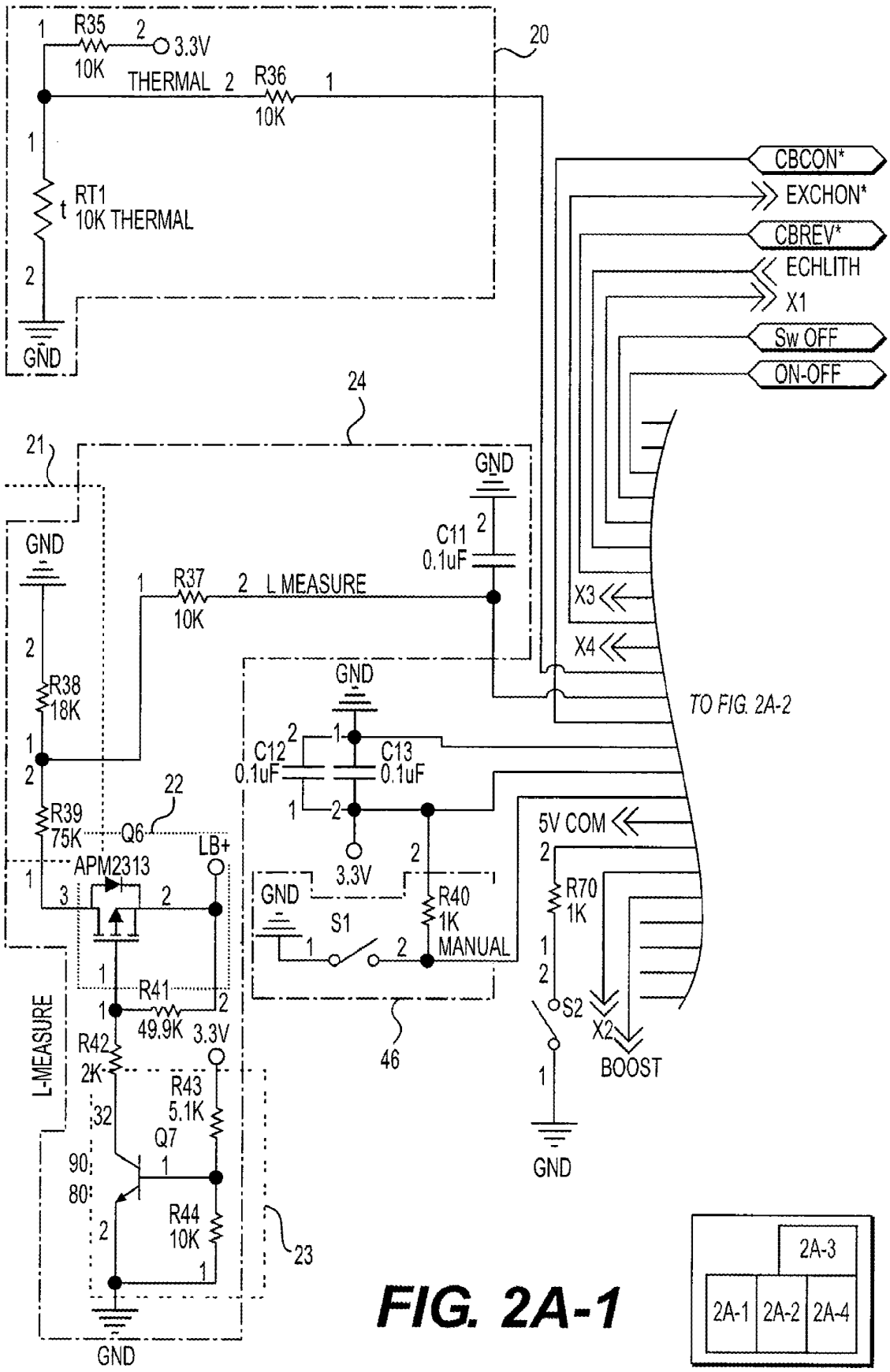
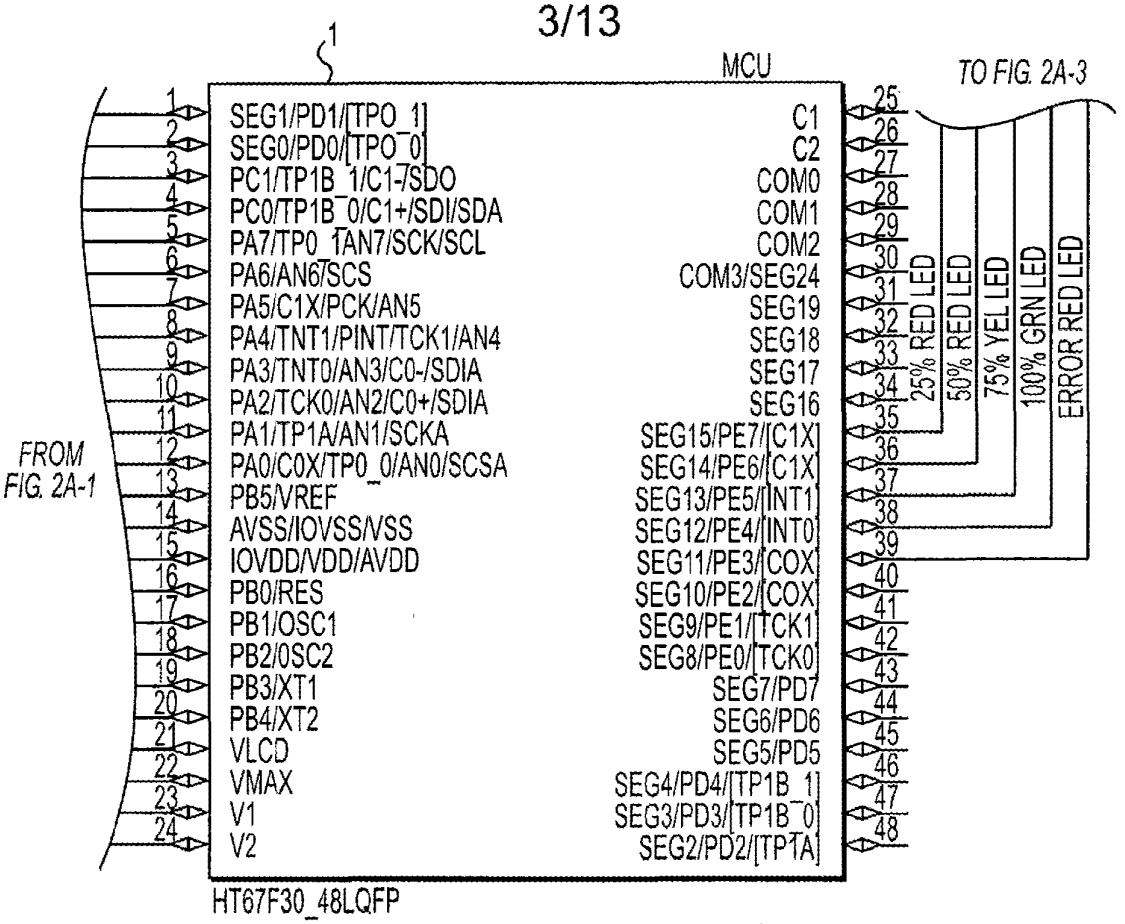


FIG. 2A-1

20202012223 20 Feb 2020



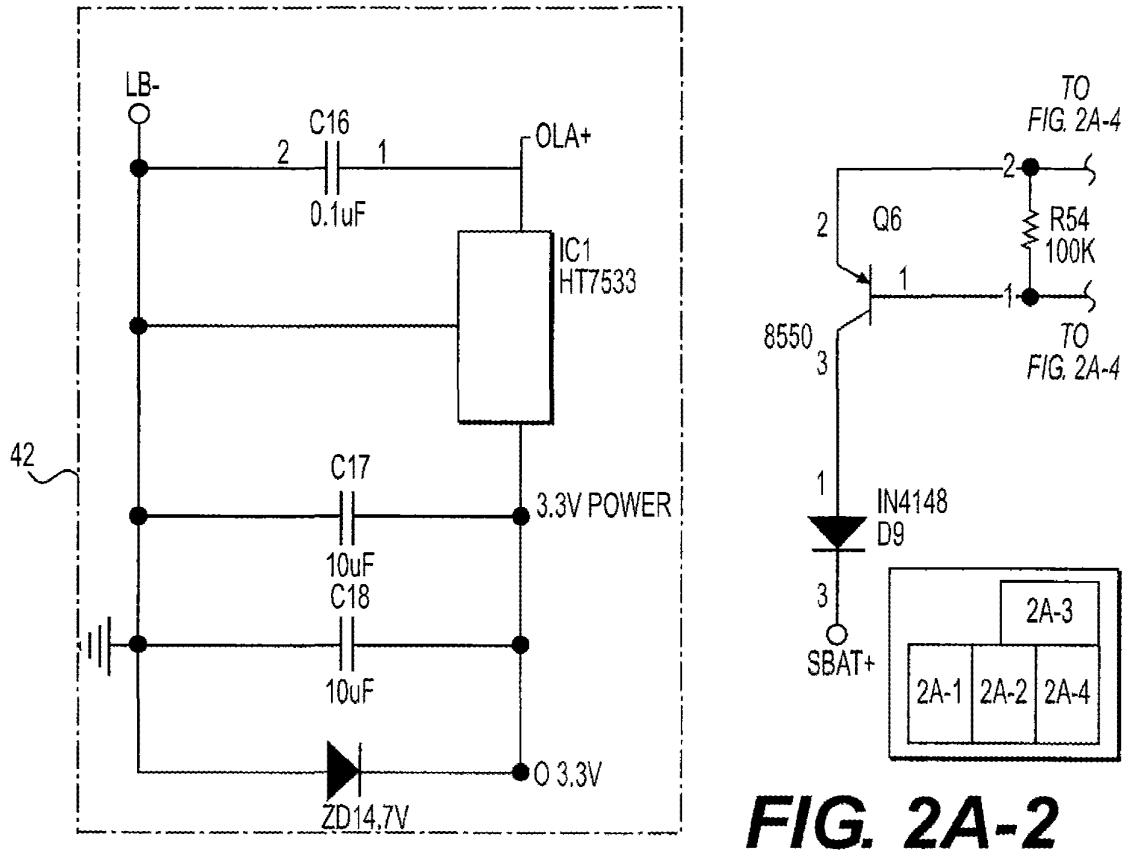


FIG. 2A-2

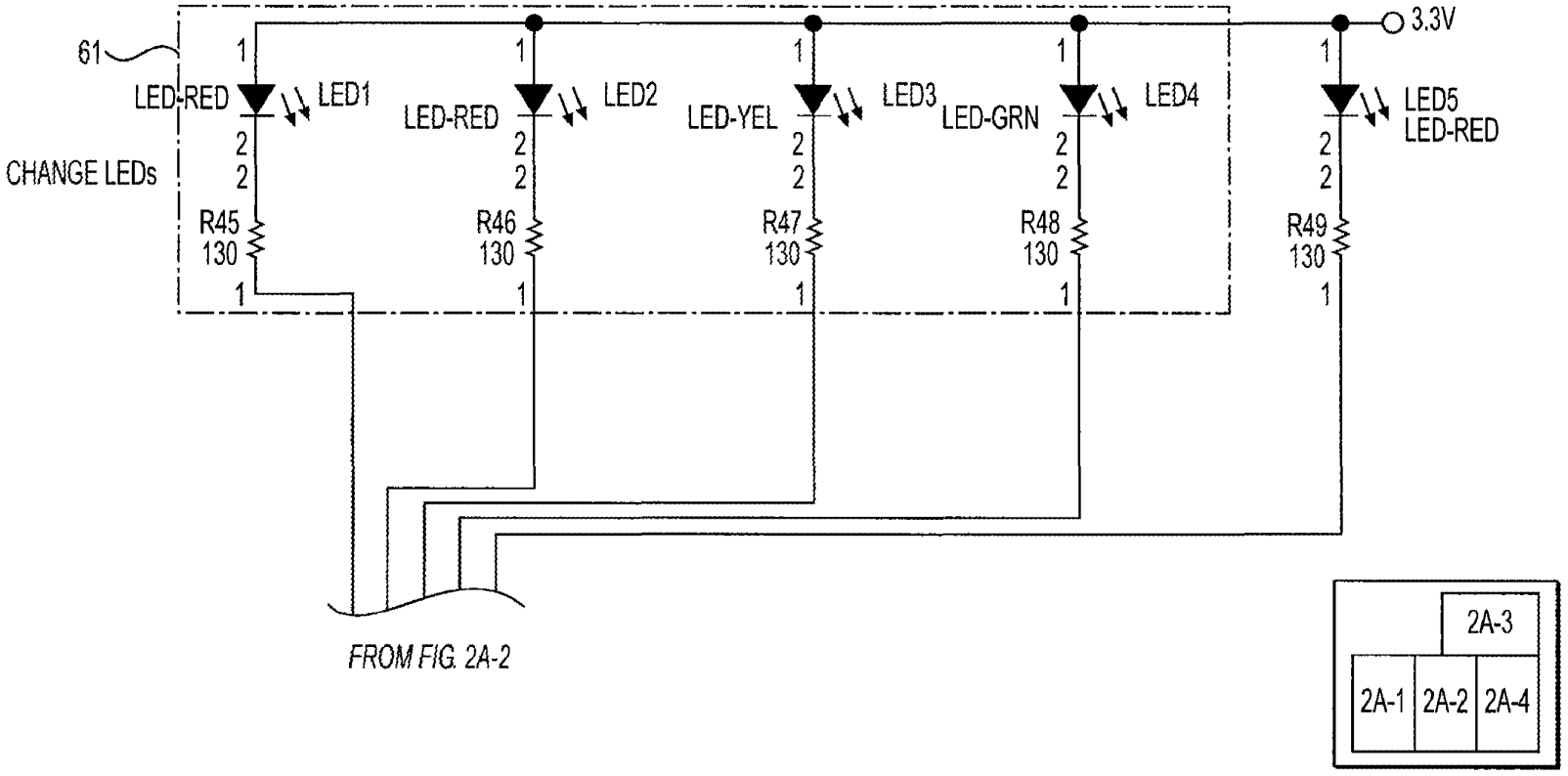


FIG. 2A-3

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

20202012223 20 Feb 2020

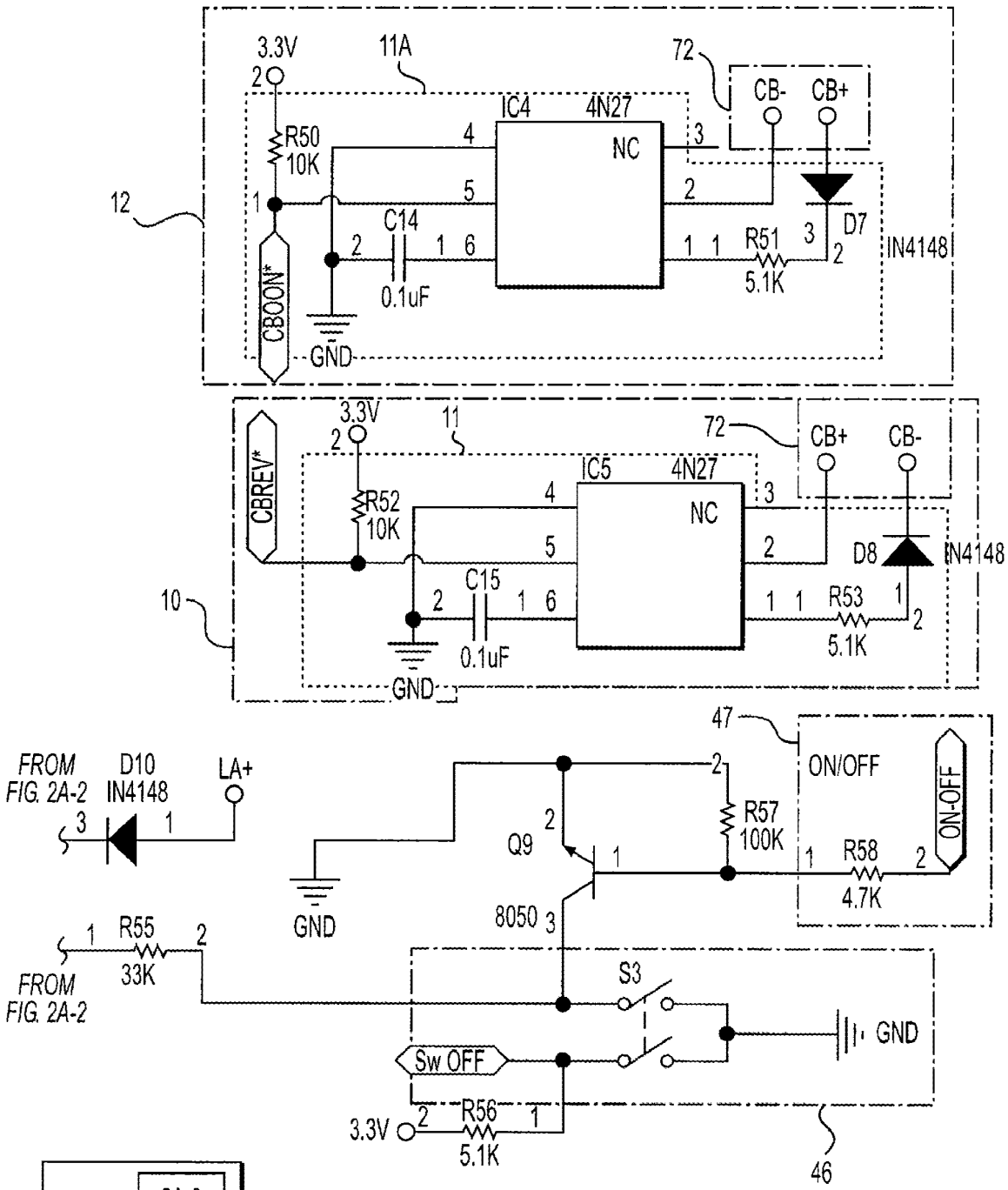


FIG. 2A-4

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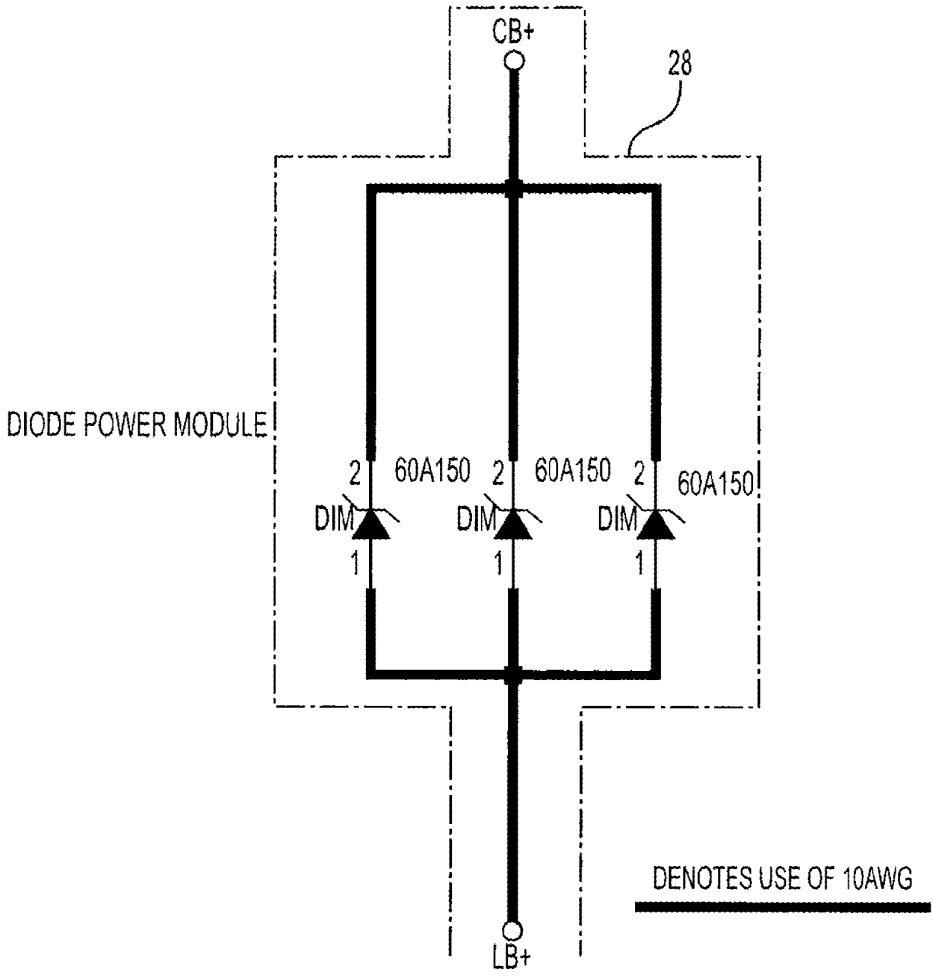


FIG. 2B-1

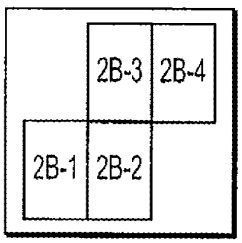


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20202012223 20 Feb 2020

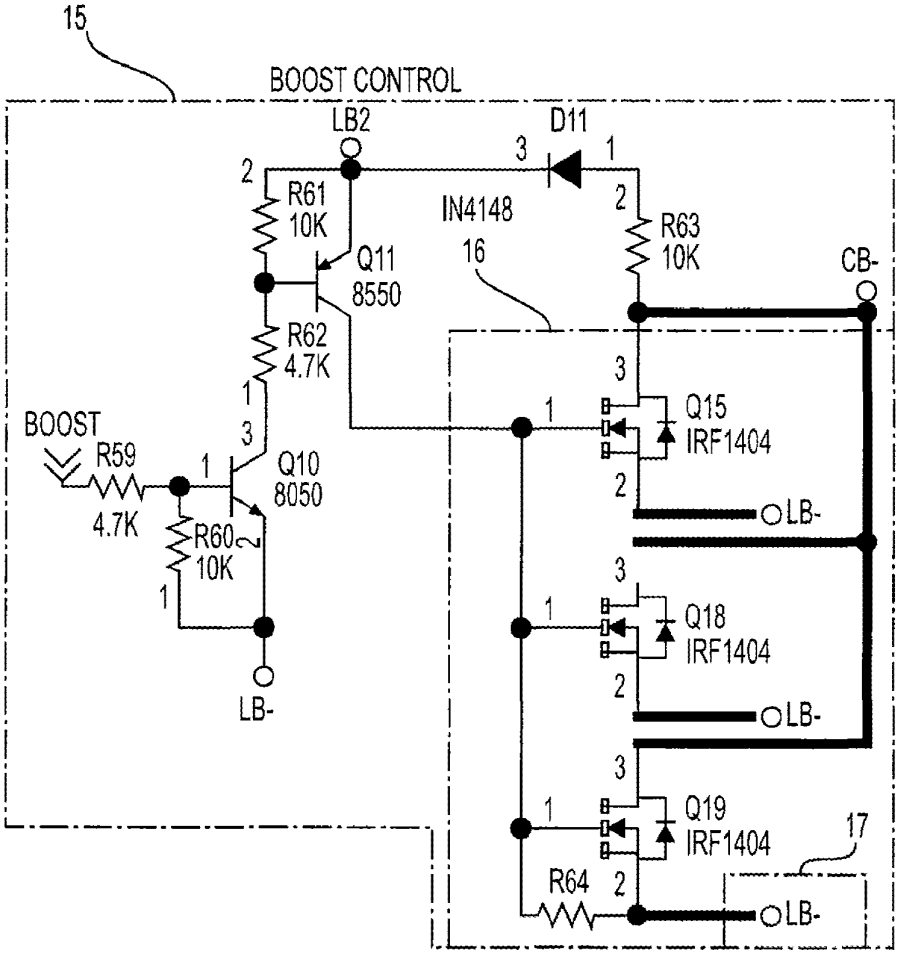


FIG. 2B-2

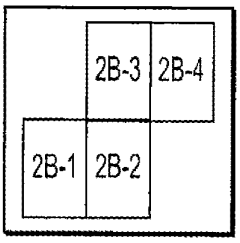


EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

20202012223 20 Feb 2020

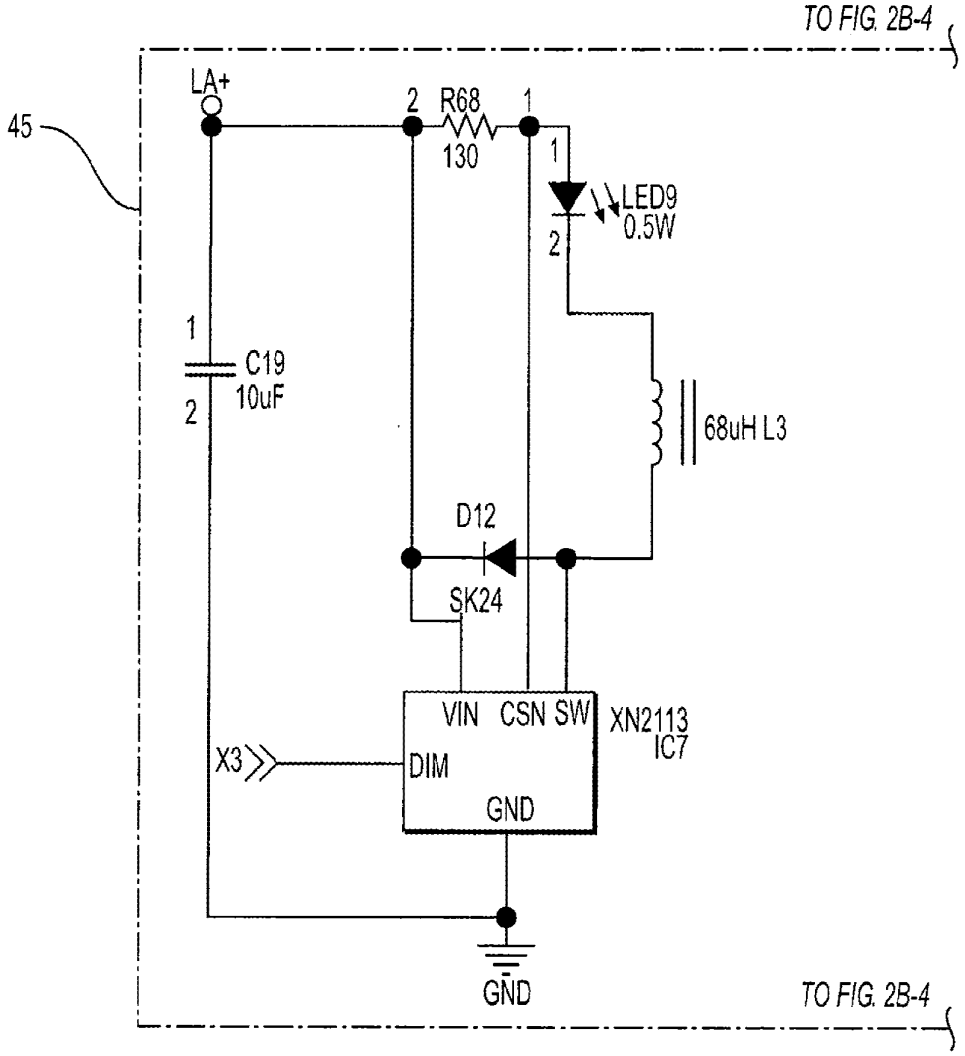
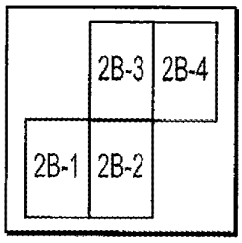


FIG. 2B-3



20202012223 20 Feb 2020

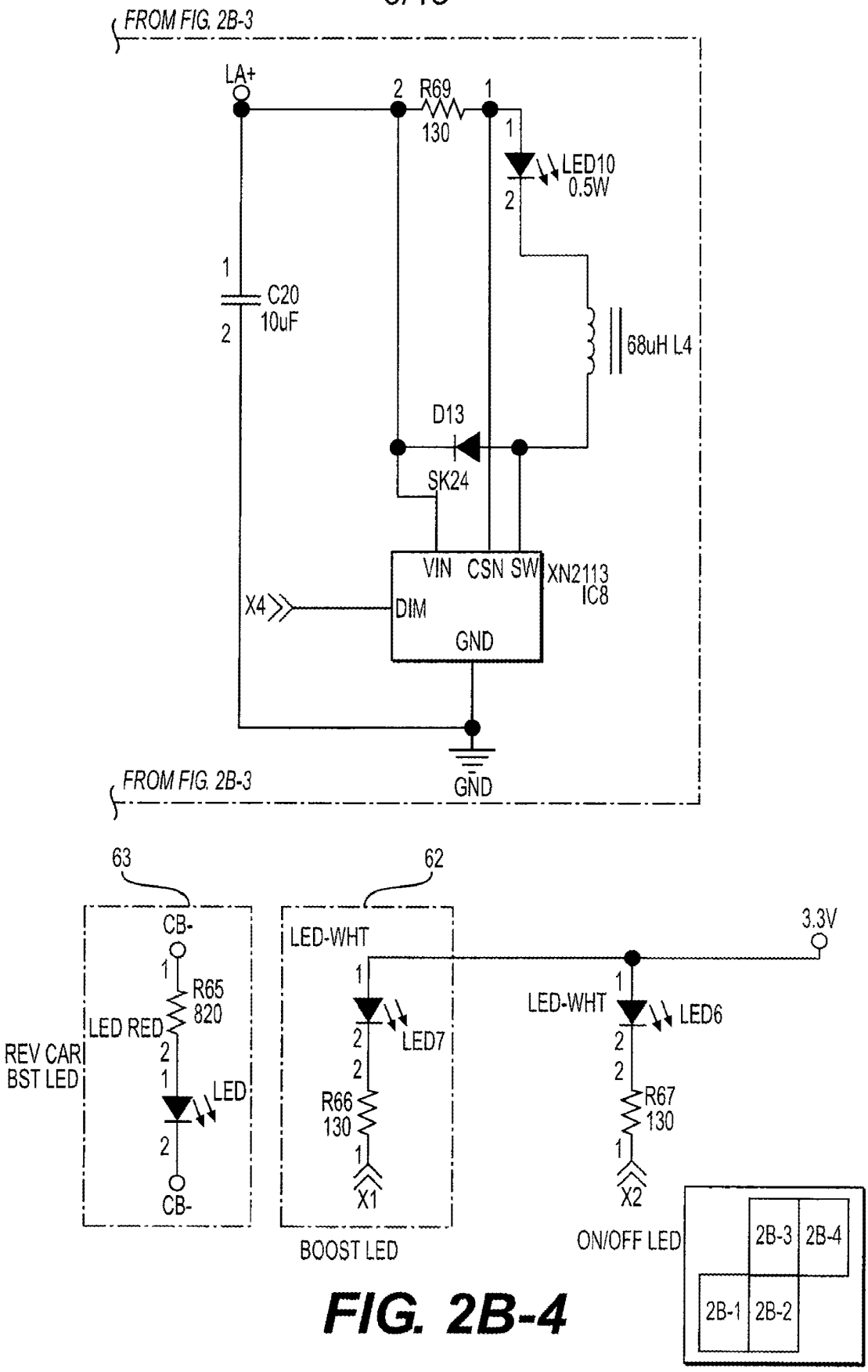


FIG. 2B-4

20202012223 20 Feb 2020

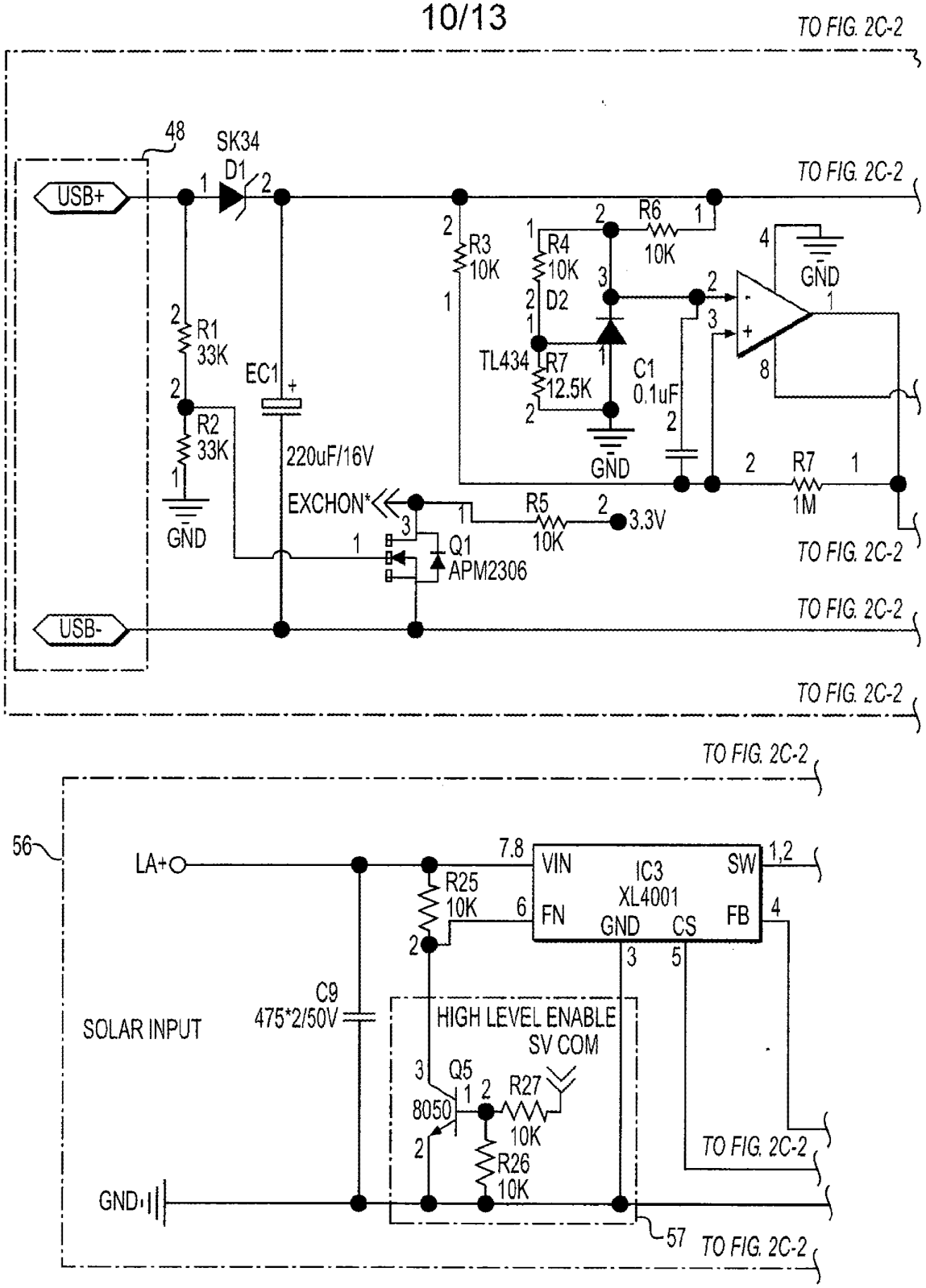


FIG. 2C-1

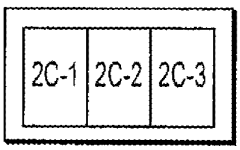


EXHIBIT 1002
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20202012223 20 Feb 2020

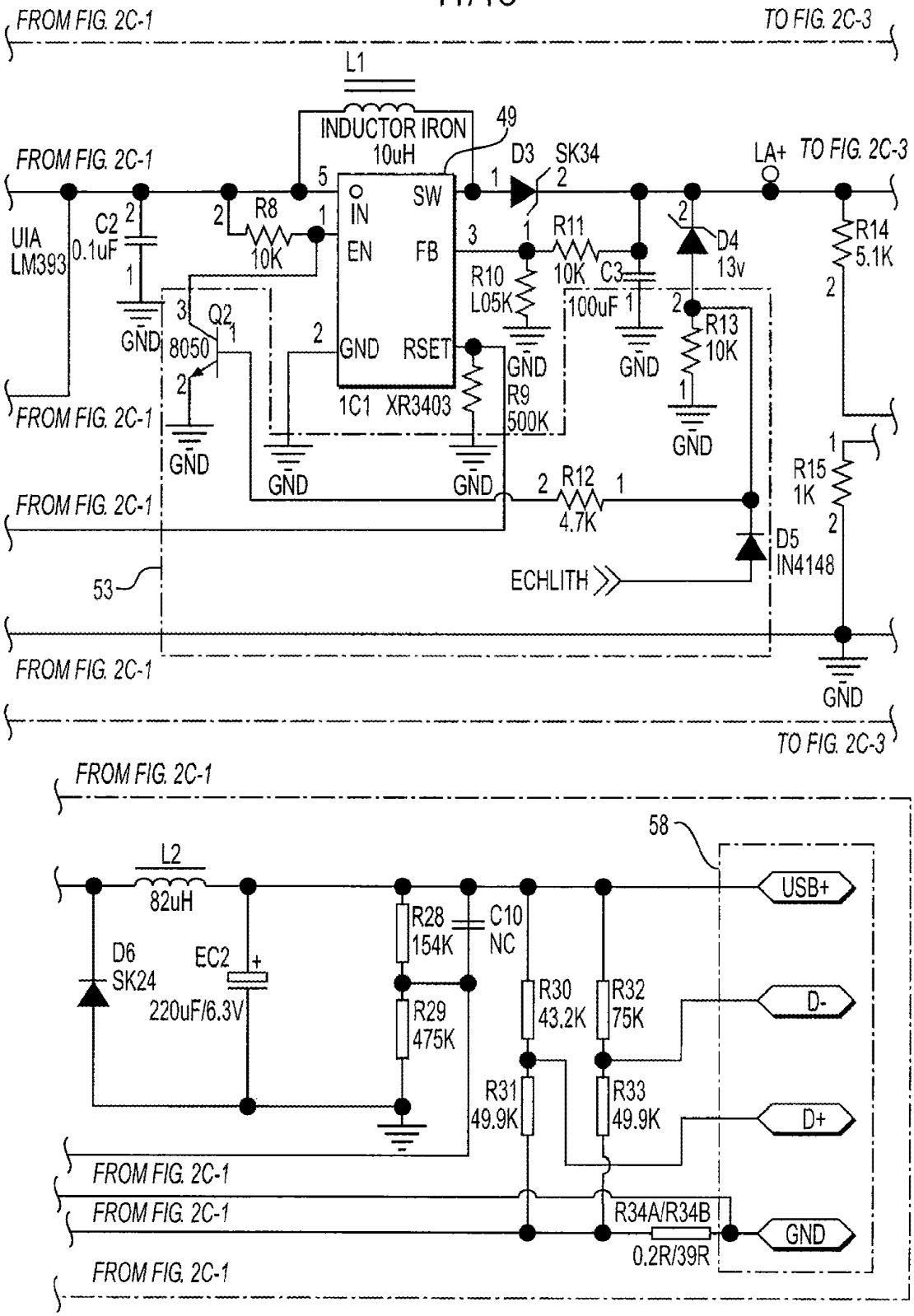
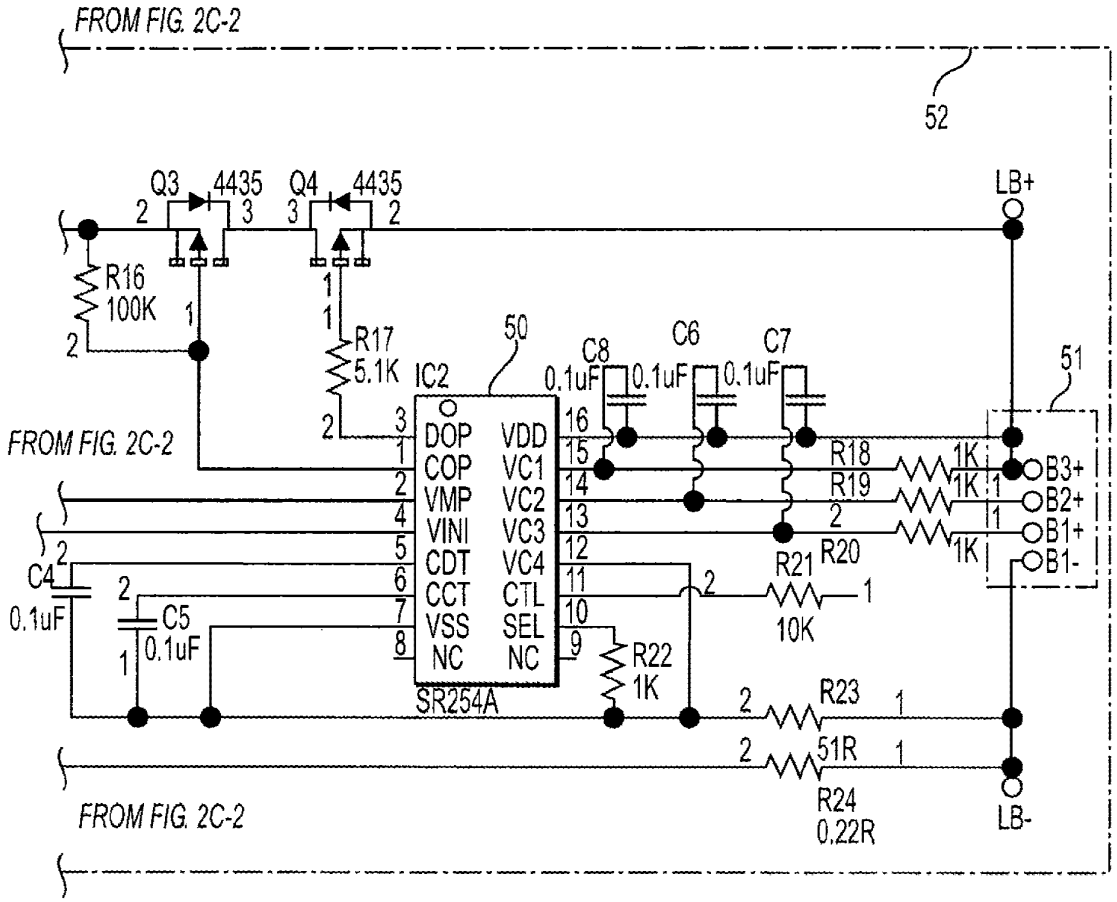


FIG. 2C-2

EXHIBIT 1002
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20202012223 20 Feb 2020



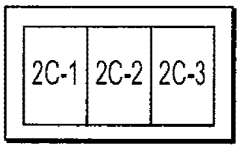


FIG. 2C-3

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20202012223 20 Feb 2020

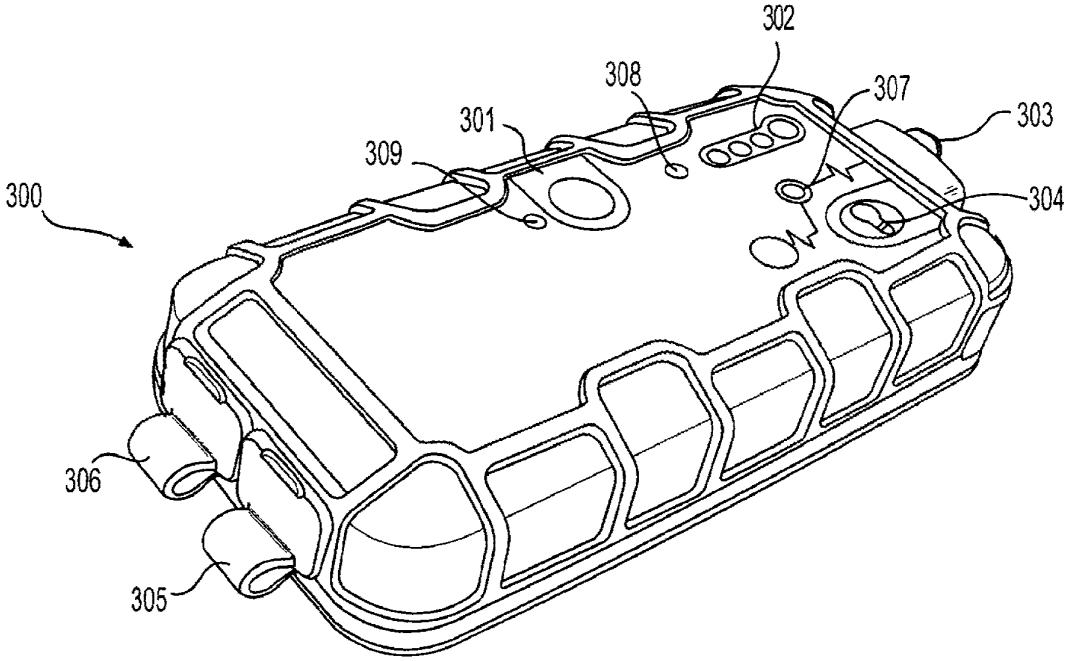


FIG. 3

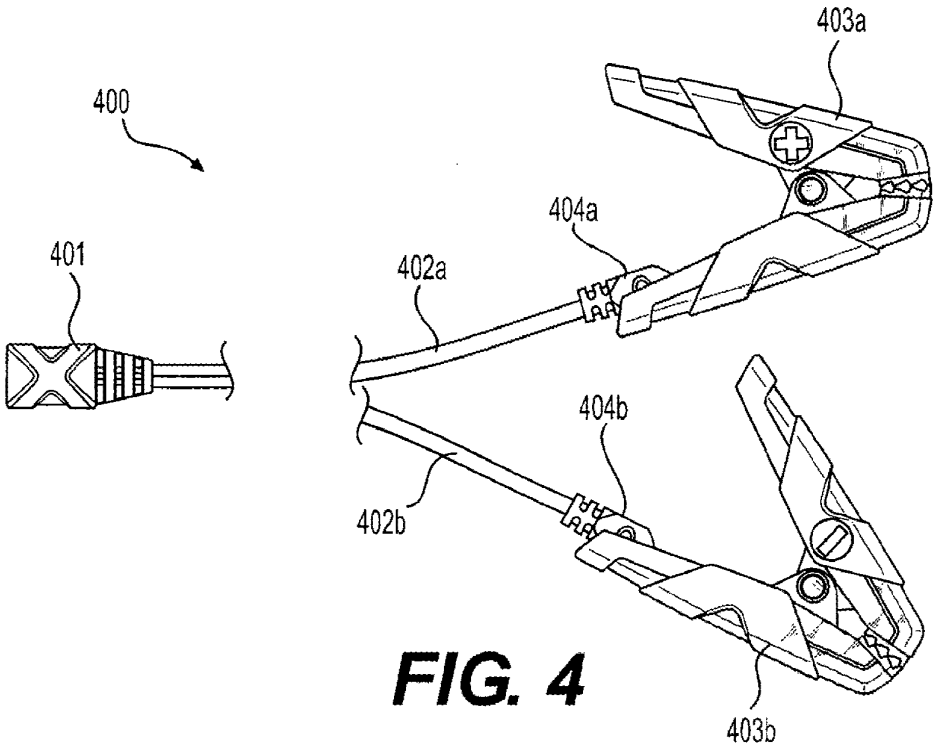


FIG. 4

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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(51)Int.Cl.　F I
H02J 7/00 (2006.01)　H02J 7/00 303C
H02J 7/00 302B

評価書の請求 未請求　請求項の数 9　OL　(全 17 頁)

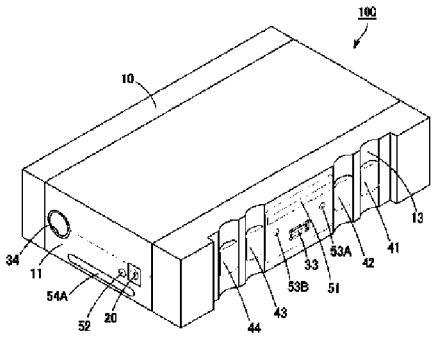
(21)出願番号　実願2013-523(U2013-523)
(22)出願日　平成25年2月1日(2013.2.1)

(73)実用新案権者　505468956
ＳＦＪ株式会社
千葉県浦安市千鳥１２－１

最終頁に続く

(54)【考案の名称】車両用補助給電装置

(57)【要約】　(修正有)
【課題】ジャンプスタータとポータブル電源としての機能を有し、小型軽量で携帯性に優れ、使い勝手のよい車両用補助給電装置を提供する。
【解決手段】内部接続された充電回路部、リチウムイオン蓄電池、出力回路部、制御回路部を筐体内に備え、制御回路部は、ＤＣ出力端子に給電されると充電回路部の動作を制御して、リチウムイオン蓄電池を充電する。制御回路部は、リチウムイオン蓄電池から、第１のＤＣ出力端子に外部接続される車両バッテリにジャンプスタート用の電源を供給し、第２のＤＣ出力端子に外部接続されるＰＣにＰＣ駆動用の電源を供給し、第３のＤＣ出力端子３３に外部接続されるＵＳＢ機器にＵＳＢ機器駆動用の電源を供給し、第４のＤＣ出力端子３４に外部接続される外部機器に外部機器駆動用の電源を供給するように出力回路部の動作を制御する。
【選択図】図１



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DESCRIPTION JP3182855U

10 Auxiliary power supply device for vehicles

[0001]

14 The present invention is for jump-starting the engine by connecting to the in-vehicle battery and supplying electric power to the electric load of the vehicle including the starter for starting the engine when the battery of the vehicle is exhausted. Regarding auxiliary power supply device for vehicles.

[0002]

21 Conventionally, for example, on the road, when the battery mounted on the vehicle tends to be discharged due to an increase in the amount of electricity consumed, the battery capacity becomes insufficient, the voltage drops, and the electrical components do not operate (so-called battery exhaustion). In some cases), a jump start is performed in which the engine is started by supplying electric power from the battery of another automobile or an emergency portable power source (jump starter) via a booster cable. Then, various proposals have been made such as a technique for facilitating electrical connection for jump start (see, for example, Patent Documents 1 and 2) and a technique for determining jump start (for example, see Patent Document 3).

[0003]

33 Conventionally, a sealed lead-acid battery has been used in a jump starter because of the relationship between cost and capacity.

[0004]

38 In addition, information devices such as battery-powered notebook PCs that can be charged using an AC adapter and their ancillary devices have become widespread.

40 In addition, a large number of in-vehicle electric devices that can be used by connecting to a DC12V / 24V in-vehicle power socket, that is, a so-called cigar socket, which is installed as standard in the vehicle, are provided.

43 Further, in recent years, power-saving and driveable electronic devices such as mobile phones and portable music players that can be powered by USB (Universal Serial Bus) are widely used. Traditionally, portable power supplies have been used to use electrical equipment outdoors.

[0005]

49 特開２００４－１３４２７８号公報

50 特開２０１１－９７７１０号公報

51 特開２００７－２７８２１６号公報

[0006]

55 By the way, a conventional jump starter using a general sealed lead-acid battery weighs about 5 to 7 kg, and has a problem of lacking portability.

57 Further, it took about 10 to 15 hours on average to fully charge the battery, and the number of times that the vehicle could be started (jump start) in the fully charged state was about 5 times on average.

60 Furthermore, lead-acid batteries deteriorate faster when over-discharged or over-charged, and self-discharge tends to proceed. The discharge rate of normal lead-acid batteries is about 30%, and they self-discharge even when not in use. The need for charging comes out.

63 People who cannot get used to it cannot perform the charging operation at the proper time, and often cause overcharging or overdischarging. It is not easy for anyone to handle, and it is very inconvenient to use.

[0007]

69 Further, the conventional portable power supply device is also heavy because a lead storage battery is used, and has the same problems as the conventional jump starter from the viewpoint of portability and usability.

[0008]

75 The present invention has been made in view of the conventional circumstances as described above, and its purpose is to have a function as a jump starter, and also to provide an information device such as a battery-powered notebook PC and its ancillary devices, and a cigar. It has a function as a portable power supply that enables the use of in-vehicle electric devices that can be used by connecting to a socket, mobile phones, portable music players that

EXHIBIT 1002
Page 1714 of 2306 Petitioner ADC (IPR2024-00671)

can be powered by USB, etc., and also has an OBD (On-Board Diagnostic system).) The purpose is to provide a compact, lightweight, highly portable, and easy-to-use auxiliary power supply device for vehicles that functions as a portable power source for memory backup of vehicles compatible with the system.

[0009]

87 Yet another object of the present invention, the specific advantages obtained by the present invention, will be further clarified from the embodiments described below with reference to the drawings.

[0010]

93 The present invention is an auxiliary power supply device for a vehicle, and includes a housing, a DC input terminal including a DC jack installed on the side wall of the housing and a power supply cable for charging being externally connected via a DC plug. A charging circuit unit installed in the housing and internally connected to the DC input terminal, a lithium ion storage battery installed in the housing and internally connected to the charging circuit unit, and installed in the housing and described above. An output circuit unit internally connected to a lithium-ion storage battery, a control circuit unit installed in the housing and controlling the operation of the charging circuit unit and the output circuit unit, and an output circuit unit installed on the side wall of the housing. A first DC output terminal for jump start consisting of a jack that is internally connected to the unit and the booster cable is externally connected via a plug, and is installed on the side wall of the housing and internally connected to the output circuit unit. The PC power cable is installed on the front wall of the housing and internally connected to the output circuit section and the second DC output terminal for the PC power supply, which consists of a jack to which the PC power cable is externally connected via a plug. A third DC output terminal consisting of a USB socket to which the USB cable is externally connected via a USB plug, and an external power cable installed on the back wall of the housing and internally connected to the output circuit section. A fourth DC output terminal composed of a cigar socket externally connected via a cigar plug, a power switch installed on the front wall of the housing and internally connected to the control circuit unit, a jump start switch, and the above. It is installed on the front wall of the housing and is provided with a charge amount display unit which is controlled by the control circuit unit and displays the charge amount of the lithium ion storage battery as a level bar. The control circuit unit is the charge amount of the lithium ion storage battery. Is controlled so that the charge amount is displayed on the level bar by the charge amount display unit, and in the control circuit unit, the vehicle battery is externally connected to the first DC output terminal via the booster cable. By accepting the operation input of the jump start switch while the power switch is turned on, control is performed to supply power for jump start from the output circuit unit via the first DC output terminal. By accepting the operation input of the power switch in a state where the PC is externally connected to the second DC output terminal via the PC power cable,

the PC is driven from the output circuit unit via the second DC output terminal. Controls to supply power for the above, and US to the above third DC output terminal By accepting the operation input of the power switch while the USB device is externally connected via the B cable, power for driving the USB device is supplied from the output circuit unit via the third DC output terminal. By performing control and receiving the operation input of the power switch in a state where the external device is externally connected to the fourth DC output terminal via the external power cable, the fourth DC output is output from the output circuit unit. It is characterized in that it controls to supply power for driving an external device via a terminal.

[0011]

134 In the dual-purpose auxiliary power supply device according to the vehicle of the present invention, power is supplied to the DC input terminal via the charging power cable provided with an AC adapter or a cigar socket at one end, and the control circuit unit is the DC input terminal. When a state in which power is supplied via the charging power cable is detected, the lithium ion storage battery is controlled to be charged via the charging circuit unit, and during charging control, the power supply from the output circuit unit to the outside is performed. Control may be performed to prohibit the supply.

[0012]

144 Further, in the dual-purpose auxiliary power supply device according to the vehicle of the present invention, the control circuit unit detects the power ON by the operation of the power switch, controls the operation of the charge amount display unit, and serves as a power lamp for displaying the power ON. The charge amount display unit is made to function, and in this power-on state, the jump start by a short-time operation of the jump start switch is detected and the jump start mode is controlled. In the control of the jump start mode, the first DC When the voltage of the in-vehicle battery of the automobile to be jump-started via the booster cable externally connected to the output terminal can be detected normally, the operation of the output circuit section is controlled and the lithium-ion storage battery is used as a power source for jump-start. The charge amount display unit is connected to the first DC output terminal via the output circuit unit, controls the operation of the charge amount display unit, and functions as a jump start lamp for displaying the jump start. can do.

[0013]

160 Further, in the dual-purpose auxiliary power supply device according to the vehicle of the present invention, the control circuit unit detects that the jump start switch has been operated for a long time in the power-on state and controls the charge boost mode, and controls the jump start. In the mode control, when the voltage of the in-vehicle battery of the

EXHIBIT 1002
Page 1716 of 2306 Petitioner ADC (IPR2024-00671)

automobile to be jump-started via the booster cable externally connected to the first DC output terminal can be detected normally, the operation of the output circuit unit is controlled. As a charge boost lamp that displays the charge boost by connecting the lithium ion storage battery as a power source for charge boost to the first DC output terminal via the output circuit unit and controlling the operation of the charge amount display unit. The charge amount display unit can be made to function.

[0014]

173 Further, in the dual-purpose auxiliary power supply device according to the vehicle of the present invention, the charge amount display unit is controlled by the control circuit unit and is arranged on a straight line that displays the charge amount of the lithium ion storage battery as the emission color changes. The control circuit unit is composed of a plurality of light emitting elements, and the control circuit unit is a power lamp for displaying the power ON by lighting one of the plurality of light emitting elements with a first light emitting color. By functioning and lighting the other one of the plurality of light emitting elements with the second light emitting color, the charge amount is used as a jump start lamp for displaying the jump start or a charge boost lamp for displaying the charge boost. The display unit can be made to function.

[0015]

186 Further, in the dual-purpose auxiliary power supply device according to the vehicle of the present invention, the vehicle's OBD (On-Board Diagnostic system) system is externally connected as an external device via the external power cable to the fourth DC output terminal. When the control circuit unit receives the operation input of the power switch, the output circuit unit supplies power for memory backup of the OBD as a power source for driving an external device via the fourth DC output terminal. Can be.

[0016]

195 Further, the dual-purpose auxiliary power supply device according to the vehicle of the present invention may include a plurality of rechargeable lithium ion batteries installed in the housing as the lithium ion storage battery.

[0017]

201 Further, the dual-purpose auxiliary power supply device according to the vehicle of the present invention functions as a jump starter having a weight of about 830 g and a capacity of 12 V / 4.5 Ah by mounting three 3.6 V rechargeable lithium ions in the housing. Can be made to.

EXHIBIT 1002
Page 1717 of 2306 Petitioner ADC (IPR2024-00671)

[0018]

208 Further, the dual-purpose auxiliary power supply device according to the vehicle of the present invention is to function as a jump starter having a weight of about 1300 g and a capacity of 12 V / 9 Ah by mounting six 3.6 V rechargeable lithium ions in the housing. Can be.

[0019]

215 According to the present invention, an information device such as a battery-powered notebook PC and its ancillary devices, an in-vehicle compatible electric device that can be used by connecting to a cigar socket, a mobile phone, etc. It has a function as a portable power supply that enables the use of portable music players that can be powered by USB, and also has a small size that functions as a portable power supply for memory backup of vehicles compatible with the OBD (On-Board Diagnostic system) system. It is possible to provide an auxiliary power supply device for a vehicle that is lightweight, has excellent portability, and is easy to use.

[0020]

226 It is an external perspective view of the auxiliary power supply device for a vehicle to which the present invention is applied, viewed from diagonally above the front left side.

228 It is an external perspective view of the auxiliary power supply device for a vehicle seen from the front side diagonally upper right.

230 It is a block diagram which shows the electrical connection state of the component of the auxiliary power supply device for a vehicle.

232 It is a top view which shows the power supply cable for charging connected to the DC input terminal of the auxiliary power supply device for a vehicle, (A) shows an AC adapter cable, and (B) shows a cigar plug cable.

235 It is an external perspective view which shows the auxiliary power supply device for a vehicle in the state which the AC adapter is connected to the DC input terminal.

237 It is a front view of the charge amount display part of the said vehicle auxiliary power supply device which shows the bar display state of the charge level.

239 It is a top view which shows the booster cable connected to the 1st DC output terminal of the said vehicle auxiliary power supply device.

241 FIG. 5 is an external perspective view showing the auxiliary power supply device for a vehicle in a state where an in-vehicle battery of an automobile to be jump-started via a booster cable is connected to the first DC output terminal.

244 It is an external perspective view which shows the said auxiliary power supply device for a vehicle in the state which the USB device is connected to the 3rd DC output terminal via a USB cable.

247 It is a top view which shows the cigar plug cable connected to the 4th DC output terminal of

EXHIBIT 1002
Page 1718 of 2306 Petitioner ADC (IPR2024-00671)

the said vehicle auxiliary power supply device, (A) shows the 1st cigar plug cable which has a DC plug at one end, (B) is A second cigar plug cable provided in the OBD2 connector is shown at one end.

251 It is external perspective view of the said vehicle auxiliary power supply device which shows the lighting state of the side illumination lamp provided on the side wall of the said vehicle auxiliary power supply device.

[0021]

257 Hereinafter, embodiments of the present invention will be described in detail with reference to the drawings.

259 Needless to say, the present invention is not limited to the following embodiments, and various changes can be made without departing from the gist of the present invention.

[0022]

264 1 and 2 show an external perspective view of the vehicle auxiliary power feeding device 100 to which the present invention is applied, as viewed from diagonally above the front left and diagonally above the front right.

267 Further, it is shown in the block diagram of FIG. 3 which shows the electric connection state of the component of the auxiliary power supply device 100 for a vehicle.

[0023]

272 The vehicle auxiliary power supply device 100 includes a thin box-shaped housing 10 as shown in the external perspective views of FIGS. 1 and 2, and is inside the housing 10 as shown in the block diagram of FIG. It includes an installed charging circuit unit 1, a lithium ion storage battery 2, an output circuit unit 3, and a control circuit unit 4.

[0024]

279 Then, in the vehicle auxiliary power supply device 100, as shown in the external perspective view of FIG. 1, a DC input terminal 20 for receiving a power supply of, for example, 12 V from a household power source or an automobile battery is provided on the left side wall of the housing 10. It is installed in 11.

[0025]

286 The DC input terminal 20 includes a DC jack to which a power supply cable for charging is externally connected via a DC plug, as will be described later.

EXHIBIT 1002
Page 1719 of 2306 Petitioner ADC (IPR2024-00671)

[0026]

291 As shown in the block diagram of FIG. 3, the charging circuit unit 1 is internally connected to the DC input terminal 20.

293 The lithium ion storage battery 2 is internally connected to the charging circuit unit 1.

294 Further, the output circuit unit 3 is internally connected to the lithium ion storage battery 2.

295 Further, the control circuit unit 4 is internally connected to the charging circuit unit 1 and the output circuit unit 3.

[0027]

300 Further, as shown in the block diagram of FIG. 3, the vehicle auxiliary power supply device 100 includes a first DC output terminal 31 for jump start and a second for PC power supply, which are internally connected to the output circuit unit 3. It includes a DC output terminal 32, a third DC output terminal 33 for a USB power supply, and a fourth DC output terminal 34 for a memory backup power supply.

[0028]

308 The first DC output terminal 31 includes a jack to which a booster cable is externally connected via a plug, as will be described later.

[0029]

313 The second DC output terminal 32 includes a jack to which a PC power cable is externally connected via a plug, as will be described later.

[0030]

318 The third DC output terminal 33 includes a USB socket to which a USB cable is externally connected via a USB plug, as will be described later.

[0031]

323 The fourth DC output terminal 34 includes a cigar socket to which an external power cable is externally connected via a cigar plug, as will be described later.

[0032]

328 The first DC output terminal 31 for the jump start and the second DC output terminal 32 for the PC power supply are installed on the right side wall 12 of the housing 10 as shown in the external perspective view of FIG. There is.

331 Further, as shown in the external perspective view of FIG. 1, the third DC output terminal 33

for the USB power supply is installed on the front wall 13 of the housing 10, and the fourth DC output terminal 33 for the memory backup power supply is installed. The DC output terminal 34 is installed on the left side wall 11 of the housing 10.

[0033]

338 Further, as shown in the block diagram of FIG. 3, the vehicle auxiliary power supply device 100 includes a power switch 41, a jump start switch 42, a light select switch 43, and a side light on / internally connected to the control circuit unit 4. It includes an off switch 44.

341 The power switch 41, the jump start switch 42, the light select switch 43, and the side light on / off switch 44 are installed on the front wall 13 of the housing 10 as shown in the external perspective view of FIG. ..

[0034]

347 Further, as shown in the block diagram of FIG. 3, the vehicle auxiliary power supply device 100 includes a charge amount display unit 51 internally connected to the control circuit unit 4, a battery low indicator light 52, and a pair of emergency warning lights 53A. , 53B and a pair of side illumination lights 54A, 54B.

[0035]

354 The charge amount display unit 51 and the pair of emergency warning lights 53A and 53B are installed on the front wall 13 of the housing 10 as shown in the external perspective view of FIG.

[0036]

360 The charge amount display unit 51 is composed of a plurality of LEDs having different emission colors (in this embodiment, four colors of red, orange, yellow, and green) arranged linearly.

363 The charge amount display unit 51 is controlled by the control circuit unit 4 and not only functions as a bar display of the charge amount, but also functions as a power lamp when lit in green and as a jump start lamp when lit in yellow. do.

366 Further, the pair of emergency warning lights 53A and 53B are composed of a red LED and a white LED, are controlled by the control circuit unit, and function as an emergency warning light by blinking alternately.

[0037]

372 Further, the battery low indicator lamp 52 is installed on the right side wall 12 of the housing 10 as shown in the external perspective view of FIG.

[0038]

377 The battery low indicator lamp 52 is composed of a red LED, is controlled by the control circuit unit 4, and becomes a blinking state or a lighting state when the voltage of the lithium ion storage battery 2 drops to a predetermined value. Functions as.

[0039]

383 Further, as shown in the external perspective views of the pair of side lighting lamps 54A and 54B, FIGS. 1 and 2, they are installed on the left side wall 11 and the right side wall 12 of the housing 10.

[0040]

389 The pair of side illumination lamps 54A and 54B are each composed of a plurality of white LEDs arranged in a straight line.

[0041]

394 In the vehicle auxiliary power supply device 100 having such a configuration, the control circuit unit 4 installed in the housing 10 performs the operation of the charge control unit and the output circuit unit 1 that control the operation of the charge circuit unit 1. It consists of a microcomputer that functions as a display control unit that controls the operation of the output control unit to be controlled, the charge amount display unit 5151, etc., and controls the operations of the internally connected charging circuit unit 1 and output circuit unit 3 as follows. do.

[0042]

404 Here, as the charging power supply cable connected to the vehicle auxiliary power supply device 100, as shown in FIGS. 4A and 4B, a 12V power supply for charging is supplied from the household power supply. AC adapter cable 110A and cigar plug cable 110B for supplying power supply of, for example, 12V from an automobile battery are prepared.

[0043]

411 The AC adapter cable 110A shown in FIG. 4A is provided with an AC adapter 111A for supplying 12V power for charging from a household power source at one end, and a DC plug 112 is attached to a DC input terminal 20 composed of the DC jack. Externally connected via.

414 Further, the cigar plug cable 110B shown in FIG. 4B is provided with a cigar plug 111B for supplying a power supply of, for example, 12V from an automobile battery at one end, and a

EXHIBIT 1002
Page 1722 of 2306 Petitioner ADC (IPR2024-00671)

DC plug 112 is provided at a DC input terminal 20 composed of the DC jack. It is connected externally via.

[0044]

421 Then, in the control circuit unit 4 of the vehicle auxiliary power supply device 100, as shown in FIG. 5, the AC adapter cable 110A or the cigar plug cable 110B is externally connected to the DC input terminal 20, and the household power supply or the automobile battery is connected. When it is detected that a voltage equal to or higher than a predetermined voltage value is applied to the DC input terminal 20 by supplying power for charging from, the charging mode is controlled.

[0045]

430 In the control of the charging mode, the control circuit unit 4 controls the operation of the charging circuit unit 1 by the charging control unit, charges the lithium ion storage battery 2 via the charging circuit unit 1, and charges the lithium ion storage battery 2. When the storage battery 2 is fully charged, the overcharge protection circuit is activated and charging is completed.

[0046]

438 Further, the control circuit unit 4 controls the operation of the output circuit unit 3 by the output control unit during charge control, and prohibits the power supply from the output circuit unit 3 to the outside.

[0047]

444 Further, during charge control, the control circuit unit 4 controls the operation of the charge amount display unit 51 by the display control unit, controls the charge amount display unit 51, and displays the charge amount as a bar.

[0048]

450 The operation of the charge amount display unit 51 is controlled by the control circuit unit 4, and as shown in FIG. 6, the charge amount display unit 51 starts from an uncharged state, a red dot state indicating a battery remaining amount of 20% or less, and a battery remaining amount of 20%. Lights red to indicate 30%, blinks orange to indicate 30% to 40% remaining battery power, lights yellow to indicate 40% to 70% remaining battery power, and lights green to indicate 70% to 100% remaining battery power. As the charging progresses to the fully charged state, the lighting state changes sequentially.

EXHIBIT 1002
Page 1723 of 2306 Petitioner ADC (IPR2024-00671)

[0049]

460 The vehicle auxiliary power supply device 100 functions as a portable jump starter in a state where the lithium ion storage battery 2 is charged, and can also be used as a portable power supply device for using electrical equipment outdoors.

[0050]

466 Here, as shown in FIG. 7, the vehicle auxiliary power supply device 100 is provided with connection clips 121A and 121B for gripping the electrode terminals of the vehicle-mounted battery at one ends of the two cables, and is the first jump start device. A booster cable 120 for jump start, which is externally connected to the jack constituting the DC output terminal 31 of the above via the plug 122, is prepared.

[0051]

474 Then, the vehicle auxiliary power supply device 100 is used as a jump starter as follows.

[0052]

478 That is, when the vehicle auxiliary power supply device 100 is used as a jump starter, the booster cable 120 for the jump start is used with the power switch 41 of the vehicle auxiliary power supply device 100 turned off, as shown in FIG. It is connected to the first DC output terminal 31 by the user.

[0053]

485 The user of the vehicle auxiliary power supply device 100 can confirm that the power switch 41 is in the OFF state by turning off all of the plurality of LEDs constituting the charge amount display unit 51. ..

[0054]

491 Next, when the user presses the power switch 41 to turn on the power, the control circuit unit 4 of the vehicle auxiliary power supply device 100 detects the power ON and controls the operation of the charge amount display unit 51 by the display control unit. , The charge amount display unit 51 is set to the green lighting state.

495 The charge amount display unit 51 functions as a power lamp that indicates that the power is turned on by lighting in green.

[0055]

500 Then, when the user presses the jump start switch 42 in this power-on state to jump start, the control circuit unit 4 of the vehicle auxiliary power supply device 100 detects the jump start due to the short-time operation of the jump start switch 42. Controls the jump start mode.

[0056]

506 In the control of the jump start mode, the control circuit unit 4 can normally detect the voltage of the vehicle-mounted battery 200 of the automobile to be jump-started to the first DC output terminal 31 for jump start via the booster cable 120. In this case, the output control unit controls the operation of the output circuit unit 3, and the lithium ion storage battery 2 is used as a power source for the jump start, and the first DC output terminal 31 for the jump start is passed through the output circuit unit 3. The operation of the charge amount display unit 51 is controlled by the display control unit, and the charge amount display unit 51 is turned on in yellow.

514 The charge amount display unit 51 functions as a jump start lamp that displays a jump start by lighting yellow.

516 In this jump start mode, the charge amount display unit 51 displays the power ON by lighting green and the jump start by lighting yellow.

[0057]

521 In this jump start mode, the user can perform a jump start to start the engine of the automobile equipped with the vehicle-mounted battery 200 to which the vehicle auxiliary power supply device 100 is connected.

[0058]

527 Here, a jump starter having a capacity of about 12 V / 4.5 Ah using a conventional general lead storage battery has a main body weight of about 5 kg to 7 kg, and can be started about 5 times on average in a fully charged state. On the other hand, the auxiliary power supply device 100 for a vehicle to which the present invention is applied is, for example, a rechargeable type of 3.6 V in a housing 10 having a size of 45 mm × 190 mm × 120 mm (height × width × depth). By mounting three lithium ions in series, it functions as a portable jump starter with a capacity of 12V / 4.5Ah, which weighs about 830g and is compatible with gasoline passenger cars up to 3000cc. The number of times that the battery can be started in the rechargeable state has also improved to about 10 to 20 times.

[0059]

539 Further, in the auxiliary power supply device 100 for a vehicle, for example, a housing 10 having a size of 45 mm × 190 mm × 160 mm (height × width × depth) is used, and six rechargeable lithium ions that are doubled are mounted. As a result, it functions as a portable

EXHIBIT 1002
Page 1725 of 2306 Petitioner ADC (IPR2024-00671)

jump starter with a capacity of 12V / 9Ah, which weighs about 1300g and is compatible with all gasoline passenger cars and diesel vehicles up to 3000cc 4-cylinder.

[0060]

547 Further, the control circuit unit 4 in the vehicle auxiliary power supply device 100 enters the charge boost mode control state when the user operates the jump start switch 42 for a long time, that is, for example, for 5 seconds or longer in the power ON state. The operation of the output circuit unit 3 is controlled by the output control unit so that the electricity charged in the lithium ion storage battery 2 is discharged at one time.

552 In the control state of the charge boost mode, the operation of the charge amount display unit 51 is controlled by the display control unit, and the charge amount display unit 51 is turned on in yellow.

555 That is, the charge amount display unit 51 functions as a charge boost mode that displays the charge boost mode by lighting yellow.

557 This charge boost mode is used when the vehicle-mounted battery is in a deep discharge state.

[0061]

562 Further, as described above, the auxiliary power supply device 100 for a vehicle has a capacity of 12 V / 4.5 Ah and a weight of about 830 g, and even a device having a capacity of 12 V / 9 Ah has a weight of about 1300 g and is small and lightweight, so that it is portable. In addition to the first DC output terminal 31 for jump start, the second to fourth DC output terminals 32 to 34 for external connection for using electrical equipment outdoors are provided. Therefore, it can be used as a portable power supply as follows.

[0062]

571 That is, in the vehicle auxiliary power supply device 100, a PC can be externally connected to the second DC output terminal 32 via a PC power cable.

[0063]

576 In the control circuit unit 4 of the vehicle auxiliary power supply device 100, a PC power cable is externally connected to the jack via the plug to form the second DC output terminal 32, and the PC power cable is connected to the jack via the PC power cable. When the user presses the power switch 41 to turn on the power while the PC is externally connected, the power ON is detected and the operation of the charge amount display unit 51 is controlled by the display control unit, and the charge amount display unit 51 is displayed. The power ON is displayed as a green lighting state, and the operation of the output circuit unit 3 is controlled by the output control unit, and the power supply for driving the PC of DC19V is

supplied from the second DC output terminal 32 via the PC power cable. And supply it to the PC.

[0064]

589 Further, in the vehicle auxiliary power supply device 100, an electronic device such as a portable music player capable of supplying power by USB (Universal Serial Bus) is connected to the third DC output terminal 33 via a commercially available USB cable. Can be done.

[0065]

595 As shown in FIG. 9, the control circuit unit 4 in the vehicle auxiliary power supply device 100 constitutes the third DC output terminal 33, and the USB cable 130 is externally connected to the USB jack via the USB plug. Then, when the user presses the power switch 41 to turn on the power while the USB device 300 is externally connected via the USB power cable 130, the power ON is detected and the charge amount display unit 51 is subjected to the display control unit. The operation is controlled, the charge amount display unit 51 is lit in green to display the power ON, and the output control unit controls the operation of the output circuit unit 3 to supply the power supply for USB drive of DC5V. It is supplied from the DC output terminal 33 of No. 3 to the USB device 300 via the USB power cable 130.

[0066]

607 Further, the vehicle auxiliary power supply device 100 has two types of cigar plug cables externally connected to the fourth DC output terminal 34 made of a cigar socket, as shown in FIGS. 10A and 10B. Cigar plug cable is prepared.

[0067]

613 The first cigar plug cable 140A shown in FIG. 10A is compatible with vehicles that can be used by connecting to a DC12V / 24V in-vehicle power socket, a so-called cigar socket, which is installed as standard in the vehicle. A cable for connecting an electric device, which is provided with a DC plug 141A connected to an in-vehicle compatible electric device at one end, and is externally connected to the fourth DC output terminal 34 via a cigar plug 142.

[0068]

621 The second cigar plug cable 140B shown in FIG. 10B is a vehicle memory back cable compatible with an OBD (On-Board Diagnostic system) system, and is provided with an OBD2 connector 141B at one end and is a cigar plug. It is externally connected to the fourth DC output terminal 34 via 142.

[0069]

628 In the control circuit unit 4 of the vehicle auxiliary power supply device 100, the first cigar plug cable 140A or the second cigar plug cable 140B is attached to the cigar socket to form the fourth DC output terminal 34. When the user presses the power switch 41 to turn on the power while the external device is externally connected via the cigar plug cable and is externally connected via 142, the power ON is detected by the display control unit. The operation of the charge amount display unit 51 is controlled, the charge amount display unit 51 is lit in green to display the power ON, and the output control unit controls the operation of the output circuit unit 3 to control the operation of the output circuit unit 3 to be an external device of DC12V. Power for driving is supplied from the fourth DC output terminal 32 to an external device via a cigar plug cable.

[0070]

641 That is, the vehicle auxiliary power supply device 100 functions as a portable power source for driving an in-vehicle compatible electric device via a first cigar gable 140A externally connected to the fourth DC output terminal 34.

[0071]

647 Further, the vehicle auxiliary power supply device 100 is for memory backup of a vehicle compatible with an OBD (On-Board Diagnostic system) system via a second cigar gable 140A externally connected to the fourth DC output terminal 34. Functions as a portable power supply for.

[0072]

654 Here, the OBD (On-Board Diagnostic system) system is a self-fault diagnosis function performed by a computer mounted on an automobile, and facilitates a functional inspection of an exhaust gas purification device of an automobile in the process of use.

657 In OBD2, the inspection connector, communication protocol, failure diagnosis code, and the like are standardized.

[0073]

662 In vehicles equipped with an OBD (On-Board Diagnostic system) system, various diagnostic history information is stored in the memory so that the information in the memory will not be lost when the on-board battery is replaced. It is necessary to supply backup power.

[0074]

668 That is, the vehicle auxiliary power supply device 100 has a function as a jump starter, and can be used by connecting to an information device such as a battery-powered notebook PC or ancillary devices thereof, or a cigar socket. It has a function as a portable power source that enables the use of devices, mobile phones, portable music players that can be powered by USB, etc., and is also portable for vehicle memory backup compatible with the OBD (On-Board Diagnostic system) system. It is a compact, lightweight, highly portable auxiliary power supply device that functions as a power source and is easy to use.

[0075]

678 Further, the vehicle auxiliary power supply device 100 not only functions as a jump starter or a portable power source as described above, but also functions as a warning indicator light or an illumination light used in an emergency.

[0076]

684 That is, the control circuit unit 4 in the vehicle auxiliary power supply device 100 detects that the light select switch 43 is pressed while the power is on, and the display control unit displays the charge amount display unit 51 and a pair of emergency units. The warning lights 53A and 53B are controlled as follows.

[0077]

691 When the control circuit unit 4 detects that the light select switch 43 is pressed once, the red LED provided as the emergency warning light 53A is turned on as an emergency light, and the light select switch 43 is turned on twice. When it is detected that it has been pressed, the white LED provided as the emergency warning light 53B is turned on to function as a front light, and when it is detected that the light select switch 43 has been pressed three times, the pair of emergency lamps The warning lights 53A and 53B are blinked alternately, that is, red and white alternately, and when it is detected that the light select switch 43 is pressed four times, the pair of emergency warning lights 53A and 53B are turned off.

699 When the control circuit unit 4 detects that the light select switch 43 has been pressed and held for 3 seconds or longer, the control circuit unit 4 drives the charge amount display unit 51 to turn on the light according to the charge amount of the battery.

[0078]

705 Further, the control circuit unit 4 controls the operation of the pair of side illumination lamps 54A and 54B by the display control unit in response to the pressing operation of the side light on / off switch 44, and the side light on / off. -When it is detected that the switch 44 is pressed, as shown in FIG. 11, the pair of side illumination lamps 54A and 54B are turned on, and it is detected that the side light on / off switch 44 is pressed again. Then, the pair of side

illumination lamps 54A and 54B are turned off.

[0079]

714 Further, the control circuit unit 4 constantly monitors the battery voltage of the lithium ion storage battery 2, and when the battery voltage drops to 8.2 V, the battery low indicator lamp 52 is turned on to be in an over-discharged state. It has a function to warn that.

[0080]

720 1 Charging circuit, 2 Lithium-ion battery, 3 Output circuit, 4 Control circuit, 10 Housing, 11 Left side wall, 12 Right side wall, 13 Front wall, 20 DC input terminal, 31 First DC output terminal, 32 2nd DC output terminal, 33 3rd DC output terminal, 34 4th DC output terminal, 41 power switch, 42 jump start switch, 43 light select switch, 44 side light on / off switch, 51 charge amount Display, 52 battery low indicator, 53A, 53B emergency warning light, 54A, 54B side lighting, 100 vehicle auxiliary power supply, 110A AC adapter cable, 110B cigar plug cable, 111A AC adapter, 112 DC plug, 111B Cigar plug, 121A, 121B connection clip, 122 plug, 120 booster cable, 130 USB cable, 140A first cigar plug cable, 140B second cigar plug cable, 141A DC plug, 141B OBD2 connector, 142 cigar plug, 200 in-vehicle Battery, 300 USB device

EXHIBIT 1002
Page 1730 of 2306 Petitioner ADC (IPR2024-00671)

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CLAIMS JP3182855U

1.

13 A DC input terminal consisting of a housing and a DC jack installed on the side wall of the housing and to which a power supply cable for charging is externally connected via a DC plug, and a DC input terminal installed in the housing and inside the DC input terminal. A connected charging circuit unit, a lithium ion storage battery installed in the housing and internally connected to the charging circuit unit, and an output circuit unit installed in the housing and internally connected to the lithium ion storage battery. A control circuit unit installed in the housing and controlling the operation of the charging circuit unit and the output circuit unit, and an internal connection to the output circuit unit installed on the side wall of the housing, and a booster cable plugs the plug. A first DC output terminal for jump start consisting of a jack connected externally via a jack, installed on the side wall of the housing, internally connected to the output circuit section, and a PC power cable externally connected via a plug. It is installed on the front wall of the housing and internally connected to the output circuit section with a second DC output terminal for PC power supply consisting of a jack to be connected, and the USB cable is externally connected via a USB plug. From a cigar socket that is installed on the back wall of the housing and is internally connected to the output circuit section, and the external power cable is externally connected via a cigar plug. A fourth DC output terminal, a power switch and a jump start switch installed on the front wall of the housing and internally connected to the control circuit unit, and a control circuit unit installed on the front wall of the housing. The control circuit unit monitors the charge amount of the lithium ion storage battery and displays the charge amount on the charge amount display unit. In addition to controlling the level bar display, the control circuit unit jump-starts with the vehicle battery externally connected to the first DC output terminal via a booster cable and the power switch turned on. By accepting the operation input of the switch, control is performed to supply power for jump start from the output circuit unit via the first DC output terminal, and to the second DC output terminal via a PC power cable. By accepting the operation input

of the power switch while the PC is externally connected, control is performed to supply power for driving the PC from the output circuit unit via the second DC output terminal, and the third A USB device is externally connected to the DC output terminal via a USB cable. In this state, by accepting the operation input of the power switch, the output circuit unit controls to supply the power for driving the USB device via the third DC output terminal, and the fourth DC output. By accepting the operation input of the power switch while the external device is externally connected to the terminal via the external power cable, the power supply for driving the external device from the output circuit unit via the fourth DC output terminal. Auxiliary power supply device for vehicles, which is characterized by controlling the supply of power.

2.

51 The DC input terminal is supplied with power via the charging power supply cable provided with an AC adapter or a cigar socket at one end, and the control circuit unit supplies power to the DC input terminal via the charging power supply cable. When the detected state is detected, the lithium ion storage battery is controlled to be charged via the charging circuit unit, and during the charging control, the power supply from the output circuit unit to the outside is prohibited. The vehicle auxiliary power supply device according to claim 1.

3.

60 The control circuit unit detects the power ON by operating the power switch, controls the operation of the charge amount display unit, causes the charge amount display unit to function as a power lamp for displaying the power ON, and is in this power ON state. Detects the jump start by operating the jump start switch for a short time and controls the jump start mode, and in the control of this jump start mode, jumps via the booster cable externally connected to the first DC output terminal. When the voltage of the in-vehicle battery of the automobile to be started can be detected normally, the operation of the output circuit unit is controlled, and the lithium ion storage battery is used as a power source for jump start via the output circuit unit to the first DC. Either claim 1 or 2, characterized in that the charge amount display unit functions as a jump start lamp for displaying a jump start by connecting to an output terminal and controlling the operation of the charge amount display unit. The vehicle auxiliary power supply device according to item 1.

4.

75 The control circuit unit detects that the jump start switch has been operated for a long time in the power-on state and controls the charge boost mode. In the control of the jump start mode, the control circuit unit is connected to the first DC output terminal. When the voltage of the in-vehicle battery of the automobile to be jump-started via the externally connected booster cable can be detected normally, the operation of the output circuit unit is controlled, and the lithium

ion storage battery is used as the power source for charge boost. It is characterized in that it is connected to the first DC output terminal via a circuit unit, controls the operation of the charge amount display unit, and functions as the charge boost lamp for displaying the charge boost. The vehicle auxiliary power supply device according to claim 3.

5.

87 The charge amount display unit is composed of a plurality of light emitting elements arranged on a straight line that is controlled by the control circuit unit and displays the charge amount of the lithium ion storage battery with a change in emission color on a level bar. By lighting one of the plurality of light emitting elements with the first light emitting color, the charge amount display unit functions as a power lamp for displaying the power ON, and the other of the plurality of light emitting elements 4. The charge amount display unit functions as a jump start lamp for displaying the jump start or a charge boost lamp for displaying the charge boost by lighting one of them with a second emission color. Auxiliary power supply device for vehicles described.

6.

99 The control circuit unit accepts the operation input of the power switch while the vehicle's OBD (On-Board Diagnostic system) system is externally connected to the fourth DC output terminal as an external device via the external power cable. As a result, any one of claims 1 to 5, wherein power is supplied from the output circuit unit via the fourth DC output terminal as a power source for driving an external device for memory backup of the OBD. The vehicle auxiliary power supply device according to item 1.

7.

108 The auxiliary power supply device for a vehicle according to claim 7, wherein the lithium ion storage battery includes a plurality of rechargeable lithium ion batteries installed in the housing.

8.

114 The vehicle according to claim 7, wherein by mounting three 3.6 V rechargeable lithium ions in the housing, the vehicle functions as a jump starter having a weight of about 830 g and a capacity of 12 V / 4.5 Ah. Auxiliary power supply device for.

9.

120 The vehicle auxiliary according to claim 7, wherein six 3.6V rechargeable lithium ions are mounted in the housing to function as a jump starter having a weight of about 1300 g and a

capacity of 12 V / 9 Ah. Power supply device.

EXHIBIT 1002
Page 1734 of 2306 Petitioner ADC (IPR2024-00671)

【実用新案登録請求の範囲】
【請求項１】
筐体と、
上記筐体の側壁に設置され、充電用の給電ケーブルがＤＣプラグを介して外部接続されるＤＣジャックからなるＤＣ入力端子と、
上記筐体内に設置され、上記ＤＣ入力端子に内部接続された充電回路部と、
上記筐体内に設置され、上記充電回路部に内部接続されたリチウムイオン蓄電池と、
上記筐体内に設置され、上記リチウムイオン蓄電池に内部接続された出力回路部と、
上記筐体内に設置され、上記充電回路部及び出力回路部の動作を制御する制御回路部と、
上記筐体の側壁に設置され、上記出力回路部に内部接続されており、ブースタケーブルがプラグを介して外部接続されるジャックからなるジャンプスタート用の第１のＤＣ出力端子と、
上記筐体の側壁に設置され、上記出力回路部に内部接続されており、ＰＣ電源ケーブルがプラグを介して外部接続されるジャックからなるＰＣ電源用の第２のＤＣ出力端子と、
上記筐体の正面壁に設置され、上記出力回路部に内部接続されており、ＵＳＢケーブルがＵＳＢプラグを介して外部接続されるＵＳＢソケットからなる第３のＤＣ出力端子と、
上記筐体の背面壁に設置され、上記出力回路部に内部接続されており、外部電源ケーブルがシガープラグを介して外部接続されるシガーソケットからなる第４のＤＣ出力端子と、
上記筐体の正面壁に設置され、上記制御回路部に内部接続された電源スイッチ、ジャンプスタートスイッチと、
上記筐体の正面壁に設置され、上記制御回路部により制御されて上記リチウムイオン蓄電池の充電量をレベルバー表示する充電量表示部と
を備え、
上記制御回路部は、上記リチウムイオン蓄電池の充電量を監視し、上記充電量を上記充電量表示部によりレベルバー表示させる制御を行うとともに、
上記制御回路部は、上記第１のＤＣ出力端子にブースタケーブルを介して車両バッテリが外部接続され、上記電源スイッチがＯＮされた状態で、上記ジャンプスタートスイッチの操作入力を受け付けることにより、上記出力回路部から上記第１のＤＣ出力端子を介してジャンプスタート用の電源を供給する制御を行い、上記第２のＤＣ出力端子にＰＣ電源ケーブルを介してＰＣが外部接続された状態で、上記電源スイッチの操作入力を受け付けることにより、上記出力回路部から上記第２のＤＣ出力端子を介してＰＣ駆動用の電源を供給する制御を行い、上記第３のＤＣ出力端子にＵＳＢケーブルを介してＵＳＢ機器が外部接続された状態で、上記電源スイッチの操作入力を受け付けることにより、上記出力回路部から上記第３のＤＣ出力端子を介してＵＳＢ機器駆動用の電源を供給する制御を行い、上記第４のＤＣ出力端子に外部電源ケーブルを介して外部機器が外部接続された状態で、上記電源スイッチの操作入力を受け付けることにより、上記出力回路部から上記第４のＤＣ出力端子を介して外部機器駆動用の電源を供給する制御を行うことを特徴とする車両用補助給電装置。
【請求項２】
上記ＤＣ入力端子には、一端にＡＣアダプタ又はシガーソケットを備えた上記充電用の給電ケーブルを介して給電され、
上記制御回路部は、上記ＤＣ入力端子に上記充電用の給電ケーブルを介して給電された状態を検出すると、上記充電回路部を介して上記リチウムイオン蓄電池を充電する制御を行い、充電制御中は、上記出力回路部から外部への電源供給を禁止する制御を行うことを特徴とする請求項１記載の車両用補助給電装置。
【請求項３】
上記制御回路部は、上記電源スイッチの操作による電源ＯＮを検知して上記充電量表示部の動作を制御し、電源ＯＮを表示するパワーランプとして上記充電量表示部を機能させ

、この電源ＯＮ状態で上記ジャンプスタートスイッチの短時間操作によるジャンプスタートを検知してジャンプスタートモードの制御を行い、このジャンプスタートモードの制御において、上記第１のＤＣ出力端子に外部接続されたブースタケーブルを介してジャンプスタートさせる自動車の車載バッテリの電圧を正常に検知できた場合に、上記出力回路部の動作を制御し、上記リチウムイオン蓄電池をジャンプスタート用の電源として上記出力回路部を介して上記第１のＤＣ出力端子に接続するとともに、上記充電量表示部の動作を制御し、ジャンプスタートを表示するジャンプスタートランプとして上記充電量表示部を機能させることを特徴とする請求項１又は請求項２の何れか１項記載の車両用補助給電装置。

【請求項４】

上記制御回路部は、上記電源ＯＮ状態で上記ジャンプスタートスイッチが長時間操作されたことを検知してチャージブーストモードの制御を行い、このジャンプスタートモードの制御において、上記第１のＤＣ出力端子に外部接続されたブースタケーブルを介してジャンプスタートさせる自動車の車載バッテリの電圧を正常に検知できた場合に、上記出力回路部の動作を制御し、上記リチウムイオン蓄電池をチャージブースト用の電源として上記出力回路部を介して上記第１のＤＣ出力端子に接続するとともに、上記充電量表示部の動作を制御し、チャージブーストを表示するチャージブーストランプとして上記充電量表示部を機能させることを特徴とする請求項３記載の車両用補助給電装置。

【請求項５】

上記充電量表示部は、上記制御回路部により制御されて上記リチウムイオン蓄電池の充電量を発光色の変化とともにレベルバー表示する直線上に配置された複数個の発光素子からなり、

上記制御回路部は、上記複数個の発光素子の１つを第１の発光色で点灯させることにより、上記電源ＯＮを表示するパワーランプとして上記充電量表示部を機能させ、

上記複数個の発光素子の他の１つを第２の発光色で点灯させることにより、上記ジャンプスタートを表示するジャンプスタートランプ又は上記チャージブーストを表示するチャージブーストランプとして上記充電量表示部を機能させることを特徴とする請求項４記載の車両用補助給電装置。

【請求項６】

上記第４のＤＣ出力端子に上記外部電源ケーブルを介して外部機器として車両のＯＢＤ（On-Board Diagnostic system）システムが外部接続された状態で、上記制御回路部が上記電源スイッチの操作入力を受け付けることにより、上記出力回路部から上記第４のＤＣ出力端子を介して外部機器駆動用の電源として、上記ＯＢＤのメモリバックアップ用の電源供給を行うことを特徴とする請求項１乃至５項いずれか１項に記載の車両用補助給電装置。

【請求項７】

上記リチウムイオン蓄電池として上記筐体内に設置した複数個の充電式リチウムイオン電池を備えることを特徴とする請求項７項記載の車両用補助給電装置。

【請求項８】

上記筐体内に３．６Ｖの充電式リチウムイオンを３個実装することにより、重さ８３０ｇ程度で１２Ｖ／４．５Ａｈの容量のジャンプスタータとして機能させることを特徴とする請求項７項記載の車両用補助給電装置。

【請求項９】

上記筐体内に３．６Ｖの充電式リチウムイオンを６個実装することにより、重さ１３００ｇ程度で１２Ｖ／９Ａｈの容量のジャンプスタータとして機能させることを特徴とする請求項７項記載の車両用補助給電装置。

【考案の詳細な説明】

【技術分野】

【０００１】

本考案は、車両のバッテリが上がった場合に、車載バッテリに接続されて、エンジンを

始動させるスタータを含む車両の電気負荷に対して電力を供給して、上記エンジンを始動させるジャンプスタートさせるための車両用補助給電装置に関する。

【背景技術】

【０００２】

従来より、例えば路上等において、消費電気量の増加等により、車両に搭載されたバッテリが放電気味となりバッテリ容量が不足して電圧が低下し、電装品が作動しなくなった場合（いわゆるバッテリあがりの場合）に、他の自動車のバッテリや非常携帯電源（ジャンプスタータ）からブースタケーブルを介して電力を供給することによりエンジンを始動させるジャンプスタートが行われている。そして、ジャンプスタートのための電気的な接続を容易にする技術（例えば、特許文献１，２参照）や、ジャンプスタートを判定する技術（例えば、特許文献３参照）など各種提案がなされている。

【０００３】

従来、ジャンプスタータでは、コストと容量の関係から密閉式鉛蓄電池が用いられていた。

【０００４】

また、ＡＣアダプタを用いて充電可能なバッテリ駆動型のノートＰＣやその付帯機器などの情報機器が広く普及している。また、車両の車内に標準的に搭載されているＤＣ１２Ｖ／２４Ｖの車内用電源ソケット、いわゆるシガーソケットに接続して利用可能な車載対応の電気機器が数多く提供されている。また、近年の携帯電話やＵＳＢ（Universal Serial Bus）で給電可能な携帯音楽プレーヤ等の省電力で駆動可能な電子機器が広く使用されている。従来から、屋外で電気機器を使用するためにポータブル電源装置が用いられている。

【先行技術文献】

【特許文献】

【０００５】

【特許文献１】特開２００４－１３４２７８号公報

【特許文献２】特開２０１１－９７７１０号公報

【特許文献３】特開２００７－２７８２１６号公報

【考案の概要】

【考案が解決しようとする課題】

【０００６】

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

【０００７】

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

【０００８】

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

【０００９】
本考案のさらに他の目的、本考案によって得られる具体的な利点は、以下において図面を参照して説明される実施に形態から一層明らかにされる。
【課題を解決するための手段】
【００１０】
本考案は、車両用補助給電装置であって、筐体と、上記筐体の側壁に設置され、充電用の給電ケーブルがＤＣプラグを介して外部接続されるＤＣジャックからなるＤＣ入力端子と、上記筐体内に設置され、上記ＤＣ人力端子に内部接続された充電回路部と、上記筐体内に設置され、上記充電回路部に内部接続されたリチウムイオン蓄電池と、上記筐体内に設置され、上記リチウムイオン蓄電池に内部接続された出力回路部と、上記筐体内に設置され、上記充電回路部及び出力回路部の動作を制御する制御回路部と、上記筐体の側壁に設置され、上記出力回路部に内部接続されており、ブースタケーブルがプラグを介して外部接続されるジャックからなるジャンプスタート用の第１のＤＣ出力端子と、上記筐体の側壁に設置され、上記出力回路部に内部接続されており、ＰＣ電源ケーブルがプラグを介して外部接続されるジャックからなるＰＣ電源用の第２のＤＣ出力端子と、上記筐体の正面壁に設置され、上記出力回路部に内部接続されており、ＵＳＢケーブルがＵＳＢプラグを介して外部接続されるＵＳＢソケットからなる第３のＤＣ出力端子と、上記筐体の背面壁に設置され、上記出力回路部に内部接続されており、外部電源ケーブルがシガープラグを介して外部接続されるシガーソケットからなる第４のＤＣ出力端子と、 上記筐体の正面壁に設置され、上記制御回路部に内部接続された電源スイッチ、ジャンプスタートスイッチと、上記筐体の正面壁に設置され、上記制御回路部により制御されて上記リチウムイオン蓄電池の充電量をレベルバー表示する充電量表示部とを備え、上記制御回路部は、上記リチウムイオン蓄電池の充電量を監視し、上記充電量を上記充電量表示部によりレベルバー表示させる制御を行うとととともに、上記制御回路部は、上記第１のＤＣ出力端子にブースタケーブルを介して車両バッテリが外部接続され、上記電源スイッチがＯＮされた状態で、上記ジャンプスタートスイッチの操作入力を受け付けることにより、上記出力回路部から上記第１のＤＣ出力端子を介してジャンプスタート用の電源を供給する制御を行い、上記第２のＤＣ出力端子にＰＣ電源ケーブルを介してＰＣが外部接続された状態で、上記電源スイッチの操作入力を受け付けることにより、上記出力回路部から上記第２のＤＣ出力端子を介してＰＣ駆動用の電源を供給する制御を行い、上記第３のＤＣ出力端子にＵＳＢケーブルを介してＵＳＢ機器が外部接続された状態で、上記電源スイッチの操作入力を受け付けることにより、上記出力回路部から上記第３のＤＣ出力端子を介してＵＳＢ機器駆動用の電源を供給する制御を行い、上記第４のＤＣ出力端子に外部電源ケーブルを介して外部機器が外部接続された状態で、上記電源スイッチの操作入力を受け付けることにより、上記出力回路部から上記第４のＤＣ出力端子を介して外部機器駆動用の電源を供給する制御を行うことを特徴とする。
【００１１】
本考案車に係る両用補助給電装置において、上記ＤＣ入力端子には、一端にＡＣアダプタ又はシガーソケットを備えた上記充電用の給電ケーブルを介して給電され、上記制御回路部は、上記ＤＣ入力端子に上記充電用の給電ケーブルを介して給電された状態を検出すると、上記充電回路部を介して上記リチウムイオン蓄電池を充電する制御を行い、充電制御中は、上記出力回路部から外部への電源供給を禁止する制御を行うものとすることができる。
【００１２】
また、本考案車に係る両用補助給電装置において、上記制御回路部は、上記電源スイッチの操作による電源ＯＮを検知して上記充電量表示部の動作を制御し、電源ＯＮを表示するパワーランプとして上記充電量表示部を機能させ、この電源ＯＮ状態で上記ジャンプスタートスイッチの短時間操作によるジャンプスタートを検知してジャンプスタートモードの制御を行い、このジャンプスタートモードの制御において、上記第１のＤＣ出力端子に外部接続されたブースタケーブルを介してジャンプスタートさせる自動車の車載バッテリ

の電圧を正常に検知できた場合に、上記出力回路部の動作を制御し、上記リチウムイオン蓄電池をジャンプスタート用の電源として上記出力回路部を介して上記第１のＤＣ出力端子に接続するとともに、上記充電量表示部の動作を制御し、ジャンプスタートを表示するジャンプスタートランプとして上記充電量表示部を機能させるものとすることができる。

【００１３】

また、本考案車に係る両用補助給電装置において、上記制御回路部は、上記電源ＯＮ状態で上記ジャンプスタートスイッチが長時間操作されたことを検知してチャージブーストモードの制御を行い、このジャンプスタートモードの制御において、上記第１のＤＣ出力端子に外部接続されたブースタケーブルを介してジャンプスタートさせる自動車の車載バッテリの電圧を正常に検知できた場合に、上記出力回路部の動作を制御し、上記リチウムイオン蓄電池をチャージブースト用の電源として上記出力回路部を介して上記第１のＤＣ出力端子に接続するとともに、上記充電量表示部の動作を制御し、チャージブーストを表示するチャージブーストランプとして上記充電量表示部を機能させるものとすることができる。

【００１４】

また、本考案車に係る両用補助給電装置において、上記充電量表示部は、上記制御回路部により制御されて上記リチウムイオン蓄電池の充電量を発光色の変化とともにレベルバー表示する直線上に配置された複数個の発光素子からなり、上記制御回路部は、上記複数個の発光素子の１つを第１の発光色で点灯させることにより、上記電源ＯＮを表示するパワーランプとして上記充電量表示部を機能させ、上記複数個の発光素子の他の１つを第２の発光色で点灯させることにより、上記ジャンプスタートを表示するジャンプスタートランプ又は上記チャージブーストを表示するチャージブーストランプとして上記充電量表示部を機能させるものとすることができる。

【００１５】

また、本考案車に係る両用補助給電装置は、上記第４のＤＣ出力端子に上記外部電源ケーブルを介して外部機器として車両のＯＢＤ（On-Board Diagnostic system）システムが外部接続された状態で、上記制御回路部が上記電源スイッチの操作入力を受け付けることにより、上記出力回路部から上記第４のＤＣ出力端子を介して外部機器駆動用の電源として、上記ＯＢＤのメモリバックアップ用の電源供給を行うものとすることができる。

【００１６】

また、本考案車に係る両用補助給電装置は、上記リチウムイオン蓄電池として上記筐体内に設置した複数個の充電式リチウムイオン電池を備えるものとすることができる。

【００１７】

また、本考案車に係る両用補助給電装置は、上記筐体内に３．６Ｖの充電式リチウムイオンを３個実装することにより、重さ８３０ｇ程度で１２Ｖ／４．５Ａｈの容量のジャンプスタータとして機能させるものとすることができる。

【００１８】

さらに、本考案車に係る両用補助給電装置は、上記筐体内に３．６Ｖの充電式リチウムイオンを６個実装することにより、重さ１３００ｇ程度で１２Ｖ／９Ａｈの容量のジャンプスタータとして機能させるものとすることができる。

【考案の効果】

【００１９】

本考案によれば、ジャンプスタータとしての機能を有し、しかも、バッテリ駆動型のノートＰＣやその付帯機器などの情報機器、シガーソケットに接続して利用可能な車載対応の電気機器、携帯電話やＵＳＢで給電可能な携帯音楽プレーヤ等の使用を可能にするポータブル電源としての機能を有し、さらに、ＯＢＤ（On-Board Diagnostic system）システムに対応した車両のメモリバックアップ用のポータブル電源として機能する小型軽量で携帯性に優れ、使い勝手のよい車両用補助給電装置を提供することができる。

【図面の簡単な説明】

【００２０】

【図１】本考案を適用した車両用補助給電装置を前方側左斜め上方から見た外観斜視図である。
【図２】上記車両用補助給電装置を前方側右斜め上方から見た外観斜視図である。
【図３】上記車両用補助給電装置の構成要素の電気的な接続状態を示すブロック図である。
【図４】上記車両用補助給電装置のＤＣ入力端子に接続される充電用の給電ケーブルを示す平面図であり、（Ａ）はＡＣアダプタケーブルを示し、（Ｂ）はシガープラグケーブルを示している。
【図５】上記ＤＣ入力端子にＡＣアダプタを接続した状態の上記車両用補助給電装置を示す外観斜視図である。
【図６】充電レベルのバー表示状態を示す上記車両用補助給電装置の充電量表示部の正面図である。
【図７】上記車両用補助給電装置の第１のＤＣ出力端子に接続されるブースタケーブルを示す平面図である。
【図８】上記第１のＤＣ出力端子にブースタケーブルを介してジャンプスタートさせる自動車の車載バッテリを接続した状態の上記車両用補助給電装置を示す外観斜視図である。
【図９】第３のＤＣ出力端子にＵＳＢケーブルを介してＵＳＢ機器を接続した状態の上記車両用補助給電装置を示す外観斜視図である。
【図１０】上記車両用補助給電装置の第４のＤＣ出力端子に接続されるシガープラグケーブルを示す平面図であり、（Ａ）は一端にＤＣプラグを備える第１のシガープラグケーブルを示し、（Ｂ）は一端にＯＢＤ２コネクタに備える第２のシガープラグケーブルを示している。
【図１１】上記車両用補助給電装置の側面壁に設けられた側面照明灯の点灯状態を示す上記車両用補助給電装置の外観斜視図である。
【考案を実施するための形態】
【００２１】
以下、本考案の実施の形態について、図面を参照しながら詳細に説明する。なお、本考案は、以下の実施の形態のみに限定されるものではなく、本考案の要旨を逸脱しない範囲内において種々の変更が可能であることは言うまでもない。
【００２２】
本考案を適用した車両用補助給電装置１００を前方側左斜め上方から見た外観斜視図及び前方側右斜め上方から見た外観斜視図を図１及び図２に示す。また、上記車両用補助給電装置１００の構成要素の電気的な接続状態を示す図３のブロック図に示す。
【００２３】
この車両用補助給電装置１００は、図１及び図２の外観斜視図に示すように薄型箱状の筐体１０を備え、また、図３のブロック図に示すように上記筐体１０の内部に設置された充電回路部１、リチウムイオン蓄電池２、出力回路部３及び制御回路部４を備える。
【００２４】
そして、この車両用補助給電装置１００では、図１の外観斜視図に示すように、家庭用電源や自動車バッテリから例えば１２Ｖの電源供給を受けるためのＤＣ入力端子２０が上記筐体１０の左側面壁１１に設置されている。
【００２５】
このＤＣ入力端子２０は、後述するように充電用の給電ケーブルがＤＣプラグを介して外部接続されるＤＣジャックからなる。
【００２６】
このＤＣ入力端子２０には、図３のブロック図に示すように上記充電回路部１が内部接続されている。上記充電回路部１には、上記リチウムイオン蓄電池２が内部接続されている。また、上記リチウムイオン蓄電池２には、上記出力回路部３が内部接続されている。さらに、上記充電回路部１及び出力回路部３には、上記制御回路部４が内部接続されている。

【００２７】
また、この車両用補助給電装置１００は、図３のブロック図に示すように、上記出力回路部３に内部接続されたジャンプスタート用の第１のＤＣ出力端子３１、ＰＣ電源用の第２のＤＣ出力端子３２、ＵＳＢ電源用の第３のＤＣ出力端子３３及びメモリバックアップ電源用の第４のＤＣ出力端子３４を備える。
【００２８】
上記第１のＤＣ出力端子３１は、後述するようにブースタケーブルがプラグを介して外部接続されるジャックからなる。
【００２９】
上記第２のＤＣ出力端子３２は、後述するようにＰＣ電源ケーブルがプラグを介して外部接続されるジャックからなる。
【００３０】
上記第３のＤＣ出力端子３３は、後述するようにＵＳＢケーブルがＵＳＢプラグを介して外部接続されるＵＳＢソケットからなる。
【００３１】
上記第４のＤＣ出力端子３４は、後述するように外部電源ケーブルがシガープラグを介して外部接続されるシガーソケットからなる。
【００３２】
上記ジャンプスタート用の第１のＤＣ出力端子３１と、ＰＣ電源用の第２のＤＣ出力端子３２は、図２の外観斜視図に示すように、上記筐体１０の右側面壁１２に設置されている。また、図１の外観斜視図に示すように、上記ＵＳＢ電源用の第３のＤＣ出力端子３３は、上記筐体１０の正面壁１３に設置されており、上記メモリバックアップ電源用の第４のＤＣ出力端子３４は、上記筐体１０の左側面壁１１に設置されている。
【００３３】
また、この車両用補助給電装置１００は、図３のブロック図に示すように、上記制御回路部４に内部接続された電源スイッチ４１、ジャンプスタートスイッチ４２、ライトセレクトスイッチ４３及びサイドライト・オン／オフ・スイッチ４４を備える。上記電源スイッチ４１、ジャンプスタートスイッチ４２、ライトセレクトスイッチ４３及びサイドライト・オン／オフ・スイッチ４４は、図１の外観斜視図に示すように、上記筐体１０の正面壁１３に設置されている。
【００３４】
さらに、この車両用補助給電装置１００は、図３のブロック図に示すように、上記制御回路部４に内部接続された充電量表示部５１、バッテリロー表示灯５２、一対の非常用警告灯５３Ａ，５３Ｂ及び一対の側面照明灯５４Ａ，５４Ｂを備える。
【００３５】
上記充電量表示部５１及び一対の非常用警告灯５３Ａ，５３Ｂは、図１の外観斜視図に示すように、上記筐体１０の正面壁１３に設置されている。
【００３６】
上記充電量表示部５１は、直線状に配置された発光色の異なる複数（この実施の形態では、赤・橙・黄・緑の４色）のＬＥＤにより構成されている。この充電量表示部５１は、上記制御回路部４により制御されて、充電量をバー表示する機能を果たすばかりでなく、緑点灯によりパワーランプとして機能し、また、黄点灯によりジャンプスタートランプとして機能する。また、上記一対の非常用警告灯５３Ａ，５３Ｂは、赤色ＬＥＤと白色ＬＥＤからなり、上記制御回路部により制御されて、交互に点滅することにより非常用警告灯として機能する。
【００３７】
また、上記バッテリロー表示灯５２は、図２の外観斜視図に示すように、上記筐体１０の右側面壁１２に設置されている。
【００３８】
上記バッテリロー表示灯５２は、赤色ＬＥＤからなり、上記制御回路部４により制御さ

れて、上記リチウムイオン蓄電池２の電圧が所定値まで低下すると点滅状態あるいは点灯状態となることにより、バッテリロー表示灯として機能する。

【００３９】

また、上記一対の側面照明灯５４Ａ，５４Ｂ、図１及び図２の外観斜視図に示すように、上記筐体１０の左側面壁１１と右側面壁１２に設置されている。

【００４０】

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

【００４１】

このような構成の車両用補助給電装置１００において、上記筐体１０内に設置された制御回路部４は、上記充電回路部１の動作を制御する充電制御部、上記出力回路部１の動作を制御する出力制御部、充電量表示部５１５１等の動作を制御する表示制御部として機能するマイクロコンピュータからなり、内部接続された上記充電回路部１及び出力回路部３の動作を次のように制御する。

【００４２】

ここで、この車両用補助給電装置１００に接続される充電用の給電ケーブルとしては、図４の（Ａ），（Ｂ）に示すように、家庭用電源から充電用の１２Ｖの電源供給するためのＡＣアダプタケーブル１１０Ａと、自動車バッテリから例えば１２Ｖの電源供給を供給するためのシガープラグケーブル１１０Ｂが準備されている。

【００４３】

図４の（Ａ）に示すＡＣアダプタケーブル１１０Ａは、家庭用電源から充電用の１２Ｖの電源供給するためのＡＣアダプタ１１１Ａを一端に備え、上記ＤＣジャックからなるＤＣ入力端子２０にＤＣプラグ１１２を介して外部接続される。また、図４の（Ｂ）に示すシガープラグケーブル１１０Ｂは、自動車バッテリから例えば１２Ｖの電源供給を供給するためのシガープラグ１１１Ｂを一端に備え、上記ＤＣジャックからなるＤＣ入力端子２０にＤＣプラグ１１２を介して外部接続される。

【００４４】

そして、上記車両用補助給電装置１００における上記制御回路部４は、図５に示すように、上記ＤＣ入力端子２０にＡＣアダプタケーブル１１０Ａ又はシガープラグケーブル１１０Ｂが外部接続され、家庭用電源又は自動車バッテリから充電用の電源が供給されることにより、上記ＤＣ入力端子２０に所定電圧値以上の電圧が印加されたことを検出すると、充電モードの制御を行う。

【００４５】

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

【００４６】

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

【００４７】

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

【００４８】

上記充電量表示部５１は、上記制御回路部４により動作が制御されて、図６に示すように、未充電状態から、バッテリ残量２０％以下を示す赤色点状態、バッテリ残量２０％から３０％を示す赤色点灯、バッテリ残量３０％から４０％を示す橙色点滅状態、バッテリ残量４０％から７０％を示す黄色点灯状態、バッテリ残量７０％から１００％を示す緑色点灯状態へと、満充電状態まで充電が進むに従って、点灯状態が順次変化する。

【００４９】

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

【００５０】

ここで、この車両用補助給電装置１００には、図７に示すように、車載バッテリの電極端子を掴む接続クリップ１２１Ａ、１２１Ｂが２本のケーブルの一端に設けられ、上記ジャンプスタート用の第１のＤＣ出力端子３１を構成しているジャックにプラグ１２２を介して外部接続されるジャンプスタート用のブースタケーブル１２０が準備されている。

【００５１】

そして、この車両用補助給電装置１００は、次のようにしてジャンプスータとして使用される。

【００５２】

すなわち、この車両用補助給電装置１００をジャンプスータとして使用する場合、当該車両用補助給電装置１００の電源スイッチ４１がＯＦＦの状態で、図８に示すように、上記ジャンプスタート用のブースタケーブル１２０がユーザにより上記第１のＤＣ出力端子３１に接続される。

【００５３】

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

【００５４】

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

【００５５】

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

【００５６】

このジャンプスタートモードの制御において、上記制御回路部４は、上記ジャンプスタート用の第１のＤＣ出力端子３１にブースタケーブル１２０を介してジャンプスタートさせる自動車の車載バッテリ２００の電圧を正常に検知できた場合に、上記出力制御部により出力回路部３の動作を制御し、上記リチウムイオン蓄電池２をジャンプスタート用の電源として上記出力回路部３を介して上記ジャンプスタート用の第１のＤＣ出力端子３１に接続するとともに、上記表示制御部により充電量表示部５１の動作を制御し、上記充電量表示部５１を黄色点灯状態とする。上記充電量表示部５１は、黄色点灯によりジャンプスタートを表示するジャンプスタートランプとして機能する。このジャンプスタートモードでは、上記充電量表示部５１は、緑色点灯により電源ＯＮを表示するとともに黄色点灯によりジャンプスタートを表示している。

【００５７】

このジャンプスタートモードの状態で、ユーザは、この車両用補助給電装置１００が接続されている上記車載バッテリ２００を搭載した自動車のエンジンを始動させるジャンプスタートを行うことができる。

【００５８】

ここで、従来の一般的な鉛蓄電池を用いた１２Ｖ／４．５Ａｈ程度の容量のジャンプスタータは、本体重量が５ｋｇ～７ｋｇ程度あり、満充電電状態での始動可能回数は平均５回程度であったのに対し、本考案を適用した上記車両用補助給電装置１００は、例えば４５ｍｍ×１９０ｍｍ×１２０ｍｍ（高さ×幅×奥行き）の大きさの筐体１０内に例えば３

．６Ｖの充電式リチウムイオンを３個直列接続して実装することにより、重さ８３０ｇ程度で３０００ｃｃまでのガソリン乗用車に対応する１２Ｖ／４．５Ａｈの容量の可搬型ジャンプスタータとして機能し、小型軽量で、しかも、満充電電状態での始動可能回数も１０～２０回程度に向上している。

【００５９】

また、上記車両用補助給電装置１００は、例えば４５ｍｍ×１９０ｍｍ×１６０ｍｍ（高さ×幅×奥行き）の大きさの筐体１０を用いて、２倍の６個の充電式リチウムイオンを実装することにより、重さ１３００ｇ程度でガソリン乗用車全般及び３０００ｃｃ４気筒までのディーゼル車に対応する１２Ｖ／９Ａｈの容量の可搬型ジャンプスタータとして機能する。

【００６０】

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

【００６１】

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

【００６２】

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

【００６３】

この車両用補助給電装置１００における上記制御回路部４は、上記第２のＤＣ出力端子３２を構成しているにジャックにＰＣ電源ケーブルがプラグを介して外部接続され、上記ＰＣ電源ケーブルを介してＰＣが外部接続された状態で、ユーザが電源スイッチ４１を押して電源ＯＮにすると、電源ＯＮを検知して上記表示制御部により充電量表示部５１の動作を制御し、上記充電量表示部５１を緑色点灯状態として電源ＯＮを表示するとともに、上記出力制御部により上記出力回路部３の動作を制御して、ＤＣ１９ＶのＰＣ駆動用の電源を上記第２のＤＣ出力端子３２からＰＣ電源ケーブルを介してＰＣに供給する。

【００６４】

また、この車両用補助給電装置１００において、上記第３のＤＣ出力端子３３には、ＵＳＢ（Universal Serial Bus）で給電可能な携帯音楽プレーヤ等の電子機器を市販のＵＳＢケーブルを介して接続することができる。

【００６５】

この車両用補助給電装置１００における上記制御回路部４は、図９に示すように、上記第３のＤＣ出力端子３３を構成しているにＵＳＢジャックにＵＳＢケーブル１３０がＵＳＢプラグを介して外部接続され、上記ＵＳＢ電源ケーブル１３０を介してＵＳＢ機器３００が外部接続された状態で、ユーザが電源スイッチ４１を押して電源ＯＮにすると、電源ＯＮを検知して上記表示制御部により充電量表示部５１の動作を制御し、上記充電量表示部５１を緑色点灯状態として電源ＯＮを表示するとともに、上記出力制御部により上記出力回路部３の動作を制御して、ＤＣ５ＶのＵＳＢ駆動用の電源を上記第３のＤＣ出力端子３３からＵＳＢ電源ケーブル１３０を介してＵＳＢ機器３００に供給する。

【００６６】
さらに、この車両用補助給電装置１００には、シガーソケットからなる第４のＤＣ出力端子３４に外部接続されるシガープラグケーブルとして、図１０の（Ａ），（Ｂ）に示すように、２種類のシガープラグケーブルが準備されている。
【００６７】
図１０の（Ａ）に示す第１のシガープラグケーブル１４０Ａは、車両の車内に標準的に搭載されているＤＣ１２Ｖ／２４Ｖの車内用電源ソケット、いわゆるシガーソケットに接続して利用可能な車載対応の電気機器を接続するためのケーブルであって、車載対応の電気機器に接続されるＤＣプラグ１４１Ａを一端に備え、シガープラグ１４２を介して上記第４のＤＣ出力端子３４に外部接続される。
【００６８】
図１０の（Ｂ）に示す第２のシガープラグケーブル１４０Ｂは、ＯＢＤ（On-Board Diagnostic system）システムに対応した車両のメモリバック用のケーブルであって、ＯＢＤ２コネクタ１４１Ｂを一端に備え、シガープラグ１４２を介して上記第４のＤＣ出力端子３４に外部接続される。
【００６９】
この車両用補助給電装置１００における上記制御回路部４は、上記第４のＤＣ出力端子３４を構成しているにシガーソケットに第１のシガープラグケーブル１４０Ａ又は第２のシガープラグケーブル１４０Ｂがシガープラグ１４２を介して外部接続され、シガープラグケーブルを介して外部機器が外部接続された状態された状態で、ユーザが電源スイッチ４１を押して電源ＯＮにすると、電源ＯＮを検知して上記表示制御部により充電量表示部５１の動作を制御し、上記充電量表示部５１を緑色点灯状態として電源ＯＮを表示するとともに、上記出力制御部により上記出力回路部３の動作を制御して、ＤＣ１２Ｖの外部機器駆動用の電源を上記第４のＤＣ出力端子３２からシガープラグケーブルを介して外部機器に供給する。
【００７０】
すなわち、この車両用補助給電装置１００は、上記第４のＤＣ出力端子３４に外部接続される第１のシガーゲーブル１４０Ａを介して車載対応の電気機器を駆動するポータブル電源として機能する。
【００７１】
また、この車両用補助給電装置１００は、上記第４のＤＣ出力端子３４に外部接続される第２のシガーゲーブル１４０Ａを介してＯＢＤ（On-Board Diagnostic system）システムに対応した車両のメモリバックアップ用のポータブル電源として機能する。
【００７２】
ここで、ＯＢＤ（On-Board Diagnostic system）システムは、自動車に搭載されるコンピュータが行う自己故障診断機能であって、使用過程にある自動車の排出ガス浄化装置の機能点検を容易にしている。ＯＢＤ２では、その点検コネクタや通信プロトコル、故障診断コード等が標準化されている。
【００７３】
ＯＢＤ（On-Board Diagnostic system）システムを搭載した車両では、各種診断履歴情報がメモリに保存されており、搭載バッテリを交換する際に、メモリ上の情報を喪失することのないように、メモリにバックアップ電源を供給しておく必要がある。
【００７４】
すなわち、この車両用補助給電装置１００は、ジャンプスタータとしての機能を有し、しかも、バッテリ駆動型のノートＰＣやその付帯機器などの情報機器、シガーソケットに接続して利用可能な車載対応の電気機器、携帯電話やＵＳＢで給電可能な携帯音楽プレーヤ等の使用を可能にするポータブル電源としての機能を有し、さらに、ＯＢＤ（On-Board Diagnostic system）システムに対応した車両のメモリバックアップ用のポータブル電源として機能する小型軽量で携帯性に優れ、使い勝手のよい車両用補助給電装置となっている。

【００７５】
さらに、この車両用補助給電装置１００は、上述の如きジャンプスタータやポータブル電源として機能するばかりでなく、非常時に使用する警告表示灯や照明灯として機能する。

【００７６】
すなわち、この車両用補助給電装置１００における上記制御回路部４は、電源ＯＮの状態でライトセレクトスイッチ４３が押されたことを検知して、表示制御部により充電量表示部５１及び一対の非常用警告灯５３Ａ，５３Ｂを次のように制御する。

【００７７】
上記制御回路部４は、上記ライトセレクトスイッチ４３が１回押されたことを検知すると、上記非常用警告灯５３Ａとして備えられた赤色ＬＥＤを非常灯として点灯させ、上記ライトセレクトスイッチ４３が２回押されたことを検知すると、上記非常用警告灯５３Ｂとして備えられた白色ＬＥＤを点灯させ正面ライトとして機能させ、上記ライトセレクトスイッチ４３が３回押されたことを検知すると、上記一対の非常用警告灯５３Ａ，５３Ｂを交互に、すなわち、赤白交互に点滅させ、そして、上記ライトセレクトスイッチ４３が４回押されたことを検知すると、上記一対の非常用警告灯５３Ａ，５３Ｂを消灯させる。また、上記制御回路部４は、上記ライトセレクトスイッチ４３が３秒以上長押されたことを検知すると、上記充電量表示部５１を駆動して、バッテリの充電量に応じた点灯状態とする。

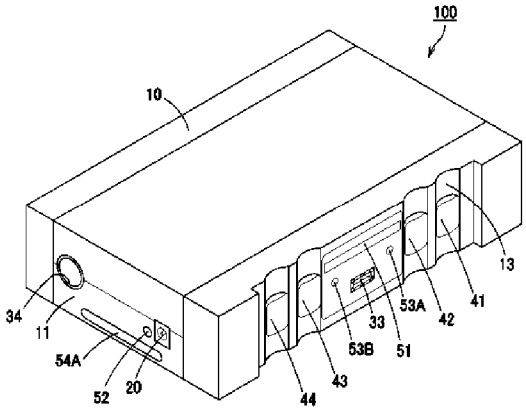
【００７８】
また、上記制御回路部４は、上記サイドライト・オン／オフ・スイッチ４４の押圧操作に応じて表示制御部により一対の側面照明灯５４Ａ，５４Ｂの動作を制御し、上記サイドライト・オン／オフ・スイッチ４４が押されたことを検知すると、図１１に示すように、上記一対の側面照明灯５４Ａ，５４Ｂを点灯させ、上記サイドライト・オン／オフ・スイッチ４４が再度押されたことを検知すると上記一対の側面照明灯５４Ａ，５４Ｂを消灯させる。

【００７９】
さらに、上記制御回路部４は、上記リチウムイオン蓄電池２のバッテリ電圧を常時監視しており、バッテリ電圧が８．２Ｖまで低下した場合にバッテリロー表示灯５２を点灯して、過放電状態であることを警告する機能を有している。

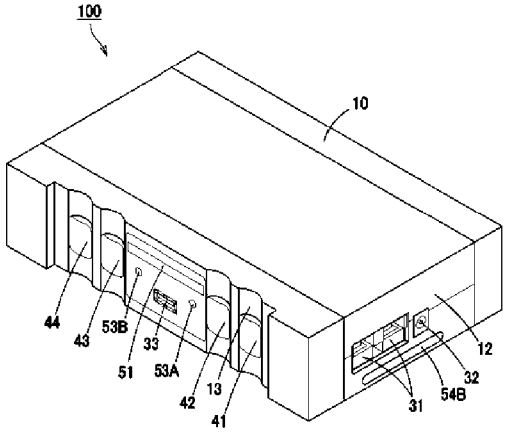
【符号の説明】

【００８０】
１　充電回路部、２　リチウムイオン蓄電池、３　出力回路部、４　制御回路部、１０　筐体、１１　左側面壁、１２　右側面壁、１３　正面壁、２０　ＤＣ入力端子、３１　第１のＤＣ出力端子、３２　第２のＤＣ出力端子、３３　第３のＤＣ出力端子、３４　第４のＤＣ出力端子、４１　電源スイッチ、４２　ジャンプスタートスイッチ、４３　ライトセレクトスイッチ、４４　サイドライト・オン／オフ・スイッチ、５１　充電量表示部、５２　バッテリロー表示灯、５３Ａ，５３Ｂ　非常用警告灯、５４Ａ，５４Ｂ　側面照明灯、１００　車両用補助給電装置、１１０Ａ　ＡＣアダプタケーブル、１１０Ｂ　シガープラグケーブル、１１１Ａ　ＡＣアダプタ、１１２　ＤＣプラグ、１１１Ｂ　シガープラグ、１２１Ａ、１２１Ｂ　接続クリップ、１２２　プラグ、１２０　ブースタケーブル、１３０　ＵＳＢケーブル、１４０Ａ　第１のシガープラグケーブル、１４０Ｂ　第２のシガープラグケーブル、１４１Ａ　ＤＣプラグ、１４１Ｂ　ＯＢＤ２コネクタ、１４２　シガープラグ、２００　車載バッテリ、３００　ＵＳＢ機器

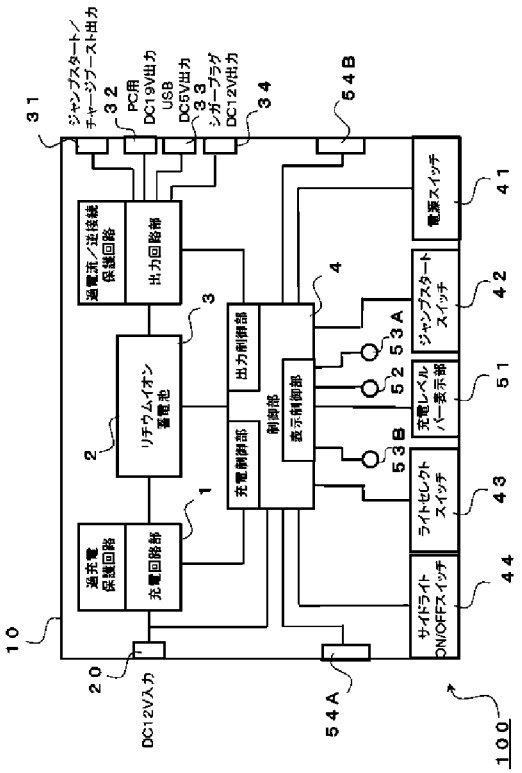
【図１】



【図２】



【図３】



【図４】

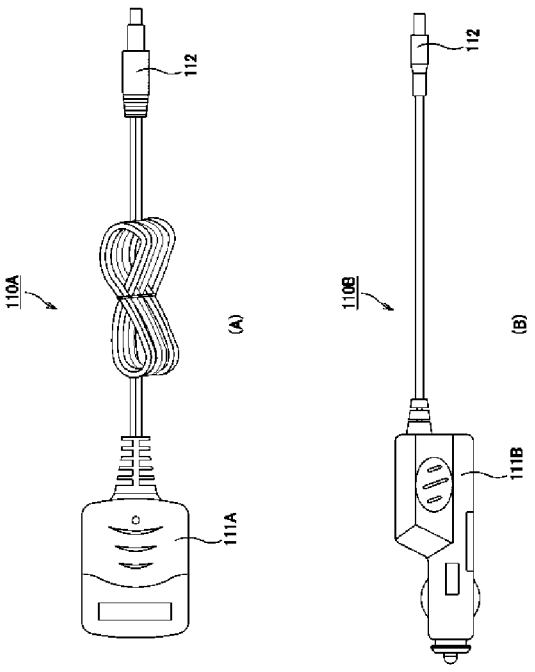
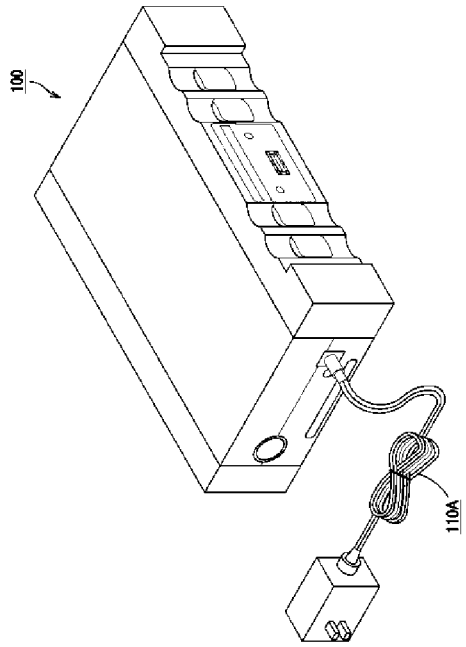
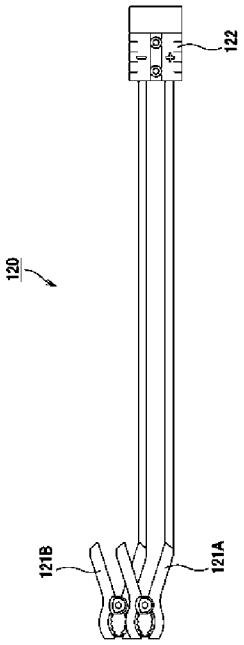


EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

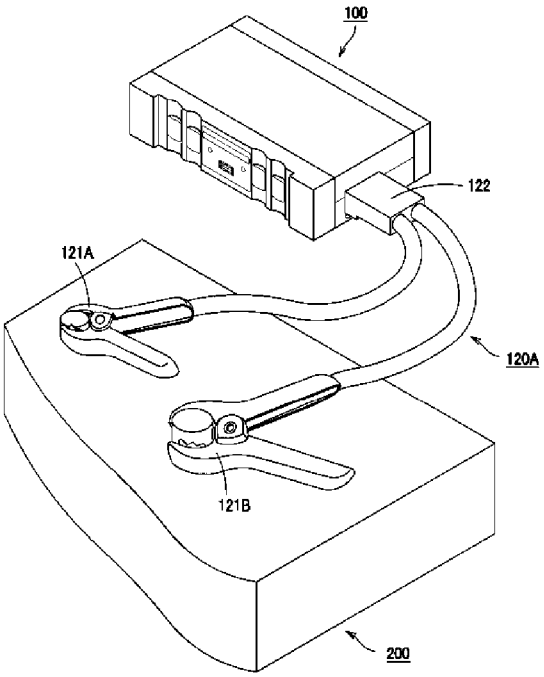
【図５】



【図７】



【図８】



【図９】

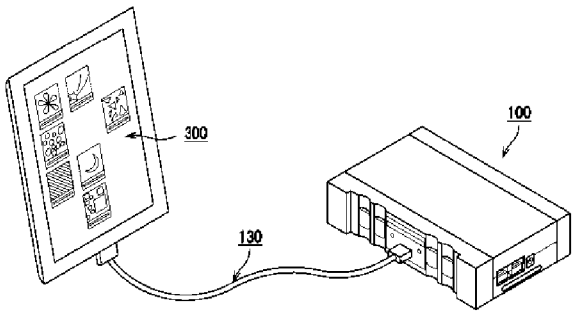
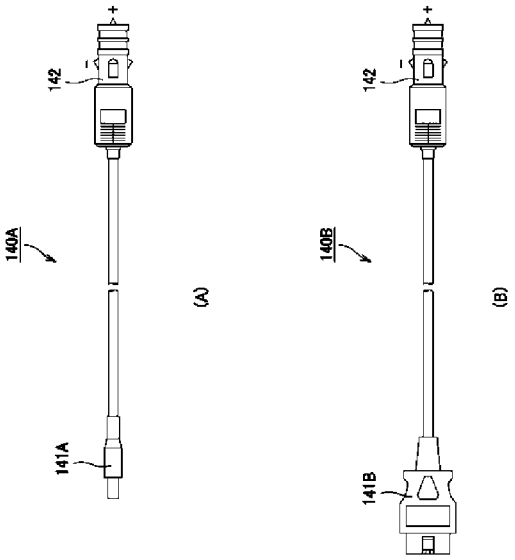
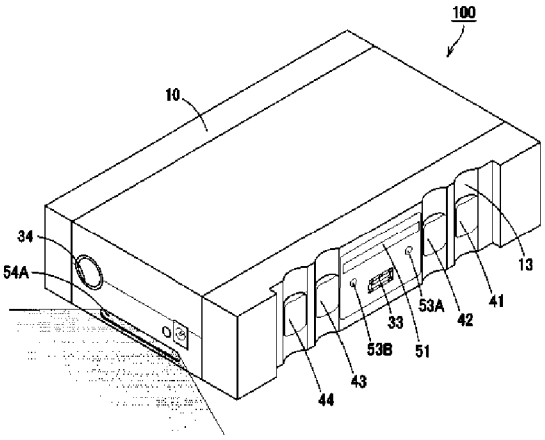


EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

【図１０】



【図１１】



【図６】

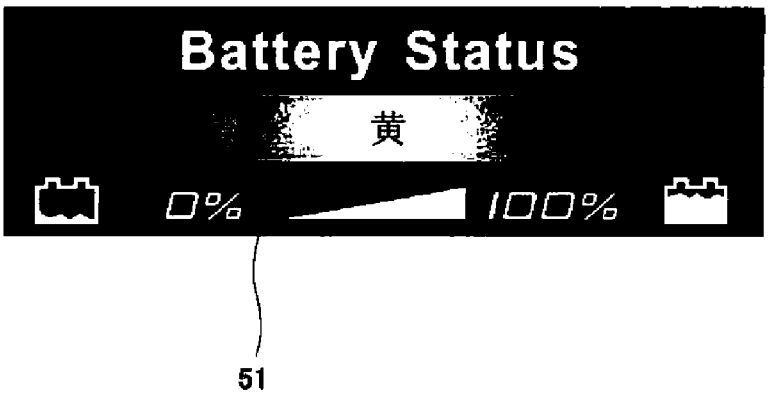


EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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Espacenet

CN103035874A Battery

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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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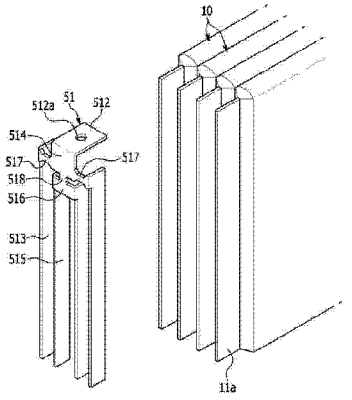
权利要求书 2 页 说明书 9 页 附图 9 页

(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。



CN 103035874 A

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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。

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

EXHIBIT 1002
Page 1753 of 2306 Petitioner ADC (IPR2024-00671)

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。

EXHIBIT 1002
Page 1754 of 2306 Petitioner ADC (IPR2024-00671)

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

EXHIBIT 1002
Page 1755 of 2306 Petitioner ADC (IPR2024-00671)

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。

EXHIBIT 1002
Page 1756 of 2306 Petitioner ADC (IPR2024-00671)

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。

EXHIBIT 1002
Page 1757 of 2306 Petitioner ADC (IPR2024-00671)

[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

EXHIBIT 1002
Page 1758 of 2306 Petitioner ADC (IPR2024-00671)

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。

EXHIBIT 1002
Page 1759 of 2306 Petitioner ADC (IPR2024-00671)

[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

EXHIBIT 1002
Page 1760 of 2306 Petitioner ADC (IPR2024-00671)

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

EXHIBIT 1002
Page 1761 of 2306 Petitioner ADC (IPR2024-00671)

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

EXHIBIT 1002
Page 1762 of 2306 Petitioner ADC (IPR2024-00671)

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。

EXHIBIT 1002
Page 1763 of 2306 Petitioner ADC (IPR2024-00671)

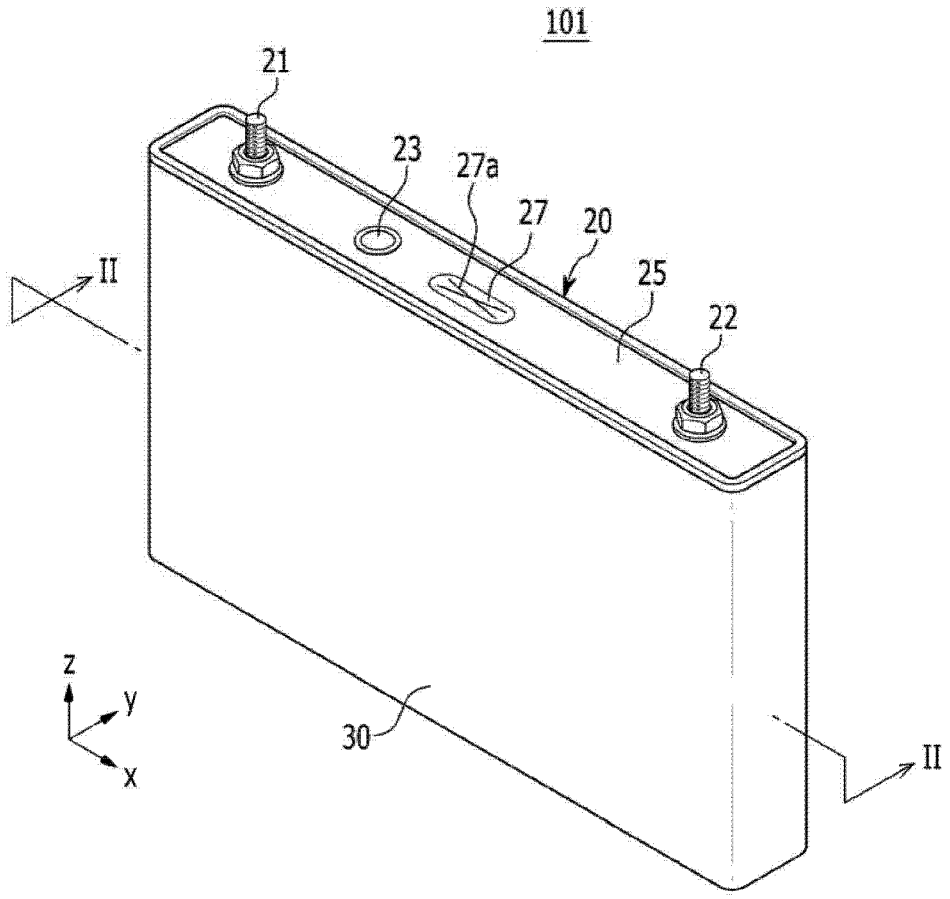


图 1

EXHIBIT 1002
Page 1764 of 2306 Petitioner ADC (IPR2024-00671)

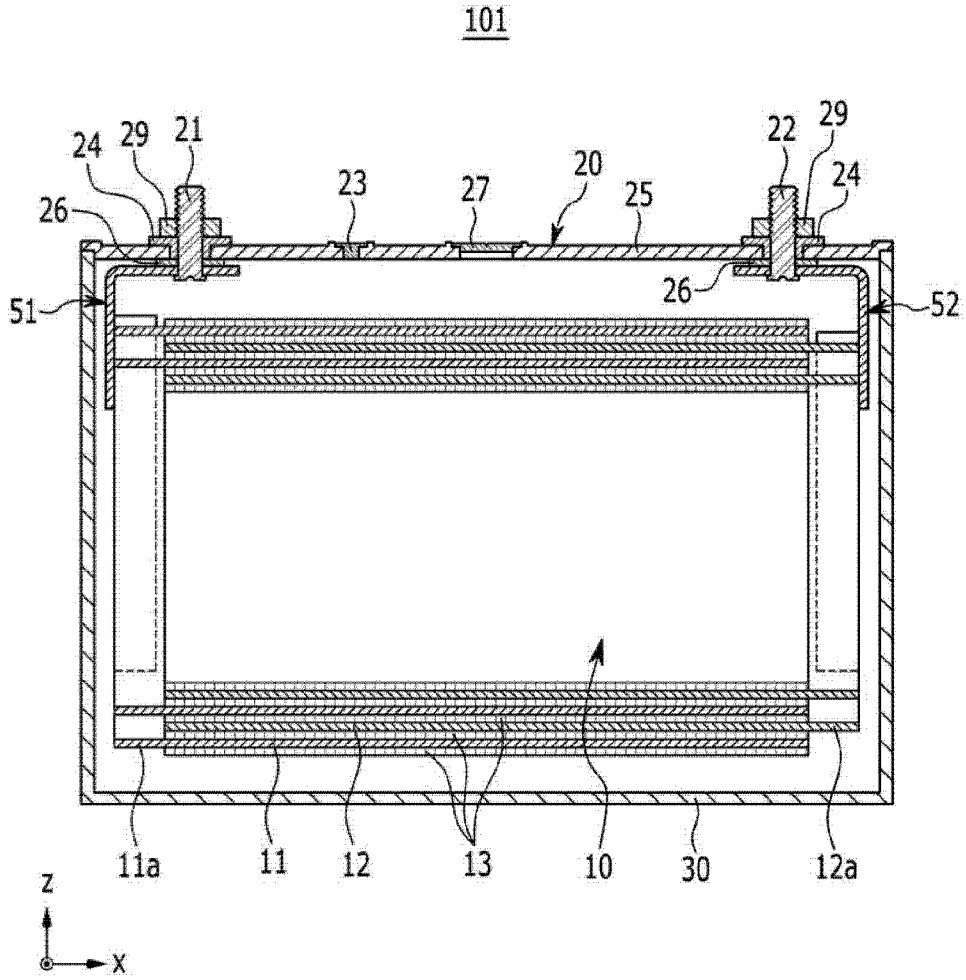


图 2

EXHIBIT 1002
Page 1765 of 2306 Petitioner ADC (IPR2024-00671)

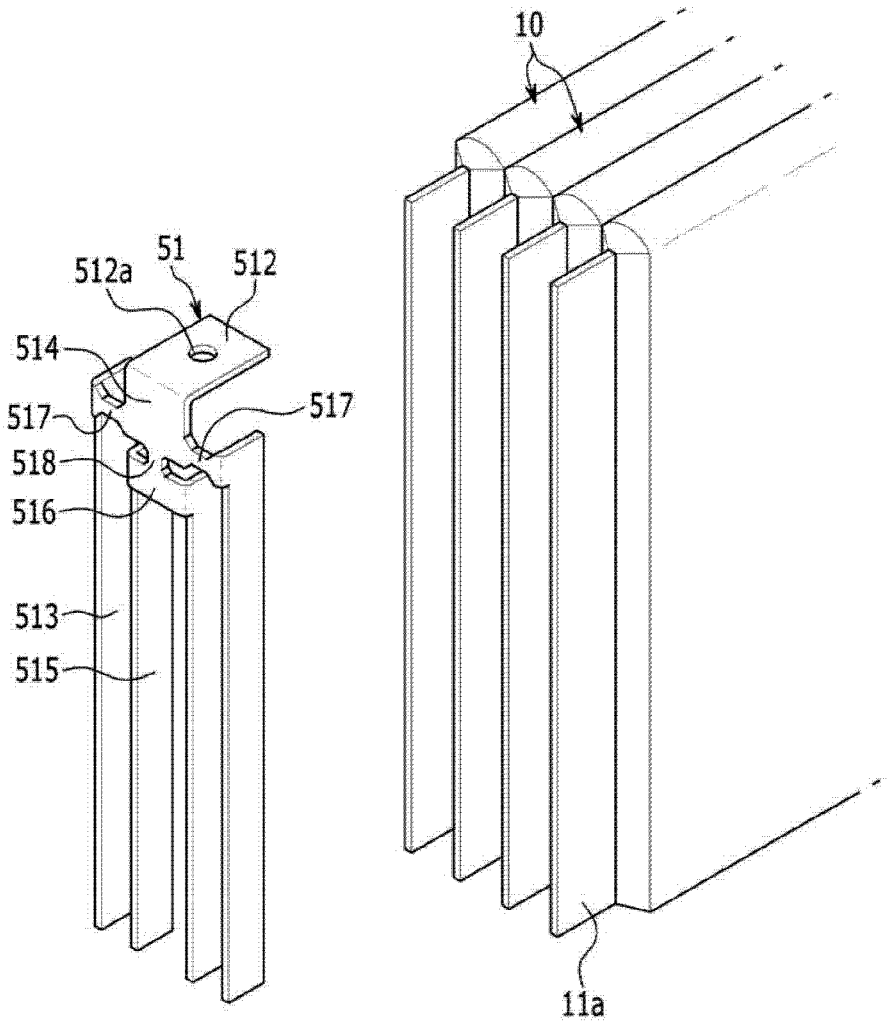


图 3

EXHIBIT 1002
Page 1766 of 2306 Petitioner ADC (IPR2024-00671)

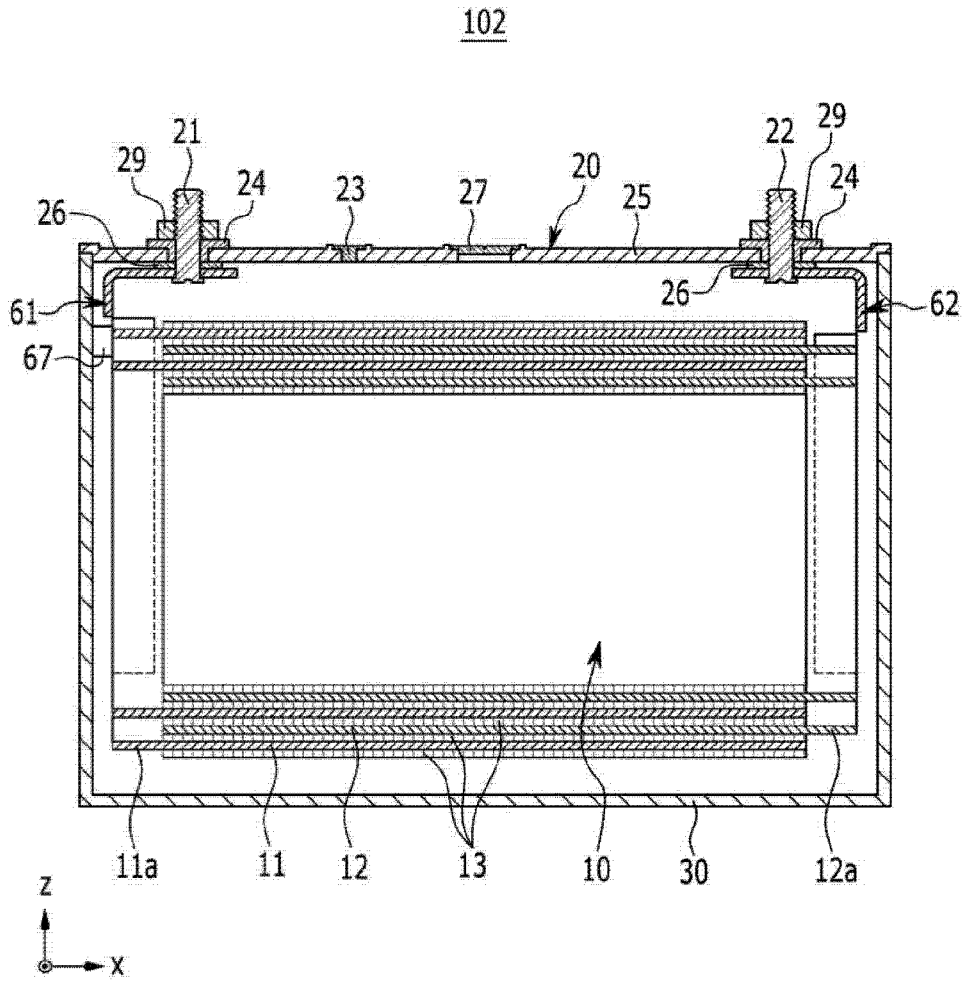


图 4

EXHIBIT 1002
Page 1767 of 2306 Petitioner ADC (IPR2024-00671)

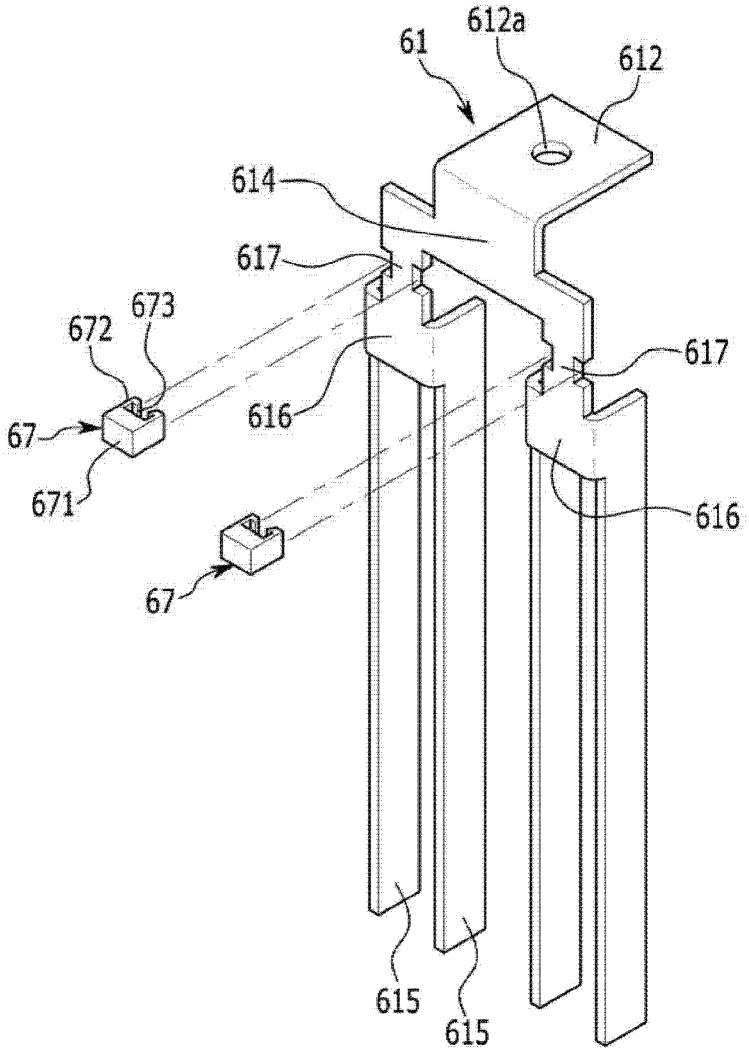


图 5

EXHIBIT 1002
Page 1768 of 2306 Petitioner ADC (IPR2024-00671)

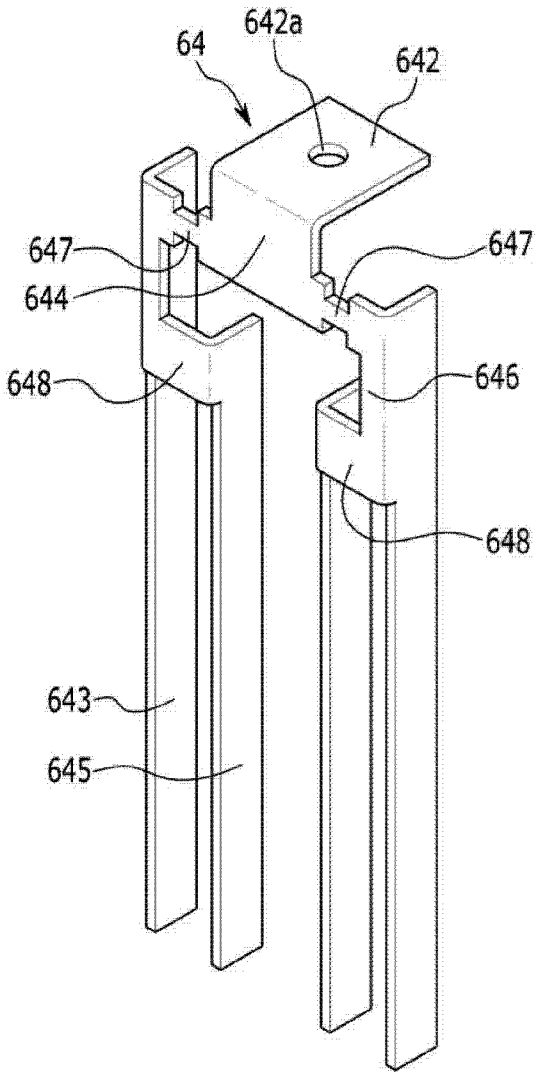


图 6

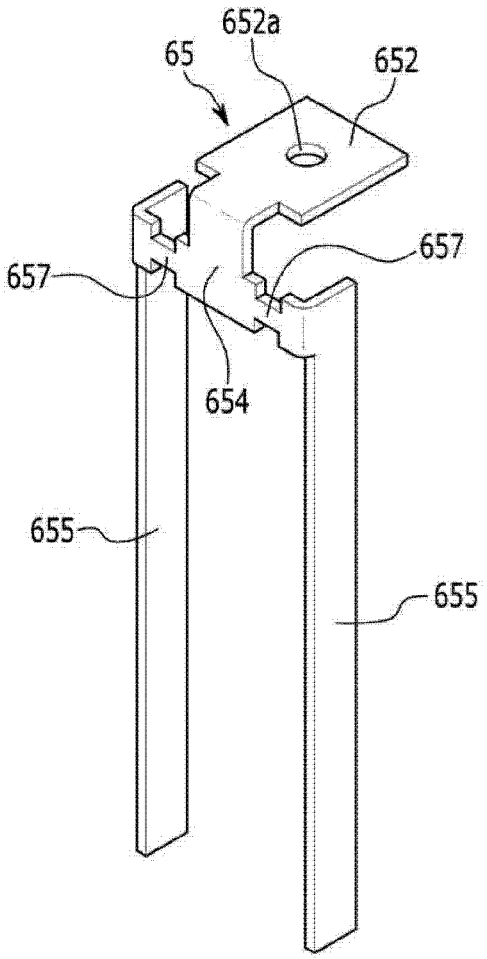


图 7

EXHIBIT 1002
Page 1769 of 2306 Petitioner ADC (IPR2024-00671)

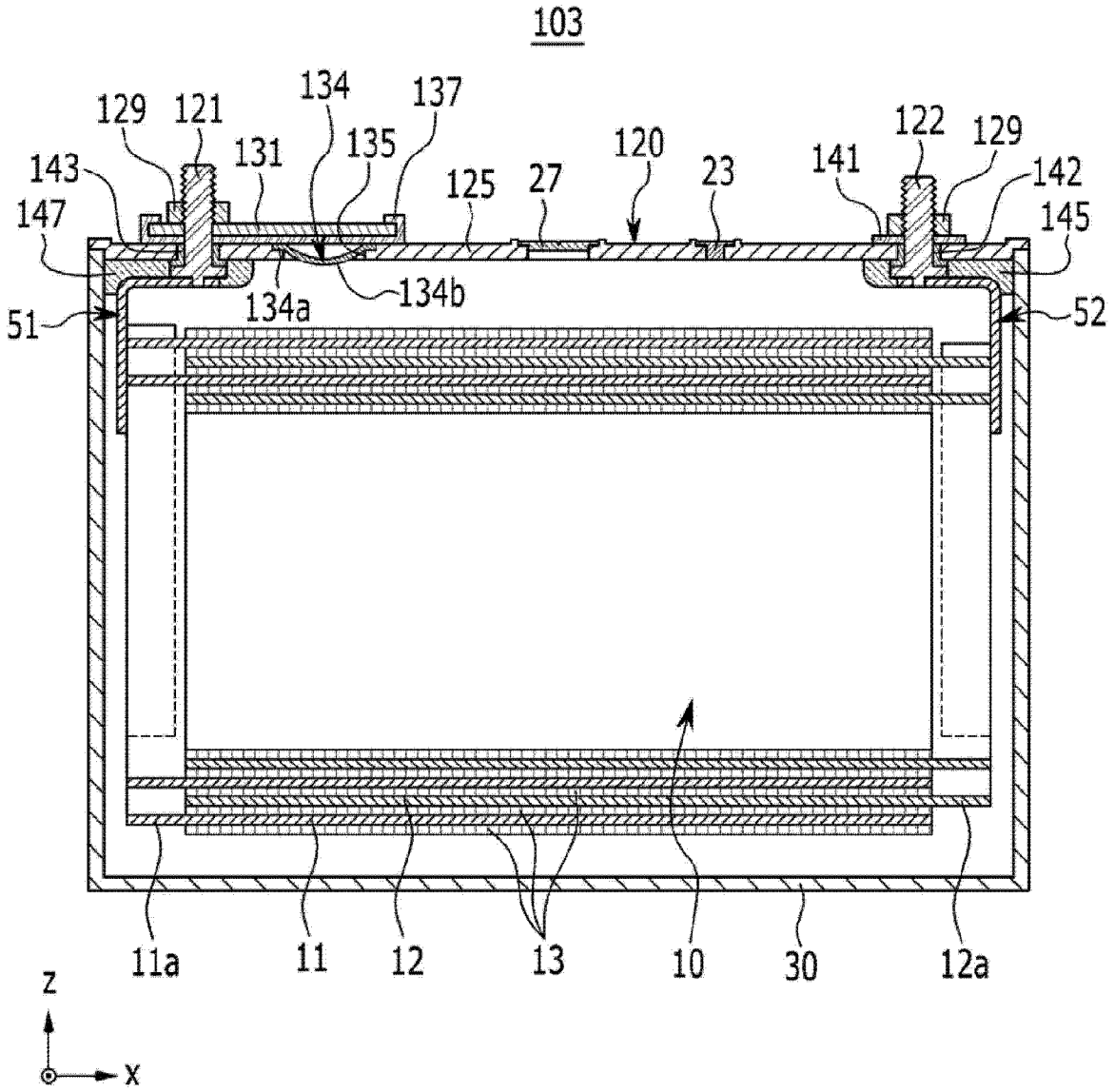


图 8

EXHIBIT 1002
Page 1770 of 2306 Petitioner ADC (IPR2024-00671)

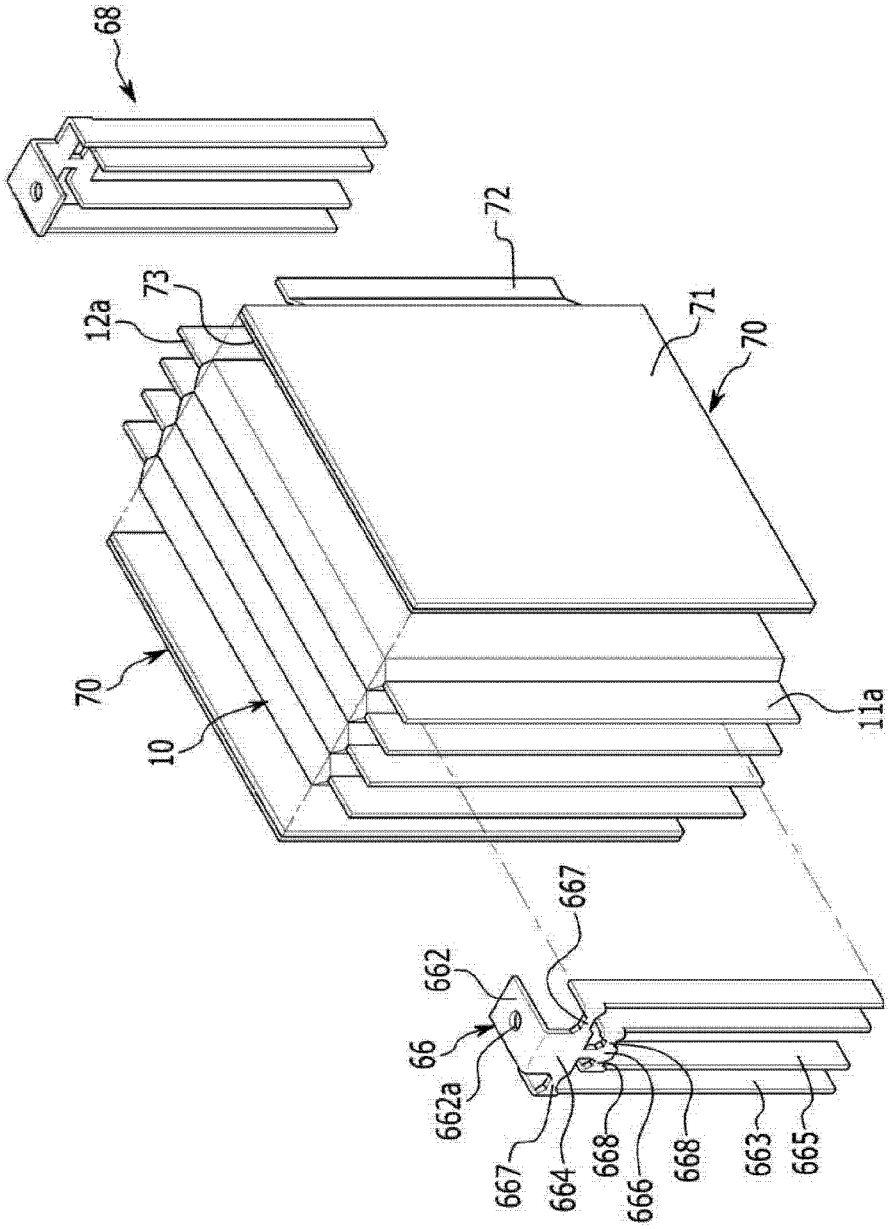


图 9

EXHIBIT 1002
Page 1771 of 2306 Petitioner ADC (IPR2024-00671)

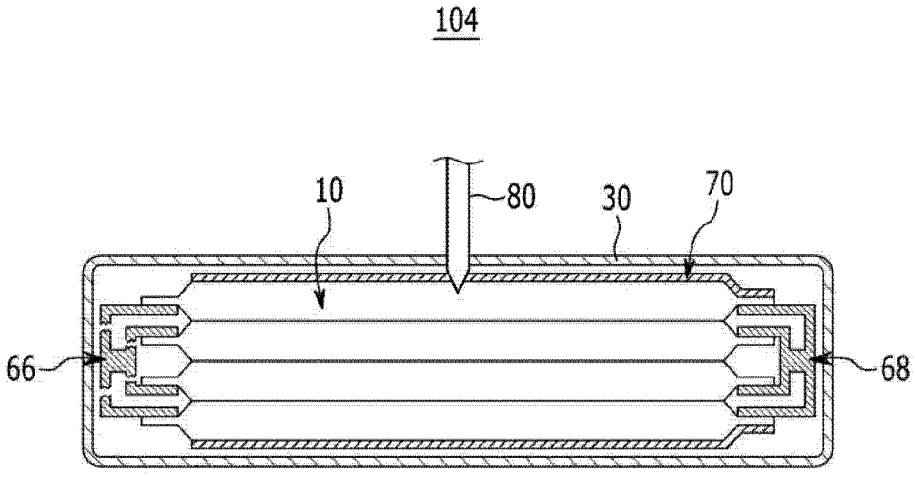


图 10

EXHIBIT 1002
Page 1772 of 2306 Petitioner ADC (IPR2024-00671)

PTO/SB/30EFS (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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REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	16820040	Filing Date	2020-03-16	Docket Number (if applicable)	054985-000055-US-02-02	Art Unit	2859
First Named Inventor	NOOK			Examiner Name	DIAO		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the orde in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

☐ Other _____

☒ Enclosed

☒ Amendment/Reply

☒ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 220585

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

X Patent Practitioner Signature

Applicant Signature

PTO/SB/30EFS (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Signature of Registered U.S. Patent Practitioner			
Signature	/William L. Klima/	Date (YYYY-MM-DD)	2022-06-15
Name	William L. Klima	Registration Number	32422

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is t file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Tim will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions fo 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.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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 informatio 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 the Freedom of Information Act requires disclosure of these records.

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 ma 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 inspections 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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
NOOK et al.
Appl. No.: 16/820,040
Filing Date: March 16, 2020
Exam: DIAO
Art Unit: 2859
Conf.: 1056
Title: **JUMP STARTING DEVICE WITH USB (as amended)**

AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION

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

Dear Commissioner:

This paper is submitted in response to the Final Office Action dated March 15, 2022, with a Request for Continued Examination (RCE), making a response due on or before June 15, 2022. Accordingly, this paper is timely filed.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

Amendments to the claims:

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

1.-23. (Cancelled)

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

a power supply;

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

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

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

[[and]]

a USB input connector; and

a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit comprising a DC-DC converter configured to up-convert voltage from the USB input connector to the power supply.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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

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

25. (Currently amended) The device according to claim 24, ~~wherein the USB charging input comprises a USB charging port~~ wherein the power switch or switch circuit is controlled to turn on power to the depleted or discharged battery only when the jump starting device is connected with correct polarity to the depleted or discharged battery.

26. (Currently amended) The device according to claim 24, wherein ~~the USB charging circuit is located internally within the jump starting device~~ the power supply is an internal power supply.

27. (Currently amended) The device according to claim 24, wherein the ~~USB charging input comprises a USB connector~~ USB charging circuit and power supply are located within the jump starting device.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

28. (Currently amended) The device according to claim 27, wherein the ~~USB charging circuit comprises~~ DC-DC converter is one or more DC-DC converters.

29. (Currently amended) The device according to claim [[28]] 24, wherein the DC-DC converter is configured to convert about 5VDC from [[the]] at the USB ~~charger~~ input connector to at least ~~12VDC~~ 11.1VDC ~~provided to~~ for the power supply when an active USB power source is connected to the USB input connector

30. (Currently amended) The device according to claim [[24]] 29, wherein the USB charger power source is a USB charger, and the USB ~~input~~ charging circuit is configured to convert power from ~~any~~ the USB charger to charge voltage and current for supplying power or charging the power supply.

31. (Previously presented) The device according to claim 24, wherein the DC-DC converter is configured to be turned on and off via a circuit by an output from a microcontroller.

32. (Currently amended) The device according to claim 31, wherein the power ~~source~~ supply is a rechargeable battery, and wherein the microcontroller software can turn charge off if the rechargeable battery voltage is measured to be too high by an A/D input.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

33. (Currently amended) The device according to claim 32, wherein the rechargeable battery is a rechargeable lithium battery, and further comprising a rechargeable lithium battery charge controller configured to provide charge balance to internal lithium battery cells of the rechargeable lithium battery.

34. (Currently amended) The device according to claim 33, wherein the rechargeable lithium battery charge controller is also configured to provide safety redundancy for eliminating over discharge of the rechargeable lithium battery.

35. (Currently amended) The device according to claim [[25]] 24, wherein the USB ~~port~~ input connector is a micro-USB connector.

36. (Currently amended) The device according to claim 24, further comprising a USB output ~~configured to provide~~ connector for providing a ~~charging~~ power output from the power supply to a USB-chargeable device.

37. (Currently amended) The device according to claim 36, wherein the USB output ~~comprises a USB output port~~ connector is electrically connected to a USB output circuit, the USB output circuit connecting the power supply to the USB output connector.

38. (Currently amended) The device according to claim 36, wherein the USB output ~~comprises a USB output~~ connector at least partially defines a USB output port.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

39. (Currently amended) The device according to claim [[36]] 37, wherein the USB output ~~comprises a USB output port connected to the power supply by a USB output circuit~~ connector and the USB output circuit define a USB output port.

40. (Currently amended) The device according to claim [[24]] 39, wherein the USB output port is configured to provide a portable charger for charging smartphones, tablets, music players, and other rechargeable electronic devices.

41. (Currently amended) The device according to claim 37, further comprising a microcontroller [[and]] with a control circuit, the control circuit [[from]] for the microcontroller allows the USB output circuit to be turned on and off by software control to prevent the power supply getting too low in capacity.

42. (Currently amended) The device according to claim 39, wherein the USB output port is ~~brought to~~ accessible from [[an]] outside of the jump charge device [[with]] using [[a]] the USB output connector.

43. (Currently amended) The device according to claim 42, wherein the USB connector includes a voltage divider configured to enable charge to certain smartphones that require [[it]] the voltage divider.

44. (Previously presented) The device according to claim 24, wherein the power supply is a rechargeable battery disposed within the jump starter device.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

45. (Currently amended) The device according to claim 24, wherein the power switch or switch circuit comprises [[a]] at least one power switch or switch circuit ~~control system or circuit~~ configured to ~~control the power switch and~~ turn power on ~~or off~~ from the power supply to the depleted or discharged battery when connected to the positive and negative battery connectors.

46. (Currently amended) The device according to claim 45, wherein the power switch ~~control system~~ or switch circuit comprises one or more sensors configured to detect whether the positive and negative battery connectors are properly connected to the depleted or discharged battery prior to switching on the power switch or switch circuit.

47. (Currently amended) The device according to claim 46, wherein the power switch ~~control system~~ or switch circuit is configured to detect presence of the depleted or discharged battery when connected between the positive and negative battery connectors.

48. (Currently amended) The device according to claim 46, wherein the power switch ~~system~~ or switch circuit is configured to detect polarity of the depleted or discharged battery when connected between the positive and negative battery connectors.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

49. (Currently amended) The device according to claim 46, wherein the power switch ~~control system~~ or switch circuit is configured to detect presence of the depleted or discharged battery when connected between the positive and negative battery connectors, and configured to detect polarity of the depleted or discharged battery when connected between the positive and negative battery connectors,

wherein the power switch ~~control system~~ or switch circuit switches on the power supply to connect the power supply to the depleted or discharged battery only when the depleted or discharged battery is present when connected between the positive and negative battery connectors and the depleted or discharged battery is connected with correct polarity between the positive and negative battery terminals.

50. (Previously presented) The device according to claim 45, wherein the power switch ~~control system~~ or switch circuit comprises a microcontroller configured for providing an output controlling the power switch or switch circuit.

51. (Previously presented) The device according to claim 50, 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.

52. (Previously presented) The device according to claim 51, 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 connectors, and another sensor configured to detect polarity of the depleted or discharged battery when connected between the positive and negative battery connectors.

53. (Previously presented) The device according to claim 52, wherein the one or more sensors is one or more sensing circuits.

54. (Currently amended) The device according to claim 50, wherein the microcontroller switches the power switch or switch circuit on 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 connected with [[the]] correct polarity to the positive and negative battery connectors.

55. (Previously presented) The device according to claim 50, wherein the microcontroller is a programmable microcontroller configured to allow updates in functionality and system parameters.

56. (Previously presented) The device according to claim 55, wherein the programmable microcontroller comprises a memory.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

57. (Previously presented) The device according to claim 24, wherein the positive battery connector comprises a positive battery cable, and the negative battery connector comprises a negative battery cable.

58. (Previously presented) The device according to claim 57, wherein the positive battery cable comprises a positive battery clamp and the negative battery cable comprises a negative battery clamp.

59. (Currently amended) The device according to claim 24, wherein said power switch or switch circuit comprises a plurality of FETs in parallel.

60. (Currently amended) The device according to claim 51, wherein the one ~~sensor is~~ or more sensors is a presence sensor configured for detecting presence of the depleted or discharged battery when connected between the positive and negative battery ~~connections~~ connectors, and ~~the other sensor is~~ a reverse polarity sensor configured to detect polarity of a connection of the positive and negative battery connectors of the jump starting device with the depleted or discharge battery.

61. (Currently amended) The device according to claim 60, wherein the ~~one sensor~~ presence sensor ~~configured for detecting presence of the depleted or discharged battery~~ and the reverse polarity sensor comprise optically coupled isolator phototransistors.

62. (Previously presented) The device according to claim 24, further comprising a plurality of power diodes coupled between the positive and negative battery connectors and the power supply to prevent back-charging of the power supply from an electrical system connected to the depleted or discharged battery.

63. (Previously presented) The device according to claim 24, further comprising an output port providing positive and negative polarity outputs to the positive and negative battery connectors.

64. (Previously presented) The device according to claim 50, further comprising a temperature sensor configured to detect temperature of the power supply and to provide a temperature signal to the microcontroller.

65. (Previously presented) The device according to claim 50, further comprising a voltage measurement circuit configured to measure output voltage of the power supply and to provide a voltage measurement signal to the microcontroller.

66. (Previously presented) The device according to claim 24, 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 device.

67. (Previously presented) The device according to claim 60, further comprising a manual override switch configured to activate a manual override mode to enable a user to connect jump start power to the positive and negative battery connectors when the one sensor configured for detecting presence of the depleted or discharged battery is unable to detect presence of the depleted or discharged battery.

68. (Previously presented) The device according to claim 67, wherein the microcontroller 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.

69. (Currently amended) The device according to claim 24, wherein the positive and negative battery connectors are defined by a jumper cable device including a plug configured to plug into an output port of the jump starting device, a pair of cables integrated with the plug at one respective end ~~thereof~~ of the pair of cables and being configured to be connected to positive and negative battery terminals of the depleted or discharged battery at ~~another respective end thereof~~ an opposite end of the pair of cables.

70. (Previously presented) The device according to claim 69, wherein the output port and the plug are dimensioned so that the plug will fit into the output port only in one specific orientation.

71. (Currently amended) The device according to claim 24, wherein the power switch or switch circuit is configured to switch power on only when the jump starting device is properly connected to the depleted or discharged battery.

72. (New) The device according to claim 29, wherein the USB charging source is a USB charger.

73. (New) The device according to claim 72, wherein the USB charger is a standard USB charger.

74. (New) The device according to claim 24, wherein the power supply is a rechargeable lithium battery pack.

75. (New) The device according to claim 74, wherein the rechargeable lithium battery pack is an internal power supply.

76. (New) The device according to claim 74, wherein the USB charge circuit is configured to convert power from a USB charger power source, to charge voltage and current suitable for charging the rechargeable lithium battery pack.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

77. (New) The device according to claim 74, further comprising a rechargeable lithium battery pack voltage measurement circuit configured to monitor the rechargeable lithium battery pack to prevent voltage potential from rising too high during a charging operation and from dropping too low during a discharge operation.

78. (New) The device according to claim 74, further comprising a fuel gauge LEDS for indicating a charge level of the rechargeable lithium battery pack.

79. (New) The device according to claim 24, wherein the power switch or switch circuit is a smart switch, or comprises a smart switch.

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

a power supply;

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

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

a power switch or switch circuit in circuit with the power supply and the positive and negative battery connectors, the power switch or switch circuit configured to switch power on from the power supply to boost or charge the depleted or discharged battery when connected between the positive and negative battery connectors;

a USB input connector;

a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit configured to up-convert voltage from a USB charger power source connected to the USB input connector to the power supply using a DC-DC converter;

a USB output connector; and

a USB output circuit electrically connecting the power supply to the USB output connector.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

Amendments to the abstract:

Please amend the Abstract, found on page 18 of the Application as filed on March 16, 2020, as follows:

ABSTRACT

A jump starting device having USB. For example, a handheld ~~device for~~ jump starting device having USB for ~~a vehicle engine~~ boosting or charging a depleted or discharged battery. The handheld jump starting device, for example, can include ~~includes~~ a rechargeable lithium ion battery pack ~~(32)~~ and a microcontroller ~~(1)~~. The lithium ion battery [[is]] can be coupled to a power output port of the device through a power switch circuit ~~(15)~~ actuated by the microcontroller. ~~A vehicle battery isolation sensor (12) connected in circuit with positive and negative polarity outputs detects the presence of a vehicle battery (72) connected between the positive and negative polarity outputs. A reverse polarity sensor (10) connected in circuit with the positive and negative polarity outputs detects the polarity of a vehicle battery connected between the positive and negative polarity outputs, such that the microcontroller will enable power to be delivered from the lithium ion power pack to the output port only when a good battery is connected to the output port and only when the battery is connected with proper polarity of positive and negative terminals.~~

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

Amendments to the specification:

Please amend the title of the application as follows:

~~**PORTABLE VEHICLE BATTERY JUMP**~~ **STARTING DEVICE WITH USB** ~~**START APPARATUS WITH SAFETY PROTECTION**~~

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

Remarks

Upon entry of the above amendments, claims 24-70 are pending in the present application.

Claims 1-23 have previously been cancelled without prejudice or disclaimer of the subject matter contained therein.

Claims 24-30, 32-43, 45-49, 54, 59, 60, 61, 69, and 71 are amended above, and claim 72-80 are newly added. No new matter has been added. Support for the amendments to the claims is set forth in paragraphs [0022] – [0025], [0037], and [0039].

Newly added claim 80 recites all the language of independent claim 1 along with additional language directed to the USB output connector and USB output circuit. Thus, independent claims 1 and 80, and all depending claims should now be allowable.

The title was amended to reflect the currently claimed subject matter.

The Abstract was amended in order to lower the word count and reflect the currently claimed subject matter.

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.

APPLICANT-INITIATED INTERVIEW SUMMARY

Applicant's below-signed representative conducted a telephonic interview with the Examiner held on Thursday, June 9, 2022, along with Rick Stanfield (from applicant The NOCO Company) and Nitish Agrawal (from applicant The NOCO Company) attending.

The prior art reference to Balmefrezol (US 2013/0154550) was discussed in detail

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

during the telephonic interview resulting in Balmefrezol being invalidated as a prior art reference in the outstanding 35 U.S.C. 103 rejections from the final Office Action dated March 15, 2022.

Specifically, Balmefrezol does not disclose up-converting (i.e. increasing or boosting) the voltage from the USB interface to the internal battery in an electronic device (e.g. cell phone) let alone in a jump starting device. Further, Balmefrezol does not teach or suggest up-converting (i.e. increasing or boosting) the voltage from the USB interface to the internal battery, but instead teaches away from the claimed USB charging feature by disclosing down-converting (i.e. decreasing or bucking) the voltage from the USB interface to the internal battery of the electronic device.

The Examiner indicated at the conclusion of the telephone interview that independent claim 1 and all depending claims will be allowable, if the claims are amended to overcome the outstanding 35 U.S.C. 112 rejection.

FINALIZING NOTICE OF ALLOWANCE

Applicant's below-signed representative invites the Examiner to contact applicant's below-signed representative in the event the Examiner determines that an Examiner's amendment is required to place the subject application in condition for allowance.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

I. Objection to Claim 24, beginning on page 2.

The Examiner objects to Claim 24 due to informality.

Please see the above amendments to Claim 24 filed herein.

In view of the foregoing, it is submitted that claim 24 is no longer objectionable. Accordingly, reconsideration and withdrawal of this objection is respectfully requested.

II. Rejection under 35 USC § 112, second paragraph: Claims 24-71 are rejected as being indefinite.

The Examiner rejects Claims 24-71 as being indefinite.

Please see the above amendments to the claims filed herein.

In view of the foregoing, it is submitted that claims 24-71 are no longer indefinite. Accordingly, reconsideration and withdrawal of this objection is respectfully requested.

III. Rejection under 35 USC § 103:

a. **Claims 24-25, 27-28, 30-32, 36-58, 60, and 63-71 are rejected as being unpatentable over Richardson et al., (Richardson) US 2009/0174362 (Exhibit 1010 IPR2020-01387) in view of Balmefrezol et al., (Balmefrezol) US 2013-0154550, beginning on page 5**
b. **Claim 35 is rejected as being unpatentable over Richardson in view of Balmefrezol and further in view of Tinaphong US 2011/0175461, beginning on page 23**
c. **Claims 69-70 are rejected as being unpatentable over Richardson in view of Balmefrezol and Brown US Patent 8,076,900 and further in view of Waldron US 2011/0068734, beginning on page 24**
d. **Claim 29 is rejected as being unpatentable over Richardson in view of Balmefrezol and in further view of Xinfang US Patent 9,506,446 (Exhibit 1008 IPR2020-01387), beginning on page 27**
e. **Claim 33 is rejected as being unpatentable over Richardson in view of**

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

Balmefrezol and in further view of Nakamoto et al., (Nakamoto) US Patent 9,601,800, beginning on page 28

f. **Claims 59 and 61 are rejected as being unpatentable over Richardson in view of Balmefrezol and in further view of Krieger US 2004/0130298 (Exhibit 1009 IPR2020-00944), beginning on page 29**

g. **Claim 62 is rejected as being unpatentable over Richardson in view of Balmefrezol and in further view of Kim US Patent 5,867,007, beginning on page 31**

The Office Action asserts that "[I]t would have been obvious to one having ordinary skill in the art before the effective filing date of the claimed invention to incorporate the teachings of Balmefrezol by incorporating a USB charge circuit comprising a DC/DC converter . . ."

In view of the following, this rejection is respectfully traversed.

Regarding motivation to modify properly combined references, **MPEP 2143.01** states that a proposed modification cannot render the prior art unsatisfactory for its intended purpose. If it does, then there is no suggestion or motivation to make the proposed modification. Further, the proposed modification cannot change the principle operation of a reference.

Regarding teaching away, **MPEP 2141.02** states that prior art must be considered in its entirety, including disclosures that teach away from the claims. See also **MPEP 2145(X)(D)**.

Richardson discloses a "method and apparatus [that] provides supplemental power to an engine" (see Abstract).

Richardson discloses "a portable power source for a motor vehicle and, more particularly, to a method and apparatus to provide supplemental power to start internal combustion and turbine engines" (see paragraph [0001]).

Richardson discloses that the "present invention monitors the voltage of the battery of the vehicle to be jump started and the current delivered by the jump starter batteries to determine if a proper connection has been established and to provide fault monitoring. For safety purposes, only if the proper polarity is detected can the system operate. The voltage is monitored to determine open circuit, disconnected conductive clamps, shunt cable fault, and solenoid fault conditions. The current through the shunt

cable is monitored to determine if there is a battery explosion risk, and for excessive current conditions presenting an overheating condition, which may result in fire. The system includes an internal battery to provide the power to the battery of the vehicle to be jump started" (see paragraph [0006]).

Richardson does not disclose a USB input connector and a USB charge circuit, let alone the claimed subject matter, including "a USB input connector; and a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit comprising a DC-DC converter configured to up-convert voltage from the USB input connector to the power supply."

Balmefrezol discloses a power management circuit for a portable electronic device such as mobile phones (see paragraph [0002]).

Balmefrezol disclosed "two battery charging circuits based on two buck converters, 210 and 220 respectively, so as to achieve fast charging (typically 1500 mA/h) of a high capacity battery (see paragraph [0043].

Balmefrezol does not disclose a jump starting device, and up-converting the voltage from a USB interface to an internal battery of an electronic device (e.g. cell phone), let alone the claimed subject matter, including "a USB input connector; and a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit comprising a DC-DC converter configured to up-convert voltage from the USB input connector to the power supply."

The power management circuit of ***Balmefrezol*** is for charging a low voltage internal battery (e.g. 3.5V) of a portable electronic device such as a mobile phone. ***Balmefrezol*** does not disclose the power management circuit being applied to a jump starter using a relatively higher voltage (e.g. 11.1V or higher). The power management circuit of ***Balmefrezol*** cannot be used to charge, for example, an internal rechargeable battery of a jump starting device, since the power management circuit of ***Balmefrezol*** is configured for down-converting (i.e. decreasing or bucking) the voltage from the USB interface (e.g. about 5V) to the internal battery of the mobile phone (e.g. 3.5V) instead of up-converting (i.e. increasing or boosting) the voltage from the USB interface (e.g. USB connector) to the power supply (e.g. rechargeable lithium ion battery) of the jump starting

device.

Thus, ***Balmefrezol*** is clearly non-analogous prior art, and does not teach or suggest up-converting the voltage from a USB interface to an internal battery of a cell phone, let alone a jump starting device.

One skilled in the art would not turn to ***Balmefrezol*** to attempt to modify and/or improve the jump starter of ***Richardson***.

Importantly, ***Balmefrezol*** in fact teaches away from attempting to modify the jump starter of ***Richardson*** with a USB input connector and USB charge circuit according to the claimed subject matter, including "a USB input connector; and a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit comprising a DC-DC converter configured to up-convert voltage from the USB input connector to the power supply."

The remaining prior art references cited in the other 35 USC 103 rejections do not teach or suggest the base claimed subject matter set forth in independent claims 1 and 80.

In view of the foregoing, it is submitted that nothing in ***Richardson and Balmefrezol***, taken alone or together, renders the presently claimed subject matter obvious within the meaning of 35 USC § 103. Accordingly, reconsideration and withdrawal of this rejection is respectfully requested.

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

Date: June 15, 2022

/William L. Klima/
William L. Klima, Registration No.: 32422
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EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/820,040	03/16/2020	Jonathan Lewis NOOK	054985-000055-US-02-02	1056

20230 7590 06/15/2022

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	

NOTIFICATION DATE	DELIVERY MODE
06/15/2022	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patlaw@vorys.com
vorys_docketing@cardinal-ip.com

PTOL-90A (Rev. 04/07)

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

Applicant-Initiated Interview Summary	**Application No.** 16/820,040	**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	Video Conference
William L. Klima Reg . No. 32,422	Attorney of Record	
Rick Stanfield	Inventor with NOCO	
Nitish Agrawal	Tech with NOCO	

Date of Interview: 09 June 2022

Issues Discussed:

35 U.S.C. 112

Applicant's representative agreed to consider Examiner's suggestion in further amending the claims to overcome the 112 rejection.

35 U.S.C. 103

While new reference US 2013/0154550 to Balmefrezol teaches a bidirectional buck/boost converter 220, the reference does not teach a boost operation from a USB port to increase the charge and voltage of the internal battery of the jumpstarting device to a 12.4V. Applicant's representative agreed to further clarify these limitations in the independent claims in order to move the application in better form of condition for allowance.

/M BAYE DIAO/ Primary Examiner, Art Unit 2859	06/09/2022

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: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the 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.

PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/820,040	Filing Date 03/16/2020	☐ 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	06/15/2022	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 57	Minus	** 48	= 9		x $50 =	450
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0		x $240 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	450

		(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.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/ALLYSON PURNELL/
*** 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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EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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	68	("20020041174"|"20040066168"|"20040130298"|"20050040788"|"20050110467"|"20050252573"|"20070285049"|"20100301800"|"20110068734"|"20120091944"|"20	(US-PGPUB; USPAT)	OR	ON	ON	2019/11/20 07:47 PM

		130154543"|"20130314041"|"20140159509"|"20150306964"|"20160001666"|"20180111491"|"20180215274"|"20180269703"|"20180342891"|"20180345803"|"20190308518"|"3933140"|"4041445"|"4885524"|"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"|"7301303"|"7749031"|"7872361"|"8076900"|"8199024"|"8376775"|"8493021"|"9007015"|"9506446"|"9770992"|"D625265"|"D649116"|"D689020"|"D726109"|"D726114"|"D726121"|"D735665"|"D746774").PN.				
L175	1	"10328808".pn.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:01 PM
L176	1	"9770992".pn.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:03 PM
L177	9696	(isolat$3 (batter$3 adj presence)) adj sens$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:25 PM
L178	279	reverse adj polarity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:25 PM
L179	11	L177 and L178	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:25 PM
L180	7	L174 and L179	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:38 PM
L182	1	"10604024".pn.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/07/01 07:06 PM
L183	3558	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:42 PM
L184	24862	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:43 PM
L185	166340	output adj port	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:43 PM
L186	0	vehicle adj batter$3 adj isolat$3 adj sens$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:44 PM
L187	1674253	(isolat$3 (batter$3 adj	(US-PGPUB; USPAT;	OR	ON	ON	2014/10/23

		presence) adj sens$3)	EPO)				12:47 PM
L188	6642	(isolat$3 (batter$3 adj presence)) adj sens$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:48 PM
L189	0	reverse adj popularity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:49 PM
L190	186	reverse adj polarity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:49 PM
L191	0	(microcontroller microcomputer microprocessor processor controller) and L183 and L184 and L185 and L188 and L190	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L192	2960317	(microcontroller microcomputer microprocessor processor controller)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L193	0	L183 and L184 and L185 and L188 and L190	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L194	0	L183 and L184 and L185 and L188	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L195	0	L183 and L184 and L185 and L190	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L196	15	L183 and L184 and L185 and L1830	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L197	3	L188 and L190	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:52 PM
L198	195	320/105.ccls. and (@ad<="20140708")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:55 PM
L199	1845	320/110-112.ccls. and (@ad<="20140708")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:55 PM
L200	0	(L198 L199) and (L196 L197)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:56 PM
L201	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	2014/10/23 12:57 PM
L202	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
L203	0	((integrated combo combination assembly)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:48 PM

		adj jumper) with ((plug connector) same (other another) adj end$2)					
L204	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
L205	222	((integrated combo combination assembly) adj jumper) and ((plug connector))	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:49 PM
L206	1674253	(isolat$3 (batter$3 adj presence) adj sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:49 PM
L207	6642	(isolat$3 (batter$3 adj presence)) adj sens$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:49 PM
L208	186	reverse adj polarity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:49 PM
L209	3	L206 and L207 and L208	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:49 PM
L210	3558	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:50 PM
L211	24862	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:50 PM
L212	48	L210 and L211	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:50 PM
L213	0	L205 L206 L207 L208	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2014/10/23 03:50 PM
L214	0	L205 L206 L207	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2014/10/23 03:50 PM
L215	0	L205 L212	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2014/10/23 03:51 PM
L216	0	L205 L212	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2014/10/23 03:51 PM
L217	1	L208 L212	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2014/10/23 03:51 PM
L218	8	L206 L212	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2014/10/23 03:51 PM
L219	12	L209 L217 L218	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:52 PM
L220	195	320/105.ccls. and (@ad<="20140708")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:52 PM
L221	1845	320/110-112.ccls. and (@ad<="20140708")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:52 PM
L222	1	(L220 L221) and (L219 L212)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:52 PM
L223	8	(L218) and (L219)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:56 PM
L224	8	(L218) and (L219)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:56 PM

L225	8	(L218) and (L212)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:56 PM
L226	8	L224 L225	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:56 PM
L227	0	L205 and L212	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 04:03 PM
L228	0	L205 and L211 and L208	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 04:04 PM
L229	0	L205 and L208	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 04:04 PM
L230	1	L212 and L208	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 04:04 PM
L231	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-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-	(USPAT)	OR	ON	ON	2014/10/23 05:39 PM

		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.					
L232	3558	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 05:41 PM
L233	24862	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 05:41 PM
L234	48	L232 and L233	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 05:41 PM
L235	1	L234 and L231	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 05:41 PM

L236	84	(jump adj (start$3 cable)) with (alligator$2 clamp$2)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:17 PM
L237	0	L236 with ((integrated embedded) adj plug)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:21 PM
L238	0	L236 and ((integrated embedded) adj plug)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:21 PM
L239	0	L236 and ((integrated embedded) adj (plug connect$3 socket$2))	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:23 PM
L240	83	L236 and (plug connect$3 socket$2)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:28 PM
L241	36	L236 and (plug)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:28 PM
L242	3558	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:29 PM
L243	24862	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:29 PM
L244	48	L242 and L243	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:29 PM
L245	0	L241 and L244	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:29 PM
L246	225	(reverse reversed) adj polarity adj (sens$3 detect$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:19 PM
L247	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
L248	95	battery adj (presence connection) adj (sens$3 detect$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:21 PM
L249	2960317	(microcontroller microcomputer microprocessor processor controller)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:22 PM
L250	0	L246 and L248 and L249	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:22 PM
L251	3558	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:22 PM
L252	0	L246 and L248 and L251	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:22 PM
L253	0	L246 and L248	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:23 PM
L254	10	(US-20130314041-$ or US-20120091944-$ or US-20070285049-$ or US-20050252573-$ or US-20050040788-	(US-PGPUB; USPAT)	OR	ON	ON	2014/10/24 11:49 PM

		$).did. or (US-6130519-$ or US-8172603-$ or US-6262559-$ or US-5083076-$ or US-4885524-$).did.					
L255	22	("5635817"|"8493021"|"7872361"|"20040130298"|"20100301800"|"5921809"|"6140796"|"6632103"|"7301303"|"5793185"|"6262492"|"5635818"|"8376775"|"20140159509"|"5111130"|"5189359"|"6756764"|"5795182"|"6212054"|"8199024"|"20020041174"|"20130154543").PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:50 PM
L256	0	L254 and L255	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:50 PM
L257	4	("20050110467"|"6362599"|"6803743"|"7148580").PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/11/12 05:02 PM
L258	2	WO-2013137873-$.did.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2014/12/03 12:05 PM
L259	134	advantages near4 (lithium-ion) adj batter$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:03 PM
L260	196	320/105.ccls. and (@ad<="20140703")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L261	0	L259 and L260	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L262	3573	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L263	25112	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L264	167713	output adj port	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L265	2991441	(microcontroller microcomputer microprocessor processor controller)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L266	15	L262 and L263 and L264 and L265	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L267	0	L259 and L266	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L268	188	reverse adj polarity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:05 PM
L269	0	L259 and L268	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:05 PM
L270	224	((integrated combo	(US-PGPUB; USPAT;	OR	ON	ON	2014/12/03

		combination assembly) adj jumper) and ((plug connector))	EPO)				01:05 PM
L271	0	L259 and L270	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:05 PM
L272	25112	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:05 PM
L273	0	L259 and L272	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:05 PM
L274	1687265	(isolat$3 (batter$3 adj presence) adj sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:06 PM
L275	53	L259 and L274	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:06 PM
L276	0	L275 and L272	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:07 PM
L277	84	(jump adj (start$3 cable)) with (alligator$2 clamp$2)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:07 PM
L278	0	L275 and L277	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:07 PM
L279	150	(US-5793185-$ 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-5796255-$ or US-6036574-$ or US-6111393-$ or US-6130519-$ or US-6232728-$ or US-	(USPAT)	OR	ON	ON	2014/12/03 01:08 PM

		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.					

L280	0	L275 and L279	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:08 PM
L281	1856	320/110-112.ccls. and (@ad<="20140703")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:08 PM
L282	0	L275 and L281	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:08 PM
L283	1	"20130241488"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:39 PM
L284	1	"20050110467"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 11:35 AM
L285	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
L286	3612	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:07 PM
L287	25490	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:07 PM
L288	169705	output adj port	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:07 PM
L289	17	L286 and L287 and L288	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:07 PM
L290	4	L285 and L287 and L288	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:08 PM
L291	1	"6130519".pn.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:32 PM
L292	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
L293	25490	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 10:34 PM
L294	169705	output adj port	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 10:34 PM
L295	4	L303 and L304 and L305	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 10:34 PM
L296	4	L306 and (@ad<="20140703")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 10:34 PM
L297	1	"9007015".PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/23 12:22 PM
L298	2	"9506446".PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/23 08:53 PM
L299	2	"20040130298"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/23 09:12 PM
L300	1	"20050110467"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 03:49 PM
L301	154	("5793185" "5752754" "4562893" "4793175" "4972135" "5886501"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 06:18 PM

		"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" "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.					
L302	4480	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 06:18 PM
L303	35042	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 06:18 PM
L304	62	L313 and L314	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 06:18 PM
L305	1	L312 AND L315	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 06:18 PM
L306	73	((batter$3 adj presence)) adj (sens$3 detect$4)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 07:16 PM
L307	259	reverse adj polarity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 07:16 PM
L308	0	L317 and L318	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 07:16 PM
L309	35	(positive negative) near vehicle near connect$2	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 07:18 PM
L310	73	((batter$3 adj presence)) adj (sens$3 detect$4)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:13 PM
L311	35	(positive negative) near vehicle near connect$2	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:13 PM
L312	0	L321 and L322	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:13 PM
L313	302	((integrated combo combination assembly) adj jumper) and ((plug connector))	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:24 PM
L314	0	L321 and L324	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:24 PM
L315	37280	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:25 PM
L316	7	L321 and L326	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:25 PM
L317	4703	jump adj start$3	(US-PGPUB; USPAT;	OR	ON	ON	2019/01/05

			EPO)				09:26 PM
L318	37280	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:26 PM
L319	67	L328 and L329	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:26 PM
L320	0	L327 and L330	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:26 PM
L321	130	battery adj (presence connection) adj (sens$3 detect$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:29 PM
L322	7	L327 and L332	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:29 PM
L323	2	"20040130298"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 11:34 PM
L324	14677	(B60L53/14 or H02J7/0047 or H02J7/0054 or H02J7/0029 or H02J7/0034 or H02J2007/0062 or H02J2007/005 or H02J2001/006).cpc.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/07/25 02:58 PM
L325	1	"9007015".PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 11:00 AM
L326	1	"9770992".PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 12:07 PM
L327	150	(US-6014016-$ 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-	(USPAT)	OR	ON	ON	2019/10/07 01:22 PM

		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-$).did.					
L328	150	(US-6014016-$ 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- 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-	(USPAT)	OR	ON	ON	2019/10/07 01:22 PM

		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.					
L329	4959	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:28 PM
L330	39692	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:28 PM
L331	70	L343 and L344	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:28 PM
L332	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	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:31 PM

		H02J2007/004 or H02J2007/0037).cpc.					
L333	331	(reverse reversed) adj polarity adj (sens$3 detect$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:32 PM
L334	135	battery adj (presence connection) adj (sens$3 detect$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:32 PM
L335	0	L347 and L348	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:32 PM
L336	0	L345 and (L347 L348) and L342	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:34 PM
L337	10	L345 and (L347 L348) and L346	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:34 PM
L338	4639064	(microcontroller microcomputer microprocessor processor controller)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:35 PM
L339	10	L351 and L352	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:35 PM
L340	38	((("THE") near3 ("NOCO") near3 ("COMPANY"))).AS,AANM.	(USPAT)	OR	ON	ON	2019/10/07 01:48 PM
L341	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
L342	68	("20020041174"|"20040066168"|"20040130298"|"20050040788"|"20050110467"|"20050252573"|"20070285049"|"20100301800"|"20110068734"|"20120091944"|"20130154543"|"20130314041"|"20140159509"|"20150306964"|"20160001666"|"20180111491"|"20180215274"|"20180269703"|"20180342891"|"20180345803"|"20190308518"|"3933140"|"4041445"|"4885524"|"4931731"|"5083076"|"5111130"|"5189359"|"5486434"|"5635817"|"5635818"|"5793185"|"5795182"|"5921809"|"5965998"|"6054779"|"6130519"|"6140796"|"6147471"|"62	(US-PGPUB; USPAT)	OR	ON	ON	2019/11/20 07:47 PM

		12054"|"6262492"|"6262559"|"6362599"|"6386907"|"6426606"|"6632103"|"6648701"|"6756764"|"6803743"|"6822425"|"7301303"|"7749031"|"7872361"|"8076900"|"8199024"|"8376775"|"8493021"|"9007015"|"9506446"|"9770992"|"D625265"|"D649116"|"D689020"|"D726109"|"D726114"|"D726121"|"D735665"|"D746774").PN.					
L343	1	"10328808".pn.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:01 PM
L344	1	"9770992".pn.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:03 PM
L345	9696	(isolat$3 (batter$3 adj presence)) adj sens$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:25 PM
L346	279	reverse adj polarity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:25 PM
L347	11	L359 and L360	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:25 PM
L348	7	L356 and L361	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:38 PM
L349	1	"10604024".pn.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/07/01 07:06 PM
L365	2	"10604024".pn.	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/08/26 11:15 PM
L366	19947	(USB (universal NEAR serial NEAR bus)) NEAR ((charg$3 NEAR input NEAR port) (input charg$3) NEAR port)	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/08/26 11:33 PM
L367	30	L233 L232 L366	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2021/08/26 11:35 PM
L368	33	L346 L366 L333 L330	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2021/08/26 11:42 PM
L369	199	(jump boost) NEAR start$3 NEAR (device apparatus instrument module)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2021/08/26 11:44 PM
L370	25	L369 L366	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2021/08/26 11:45 PM

L371	921407	"705"	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2021/08/26 11:52 PM
L372	2	("2019/0081472").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	AND	ON	ON	2021/08/27 12:19 AM
L373	15	("2479705" | "4895530" | "5367243" | "6215273" | "6222342" | "6623315" | "20020195995" | "20030141842" | "20080185996" | "20150054460" | "20150377808" | "20160049819" | "20160329731" | "20190081472").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	AND	ON	ON	2021/08/27 12:20 AM
L374	555	(Lithium NEAR battery) WITH (cell NEAR (balanc$3 equaliz$5))	(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	2021/08/30 06:48 PM
L375	1219412	mini	(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	2021/08/30 07:34 PM
L376	26965543	10	(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,	OR	ON	ON	2021/08/30 11:27 PM

			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)				
L377	2	"20090174362".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	2021/08/30 11:38 PM
L378	5	"5867007".pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/08/31 11:34 AM
L379	2	"20090174362".pn.period	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2021/08/31 03:23 PM

			IBM_TDB)				
L380	2	"8076900".pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/08/31 03:41 PM
L381	4	"20110068734".pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/08/31 03:45 PM
L382	684307	(B60L53/14 OR H02J7/342 OR H02J7/0047 OR H02J7/0034 OR H02J7/0029 OR H02J1/122 OR H02J7/00 OR H02J7/0048 OR H02J7/00302 OR H02J7/00309 OR H02J7/00306 OR Y02T90/14 OR Y02T10/7072 OR Y02T10/70 OR H02J2310/46).cpc. 320/105.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/08/31 05:56 PM
L383	2	L382 L369 L374 L346 L366	(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,	AND	ON	ON	2021/08/31 05:58 PM

			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)				
L384	135	((("NOOK") near3 ("Jonathan")) OR (("NOOK") near3 ("William")) OR (("STANFIELD") near3 ("James")) OR (("UNDERHILL") near3 ("Derek"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	AND	ON	ON	2021/08/31 05:59 PM
L385	135	((("NOOK") near3 ("Jonathan")) OR (("NOOK") near3 ("William")) OR (("STANFIELD") near3 ("James")) OR (("UNDERHILL") near3 ("Derek"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	AND	ON	ON	2021/08/31 06:00 PM
L386	0	L338 L346 L369 L313	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	AND	ON	ON	2021/08/31 06:01 PM
L387	117	("10328808" OR "10604024" OR "20010025618" OR "20020041174" OR "20030141845" OR "20040066168" OR "20040130298" OR "20040150373" OR "20040239290" OR "20050040788" OR "20050110467" OR "20050116688" OR "20050252573" OR "20060176011" OR "20060220610" OR "20060244412" OR "20070278990" OR "20070285049" OR "20080143290" OR "20100301800" OR "20110068734" OR "20110175461" OR "20120025766" OR "20120091944" OR "20120319487" OR "20130154543" OR "20130162029" OR "20130241488" OR "20130314041" OR "20140084844" OR	(US-PGPUB; USPAT)	OR	ON	ON	2021/08/31 06:04 PM

		"20140159509" OR "20140210399" OR "20140368155" OR "20150054336" OR "20150137740" OR "20150306964" OR "20150340907" OR "20160001666" OR "20180111491" OR "20180215274" OR "20180269703" OR "20180342891" OR "20180345803" OR "20190308518" OR "3590357" OR "3638108" OR "3933140" OR "4041445" OR "4885524" OR "4910628" OR "4931731" OR "5083076" OR "5111130" OR "5189359" OR "5194799" OR "5281904" OR "5319298" OR "5486434" OR "5635817" OR "5635818" OR "5650974" OR "5793185" OR "5795182" OR "5820407" OR "5921809" OR "5953681" OR "5965998" OR "6054779" OR "6130519" OR "6140796" OR "6147471" OR "6212054" OR "6262492" OR "6262559" OR "6344733" OR "6362599" OR "6386907" OR "6424158" OR "6426606" OR "6632103" OR "6648701" OR "6650086" OR "6679212" OR "6756764" OR "6759833" OR "6803743" OR "6822425" OR "7148580" OR					

		"7301303" OR "7345450" OR "7749031" OR "7872361" OR "7893657" OR "8076900" OR "8172603" OR "8199024" OR "8362745" OR "8376775" OR "8493021" OR "9007015" OR "9041244" OR "9153978" OR "9243601" OR "9506446" OR "9525297" OR "9770992" OR "9809183" OR "9954391" OR "D597029" OR "D625265" OR "D649116" OR "D689020" OR "D726109" OR "D726114" OR "D726121" OR "D735665" OR "D746774").pn.					
L388	0	L387 L374 L369 L366	(US-PGPUB; USPAT)	AND	ON	ON	2021/08/31 06:04 PM
L389	34	(USB (universal NEAR serial NEAR bus)) NEAR charg$3 NEAR (circuit$2) WITH (USB (universal NEAR serial NEAR bus)) NEAR input	(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	2022/03/08 12:43 PM
L390	0	L329 AND L389	(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	2022/03/08 12:43 PM

			NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L391	0	(L313 L319) AND L389	(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	2022/03/08 12:44 PM
L392	0	(L313 L319 L369) AND L389	(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	2022/03/08 12:45 PM
L393	1	"62294067".pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/03/08 03:48 PM
L394	1	"62294067".fmid.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY,	OR	ON	ON	2022/03/08 03:49 PM

			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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L395	2	"20080157732".pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/03/08 05:52 PM
L396	2	"20120187897".pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/03/08 05:53 PM
L397	5	JP-3182855-$.DID.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH,	OR	ON	ON	2022/03/08 06:41 PM

			TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L398	3	"9048666".pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/03/08 07:31 PM
L399	114	(jump?start$3 near3 (vehicle automobile car truck)) WITH (discharged depleted drained emptyu dead) NEAR battery	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/03/08 07:35 PM
L400	115	(jump?start$3 near3 (vehicle automobile car truck)) WITH (discharged depleted drained empty dead) NEAR battery	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/03/08 07:36 PM
L401	0	"201300154550".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA,	OR	ON	ON	2022/06/09 02:37 PM

			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)				
L402	9	"2013154550".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	2022/06/09 02:37 PM
L403	187	(jump near2 start$3 WITH boost$3 upconvert$3).clm. AND (USB NEAR (circuit$2 port))	(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	2022/07/30 01:46 PM
L404	1290	(usb NEAR (input connector port)) AND (USB near2 charg$3 NEAR circuit$2)	(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;	OR	ON	ON	2022/07/30 01:47 PM

			JPO; DERWENT; IBM_TDB)				
L405	3	L403 AND L404 AND L400	(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	2022/07/30 01:48 PM
L406	12	L382 AND L403	(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	2022/07/30 01:50 PM
L407	43	((US-8172603-B1 OR US-5083076-A OR US-6262559-B1 OR US-6130519-A OR US-4885524-A OR US-5965998-A OR US-5650974-A OR US-9041244-B2 OR US-5953681-A OR US-10981452-B2 OR US-6215273-B1 OR US-9748541-B2 OR US-9601800-B2 OR US-9048666-B2 OR US-10218172-B2 OR US-9748778-B2 OR US-7893558-B2 OR US-7893655-B2 OR US-7017055-B1 OR US-11112844-B2 OR US-10087904-B2).did. AND USPT.dbnm.) OR ((US-20130314041-A1 OR	(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	2022/08/03 01:52 PM

		US-20120091944-A1 OR US-20070285049-A1 OR US-20050252573-A1 OR US-20050040788-A1 OR US-20130241488-A1 OR US-20120319487-A1 OR US-20150137740-A1 OR US-20110175461-A1 OR US-20190081472-A1 OR US-20160181587-A1 OR US-20100052620-A1 OR US-20160111914-A1 OR US-20090026837-A1 OR US-20180341309-A1 OR US-20130154550-A1 OR US-20180369599-A1).did. AND PGPB.dbnm.) OR ((PH-12013500793-B1 OR AU-2011334615-B2 OR DE-102007052750-A1 OR WO-2009059852-A2).did. AND FTDB.dbnm.) OR ((US-20150015184-A1).did. AND DWPI.dbnm.)					
L408	3	((WO-2009059852-A2 OR DE-102007052750-A1).did. AND FTDB.dbnm.) OR ((US-10087904-B2).did. AND USPT.dbnm.)	(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); USPAT)	OR	ON	ON	2022/08/03 01:53 PM
L409	134	("10084173" OR "10128483" OR "10328806" OR "10461545" OR "20010003827" OR "20020007500" OR "20020007699" OR "20020121877" OR "20020155752" OR "20030096158" OR "20040106038" OR "20040124810" OR "20050082833" OR	(US-PGPUB; USPAT)	OR	ON	ON	2022/08/04 05:54 PM

		"20050162124" OR "20050213867" OR "20060071631" OR "20070132427" OR "20070132537" OR "20070178777" OR "20070182363" OR "20080131764" OR "20080150473" OR "20080157732" OR "20090039712" OR "20090108814" OR "20090174362" OR "20090218988" OR "20090236859" OR "20090253312" OR "20100001682" OR "20100013302" OR "20100055546" OR "20100129723" OR "20100164439" OR "20100173182" OR "20100181959" OR "20100244766" OR "20100283623" OR "20110117408" OR "20110127947" OR "20110140651" OR "20110250473" OR "20110268996" OR "20110279089" OR "20110308856" OR "20120013189" 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 "20130241498" OR "20130295444" OR "20140045001" OR "20140077755" OR "20140113463" OR "20140127550" OR "20140139175" OR "20150012174" OR "20150037662" OR "20150087182" OR "20150222060" OR "20150236329" OR "20150366538" OR					

		"20150380697" OR "20160141728" OR "20160155996" OR "20170084899" OR "20170309872" OR "3085187" OR "3105183" OR "3267452" OR "4142771" OR "4740740" OR "4972135" OR "4990723" OR "5496658" OR "5589757" OR "5637978" OR "5707257" OR "5716735" OR "5831350" OR "6002235" OR "6037778" OR "6057667" OR "6144110" OR "6160381" OR "6222342" OR "6249106" OR "6271605" OR "6300742" OR "6384573" OR "6679708" OR "6774607" OR "6799993" OR "6856764" OR "6919704" OR "7015674" OR "7095339" OR "7339347" OR "7508171" OR "7514900" OR "7579811" OR "7656118" OR "7675261" OR "7679317" OR "7791319" OR "7847520" OR "7868582" OR "8030900" OR "8125181" OR "8221915" OR "8686688" OR "8736227" OR "8786247" OR "8994327" OR "9007023" OR "9070938" OR "9197079" OR "9263717" OR "9263907" OR "9287725" OR					

		"9537136" OR "9608294" OR "9718419" OR "9871392" OR "9874611").pn.					

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
N181	5	(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	2019/11/20 09:46 PM
N182	0	(jump and vehicle and internal and power and supply and polarity and output$2 and isolation	(US-PGPUB; USPAT)	OR	OFF	OFF	2015/01/29 04:50 PM

		and sensor and reverse and polarity and sensor and switch and microcontrol$3 and input and signal$2).clm.					
N183	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
N184	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
N185	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
N186	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
N187	0	(vehicle 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 04:52 PM
N188	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
N189	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 signal$1).clm.					
N190	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
N191	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
N192	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
N193	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
N194	4	N225 and N226	(US-PGPUB; USPAT)	OR	OFF	OFF	2019/07/25 05:24 PM
N195	5	(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	2019/11/20 09:46 PM
N363	270	(power AND supply AND switch$3 AND battery AND connect$3 AND USB AND input AND charg$3 AND circuit$2).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2022/03/08 08:01 PM
N364	18	(power AND supply AND switch$3 AND battery AND connect$3 AND USB AND input AND charg$3 AND circuit$2 AND DC$1DC AND convert$2).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2022/03/08 08:02 PM
N365	11	(USB NEAR circuit$2) WITH (DC/DC boost up) NEAR converter	(US-PGPUB; USPAT)	OR	OFF	OFF	2022/03/08 10:09 PM
N366	1	"20200215926".pn.	(US-PGPUB; USPAT)	OR	OFF	OFF	2022/03/09

							12:36 PM

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/820,040	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	08/31/2021	03/10/2022	08/04/2022						
	1	-	-	-						
	2	-	-	-						
	3	-	-	-						
	4	-	-	-						
	5	-	-	-						
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	20	-	-	-						
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	22	-	-	-						
	23	-	-	-						
	24	✓	✓	✓						
	25	✓	✓	✓						
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	41	✓	✓	✓						
	42	✓	✓	✓						

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/820,040	NOOK et al.
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CLAIM		DATE								
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	43	✓	✓	✓						
	44	✓	✓	✓						
	45	✓	✓	✓						
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Procédé de démarrage pour systèmes hybrides de propulsion (French)
Starting method for hybrid drives (English)
Startverfahren für hybridantriebe (German)

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Cooperative (2019.02.01, invention): B60L 58/13 (EP,US)

Priority: DE 102007052750 A (6-Nov-2007)

Backward Patent Citations:
(Cited by: (EX) = examiner)
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DE 19846319 C1 Energieversorgungsschaltung für ein Kraftfahrzeugbordnetz mit zwei Spannungsversorgungszweigen (17-Feb-2000) | (EX)
US 6323608 B1 Dual voltage battery for a motor vehicle (27-Nov-2001) | (EX)

Abstract (English)

The invention relates to a method for starting a hybrid drive by means of an auxiliary energy source, said method comprising the following steps: an electric motor and an internal combustion engine are both provided in the hybrid drive for generating kinetic energy, a traction battery (10) for supplying the electric motor with traction energy, an on-board supply system for starting the internal combustion engine under normal operation, and a converter control system (40) for controlling a DC/DC converter (30) which is used to supply the on-board supply system from the traction battery (10), are provided, the on-board supply system supplying the converter control system (40). If the energy remaining in the on-board supply system is insufficient either for the operation of the converter control system (40) or for starting the internal combustion engine, during an emergency operation caused by an insufficient amount of energy in the on-board supply system, an external auxiliary energy quantity smaller than the amount of energy deficit is supplied to the converter control system (40) in order to at least temporarily ensure the operation of the converter control system. The DC/DC converter (30) is activated by the converter control system (40), and a quantity of start process energy from the traction battery (10) is fed into the on-board supply system via the DC/DC converter (30), which, together with the energy remaining in the on-board supply system, is sufficient for starting the internal combustion engine. As a result, the internal combustion engine is started. The invention also relates to an associated emergency supply circuit, and to a mobile auxiliary starting battery.

Abstract (German)

Die Erfindung betrifft ein Verfahren zum Starten eines Hybridantriebs mittels einer Hilfsenergiequelle mit den Schritten: Vorsehen einer E-Maschine und eines Verbrennungsmotors, die zusammen zur Erzeugung von Bewegungsenergie in dem Hybridantrieb vorgesehen sind; Vorsehen einer Traktionsbatterie (10) zur Versorgung des E-Maschine mit Traktionsenergie, einem Bordnetz zum Starten des Verbrennungsmotors im Normalbetrieb, und einer Wandlersteuerung (40) eines DC/DC-Wandlers, (30) der zur Versorgung des Bordnetzes aus der Traktionsbatterie (10) vorgesehen ist, wobei das Bordnetz die Wandlersteuerung (40) versorgt. Wenn im Notfallbetrieb aufgrund eines Energiefehlbetrags im Bordnetz die im Bordnetz verbliebene Energie weder für den Betrieb der Wandler Steuerung (40) noch zum Starten des Verbrennungsmotors ausreicht wird ein externer Hilfsenergiebetrags, der kleiner als der Energiefehlbetrag ist, der Wandlersteuerung (40) zugeführt, um den Betrieb der Wandlersteuerung (40) zumindest kurzfristig zu gewährleisten. Der DC/DC-Wandler (30) wird durch Ansteuerung mittels der Wandlersteuerung (40) aktiviert und ein von der Traktionsbatterie (10) stammender Startvorgang-Energiebetrag wird in das Bordnetz durch den DC/DC-Wandlers (30) eingespeist, der zusammen mit der im Bordnetz verbliebene Energie zum Starten des Verbrennungsmotors ausreicht. Daraufhin wird der Verbrennungsmotor gestartet. Die Erfindung betrifft ferner ein zugehörige Notversorgungsschaltung sowie eine mobile Starthilfebatterie.

Abstract (French)

La présente invention concerne un procédé de démarrage d'un système hybride de propulsion au moyen d'une source d'énergie auxiliaire, qui consiste à : fournir un moteur électrique et un moteur à combustion interne qui font tous deux partie du système hybride de propulsion pour produire de l'énergie cinétique; fournir une batterie de traction destinée à alimenter le moteur électrique en énergie de traction, un réseau de bord destiné au démarrage du moteur à combustion interne en fonctionnement normal, et une commande de convertisseur d'un convertisseur continu/continu qui sert à alimenter le réseau de bord à partir de la batterie de traction, le réseau de bord alimentant la commande de convertisseur. Lorsque lors du fonctionnement de secours suite à un déficit en énergie dans le réseau de bord, l'énergie qui subsiste dans le réseau de bord ne suffit ni au fonctionnement de la commande de convertisseur, ni au démarrage du moteur à combustion interne, la quantité d'énergie auxiliaire externe qui est inférieure au déficit en énergie, est fournie à la commande de convertisseur pour garantir au moins à court terme le fonctionnement de la commande de convertisseur. Le convertisseur continu/continu est activé par commande au moyen de la commande de convertisseur et une quantité d'énergie de processus de démarrage provenant de la batterie de traction est fournie au réseau de bord par le convertisseur continu/continu et est suffisante, additionnée à l'énergie qui subsiste dans le réseau de bord, pour démarrer le moteur à combustion interne. Le moteur à combustion interne est ensuite démarré. L'invention a également pour objet un circuit d'alimentation de secours associé et une batterie auxiliaire de démarrage mobile.

EXHIBIT 1002
Page 1867 of 2306 Petitioner ADC (IPR2024-00671)

Document Description

description title Starting procedure for hybrid drives State of the art The invention is based on known starting method for starting a hybrid drive. Vehicles with hybrid drives include a traction battery that powers the drive's electric motor. The traction battery is charged according to the known hybrid method of the internal combustion engine of the drive and has a significantly higher operating voltage (greater than 300 V) than the electrical system (12 V, 24 V) of the vehicle. While the electrical system is powered by a board battery, such as a lead-acid battery, as is also provided for conventional internal combustion engine vehicles, and thus supplies almost all components of the vehicle with power, the traction battery is only the power supply to the electric motor. Except for the electric motor all components of the vehicle are designed for the operating voltage of the electrical system, whereby components of conventional internal combustion engine vehicles can be used. There are hybrid drives known which have a DC / DC converter (DC / DC converter), which uses the voltage of the traction battery to feed the electrical system after conversion of the voltage. Such a DC / DC converter is, like almost all other components of the drive, fed by the electrical system. Usually, the converter control of the DC / DC converter is part of a controller that controls the electrical energy budget in the motor vehicle and, for example, also controls the alternator and the like. Such control, like the controlled components, is designed for an operating voltage of 12V. In addition to the different performance functions between on-board battery and traction battery is the lethal high voltage of the traction battery of the reason that both circles are strictly separated. Therefore, in the case of known hybrid drives, the case may occur that, although the traction battery is sufficiently charged, it does not supply any electrical power to a drained on-board battery or can be transmitted to a supported electrical system, because the control of the DC / DC converter, which is set up to transmit the power, can not be activated due to the low operating voltage in the electrical system. As already noted, it is very difficult in terms of isolation and design to accommodate the converter control and other control elements in the traction battery network. The document DE 41 38 943 C1 describes two memories, d. H. a memory for a vehicle electrical system and a starting memory for supplying a starter to separate the effects of the starter on its supply network from the electrical system. However, this document relates to the power supply of a conventional engine drive, which has no traction battery, which is separated from the electrical system. The document DE 101 00 889 A1 also includes the power supply of an internal combustion engine drive. The document proposes to use two partial supply networks as a vehicle electrical system to provide redundancy for the startup process. However, like the above-mentioned document, the document does not disclose a circuit structure typical of a hybrid engine and does not discuss specific situations associated with this structure. It is an object of the invention to provide a mechanism with which the internal combustion engine of a hybrid drive can be permitted if the vehicle electrical system voltage is too low. Disclosure of the invention By means of the method according to the invention, it is possible to connect with a starting aid Significantly reduce effort, with the requirements for an external jump start are significantly reduced. The jump-start can be provided significantly cheaper, lighter and smaller with the inventive method. At the same time, in contrast to starting aids according to the prior art, energy storage with low capacity and power are. In addition, the necessary currents are many times lower than in the prior art, so that almost any cable can be used. Furthermore, it is not necessary due to the low current to contact the electrical system battery directly. Rather, numerous fuses protected vehicle electrical system contacts can be used, such as the cigarette lighter socket. Compared to the prior art, the requirements for the external jump start with respect to supply duration and supply power are significantly reduced. With the method according to the invention and the device according to the invention, a hybrid motor can be switched with a starting aid which supplies energy only for a very short time, for example shorter than the supply duration of the starter during starting, and which delivers a very low current, which is significantly lower than the supply current of the starter is. It has been recognized that supply systems according to the prior art result in deadlocks, so that despite existing energy no carry (and thus no startup) can take place, since the function of the element that controls the transmission depends on the state of the electrical system. According to the invention, the system deadlock is achieved by activating the control of the energy transfer by means of auxiliary energy, whereby the available energy is mobilized with little effort. In contrast, prior art methods are not aimed at mobilizing existing energy, but instead provide the system with a high amount of energy from outside that corresponds to the shortfall in order to be able to start with

Page 1868 of 2306

Petitioner ADC (IPR2024-00671) EXHIBIT 1002

a weak on-board network. According to the inventive method, the energy of the traction battery thus takes the place of a conventional external booster battery, as used in conventional methods. While in the prior art the jump-start had the purpose of completely supplying the power loss that the on-board battery lacks for a successful startup operation, the invention is based on the concept of providing a self-help cascade that is started by activating the element with the lowest consumption , The activation mobilizes energy (the traction battery) that can be used for the boot process. The energy required for the starting process according to the invention is almost completely supplied by the traction battery. The invention is therefore not focused on the provision of energy, but provides a mechanism for mobilizing the energy stored in the traction battery. According to the invention, not the starting process itself but the mobilization of existing energy reserves is supported, it being recognized that this can be achieved very effectively, in that neither the starter nor the on-board battery, nor the DC / DC converter has to be put into operation, but only the converter control. According to the invention, a cascade is triggered by the activation of the converter control, which automatically leads to sufficient power supply of the starter. According to the invention, therefore, with a small amount of current, the converter control is put into operation only for a short time in which it is supplied with power by means of an external energy source for a short duration. Then, the DC / DC converter is automatically put into operation, which provides a high power flow from the traction battery into the electrical system in the permanent, self-sustaining commissioning of the converter control. The converter control system therefore only has to be supplied with energy until the converter itself supplies sufficient power from the traction battery to the vehicle electrical system and in particular to the converter control. In order to compensate for the energy balance, according to the invention the combustion engine is started as a further cascade step, so that both traction battery and vehicle electrical system or On-board battery can balance their energy balance. Therefore, the inventive method provides to activate the converter control by means of an external auxiliary energy amount, wherein the auxiliary energy amount is below the amount of energy that has to be additionally applied for starting. The energy is only for one Time duration is provided, which corresponds to the activation of the DC / DC converter, and thus is less than the time period for which the starter must be supplied with electrical power for a successful startup. When the converter control is activated, it can itself be supplied directly with the auxiliary power, or it can be activated via the vehicle electrical system or via parts of the electrical system to which the converter control is connected. Preferably, not all loads that are connected to the electrical system, simultaneously supplied with the supply of the converter control with power. In a preferred embodiment, the current flow is controlled such that primarily the converter control receives electrical power from the auxiliary power source. This can be provided, for example, by a connection for the auxiliary power source being connected directly to the converter control, whereas the rest of the on-board network is connected to the converter control via a current-steering or current-control device. For example, a diode may be provided between the converter control and the rest of the vehicle electrical system, which diode is provided in the forward direction of the vehicle electrical system for converter control in the connection between converter control and vehicle electrical system. In normal operation, d. H. if the vehicle electrical system has rated voltage, supply current from the on-board network then flows to the converter control, whereas with low on-board network voltage, no current flows from the converter control system into the on-board network even if it receives nominal voltage directly. Therefore, the underlying concept of the invention is implemented by a supply circuit for the converter control or for a controller that includes the converter control, and although allows the flow of current from the electrical system to converter control, but a current flow from the supply terminal of the converter control in the electrical system prevented. Preferably, a diode is provided for this purpose, for example a Schottky diode. If a converter control is connected via such a connection to the electrical system, then according to the inventive method, an auxiliary power source or Start-up power source can be coupled to the converter control without electrical power from the auxiliary power source flows into the electrical system and other loads. Rather, this ensures that the entire portion of the electrical power or at least a large part thereof, from the auxiliary power source actually flows to the converter control. Thus, the auxiliary power source is protected and can be designed with a small capacity. At the same time it is prevented that the auxiliary power source is loaded with other loads than the converter control, whereby the auxiliary power is used effectively and significantly for the activation of the converter control. For this purpose, a disconnect switch can be used, which in an emergency situation with too low vehicle electrical system voltage loads or disconnects the vehicle electrical system from the converter control to ensure that the auxiliary power is substantially

EXHIBIT 1002
Page 1869 of 2306 Petitioner ADC (IPR2024-00671)

completely used only to supply the converter control. If, after activation of the converter control, the DC / DC converter is supplied, the circuit breaker can be folded again, so that the converter control of the vehicle electrical system, which now has a sufficient voltage, is powered. In the same way, the diode allows that when a nominal operating voltage of the vehicle electrical system, the converter control is supplied again in the usual way from the electrical system. The supply line between a connection for the auxiliary power source and the converter control can be designed for low currents, i. H. for common currents that occur during operation of the converter control. In particular, already provided, secure connections, such as connections with which the cigarette lighter socket is connected to the electrical system, since they are sufficient to supply the converter control. In contrast, the prior art provides to feed a starter current directly into the electrical system, wherein due to the height of the injected current no secure connections can be used and at least the cigarette lighter socket due to the high starter current can not be used for this purpose. The converter control typically includes a microprocessor with software or logic circuitry that requires a power supply of less than 1 A and typically between 1 mA and 100 mA to activate the DC / DC converter. Accordingly, the auxiliary power source according to the invention is provided with a capacitor which supplies a minimum voltage, for example 10 V, 11 V or 11.5 V, for a period of time which the converter control needs to deliver an activation signal to the DC / DC converter. In the case of a hard-wired logic circuit, the minimum supply duration through the auxiliary power source is thus less than 1 second, typically between 5 and 100 milliseconds. If the converter control is provided by a microprocessor and software running on it, similar values can also be obtained, and depending on the converter control initialization process, it may be necessary to maintain converter control operation for at least 1 second, but less than 3 seconds. Does the auxiliary power source, the converter control with a voltage that is always above a minimum operating voltage, d. H. never falls below 10 V, 11 V, or 11.5 V, this can be used to activate the DC converter, which supplies the vehicle electrical system and the converter control. Preferably, the auxiliary power source provides a voltage of 12V at a load of 10-100mA for typically 1, 3, 5 or 10 seconds. For cost reasons and for better handling, however, the auxiliary power source is preferably configured to provide the supply for a maximum of 10 seconds, a maximum of 30 seconds, a maximum of 1 minute or a maximum of 5 minutes at a current of 10-100 mA. The auxiliary power source may thus be a high capacitance (greater than 0.1 F) electrolytic capacitor, a capacitive capacitance goldcap capacitor, preferably a series connection of galvanic cells that are rechargeable or non-rechargeable, such as alkaline manganese batteries, zinc-air batteries. May be batteries, lithium cells or similar primary cells, or may be secondary cells such as lead-acid batteries, nickel-cadmium storage batteries, nickel-metal hydride storage batteries, lithium-ion secondary batteries or similar accumulators which may have solid or liquid electrolytes. In particular, alkaline-based 12V alkaline batteries of low capacity, such as those used for mobile devices, are suitable. The rated voltage of the series connection of galvanic cells is preferably about 12 V, at least 12 V or at least 14 V. Further, a combination of a battery pack and a boost converter may be used, with the battery pack providing a voltage lower than 12V, for example 3.6V or 9V, and the boost converter is arranged to convert the battery voltage to a voltage at which the battery packs Converter control can be operated, for example, by using a boost converter with a regulated output voltage of 10-14 V or about 12 V. The auxiliary current element is preferably not designed for continuous operation, but only for a short operation of less than 1 minute or less than 10 seconds duration. Further, when an up-converter is used to achieve the rated voltage of the converter control, a control is preferably provided to connect the converter to the battery only during operation to prevent discharge by the quiescent current of the boost converter. In another embodiment, instead of or in combination with a battery, a hand dynamo is used, which is suitable to provide a voltage of 12 V, for example due to the number of turns or due to an up-converter. Since only a small operating current for a short time is necessary to activate the converter control, hand generators, as they are also used for mobile devices, suitable for short-term operation of the converter control. Further, solar cells may be used, optionally in combination with a boost converter, providing a rated output power of 10-100 mA at 12V. Furthermore, it is basically possible to use the power supply of a USB port, for example a laptop, to reach a voltage of 12 V from the operating voltage of 5 V by means of an up-converter. Therefore, the erfmdungsgemäße auxiliary power source can also be provided by means of an adapter, the supply current of a USB port to a voltage of 12 V converts, for example, at a load of 50 mA to operate the converter control short-term. Optionally, in addition to the boost converter in the above-mentioned embodiment, intermediate buffer memories can also be provided which support short-term operation of, for example, less than 3 seconds. In a particularly preferred embodiment, the

mobile jump-start power source providing an auxiliary power amount comprises an array of 2-8 zinc / carbon batteries, alkaline batteries, nickel metal hydride batteries or nickel cadmium storage batteries, for example in the form of mignon cells, which in combination with a boost converter Provide output voltage of 12 V at 20, 50 or 100 mA. The boost converter may be eliminated if 8 or more alkaline or zinc / carbon batteries are used, or if 10 or more nickel metal hydride or nickel cadmium storage batteries are used. The boost converter preferably includes an actuator such as a switch that completely disconnects and connects the boost converter from the battery cells when actuated. The term "auxiliary power source" is hereby equivalent to "jump-start power source" and refers to an (external) energy storage, which stores a Hilfsenergiebetrag and can deliver to the converter control. To the auxiliary power source or In order not to unnecessarily burden the starting aid energy source, preferably loads of the electrical system such as lighting, ventilation, heating, servo drive, hi-fi component or the like are switched off, preferably by means of a jointly actuable circuit device. This circuit device can be provided, for example, between the supply of the converter control and the rest of the electrical system in order to switch off the electrical system during the activation of the converter control. Alternatively, or in combination, the starter, which is a heavy load, is blocked or not activated, so as not to unnecessarily burden the insufficient auxiliary power source or to empty. For this purpose, for example, a guard interval can be provided which blocks the supply of power to the starter during the activation process of the converter control, wherein the guard interval may be a predetermined guard interval, which depends on the usual length of the activation process of the converter control, or may be a guard interval with variable End, which ends when it is detected that the electrical system by the energy transfer from the traction battery provides enough energy to start. Preferably, this is detected, whether the electrical system or the vehicle electrical system battery has sufficient energy by detecting a battery current or by detecting the voltage applied to the battery. Criteria for terminating the guard interval are therefore a low charging current, which indicates a sufficient charge level of the vehicle electrical system battery, and / or a terminal voltage at the accumulator, which reaches a certain height, which also indicates a high charging level of the vehicle electrical system battery. Likewise, the guard interval can be terminated when it is detected that the DC / DC converter sufficiently supports the vehicle electrical system, for example, by detecting whether the DC / DC converter has sufficient power or generates sufficient power to bring the electrical system to a sufficient voltage. In particular, it can be detected whether a chopper circuit generates an AC voltage within the DC / DC converter, this being evaluated as a signal that sufficient electrical power is generated for the electrical system, so that no further supply of the converter control by the auxiliary power source is necessary. Brief description of the drawings Embodiments of the invention are illustrated in the drawings and explained in more detail in the following description. Show it FIG. 1 shows a circuit principle for connecting the starting aid energy source according to the invention to the converter control and the vehicle electrical system; and FIG. 2 shows a course of action of the cascade provided by the method according to the invention. Embodiments of the invention FIG. 1 shows a circuit principle which can be used to describe the method according to the invention. The circuit of FIG. 1 includes a traction battery 10, an on-board battery 20, a DC / DC converter 30, which connects the traction battery 10 to the onboard power supply battery 20, and a converter controller 40, which controls the DC / DC converter 30. The control of the DC / DC converter 30 by the converter control 40 is provided via a converter control line 44. The converter is further powered by an input 32 from the traction battery 10 to convert it and output at an output 34 of the DC / DC converter 30. In this way, electrical energy can be fed from the traction battery into a vehicle electrical system and, in particular, into the vehicle electrical system battery 20, which is connected to the vehicle electrical system. For example, at the terminals 22 can connect a vehicle electrical system with the associated loads. The vehicle electrical system connection 22 is connected in parallel to the vehicle electrical system battery 20, wherein the vehicle electrical system, in addition to the loads such as lighting, heating, ventilation, other controls, ignition voltage generator and the like also includes a Stromgenera-gate, such as an alternator to charge the electrical system battery 20 in a way as known from internal combustion engine-powered vehicles. The onboard power supply battery 20 is further connected via a switch 24 to a starter 50, which generates a torque, which is supplied directly to the internal combustion engine and starts this by supplying a starter current (typically significantly more than 20 A). Furthermore, a current limiter or a fuse can be provided between the DC / DC converter 30 and the onboard power supply battery 20. The converter control 40 is supplied with electrical energy via a connection circuit 42 from the onboard power supply battery 20 in order to ensure the operation of

the controller 40. The controller 40 may only have the function to drive the DC / DC converter 30, whereby a minimum power consumption is achieved. Further, it is possible that the converter controller 40 is part of a controller that includes other functions, such as power management and others. Preferably, the function of the converter control can be activated individually in order not to unnecessarily have to deliver additional functions in the case of a jump-start auxiliary power supply. The primary function of the converter control is to activate the DC / DC converter 30 to transfer energy from the traction battery 10 to the on-board network, and in particular to the battery 20. In particular, it is the task of the converter controller 40 to send an activation signal to the DC / DC converter 30, which thereupon generates energy with which the converter controller 40 can supply itself with energy. By this self-preservation, it is possible to be able to start-jump with very small amounts of energy, in particular with amounts of energy that are sufficient essentially only for delivering an activation signal to the DC / DC converter 30. The ensuing self-holding effect, fed from the traction energy 10, allows a continuous activation of the circuit. In an alternative embodiment, which is not shown in FIG. 1, an external jump-start function takes over the function of the converter control 40 and outputs an activation signal directly into the line 44, so that the activation signal is output directly to the DC / DC converter 30. As a result, electrical energy is emitted from the traction battery 10 into the electrical system and, in particular, to the converter controller 40. The connection 42, which connects the power supply input of the converter control 40 to the vehicle electrical system, preferably comprises a diode 60, which has the function of protecting an external power source, which is connected via the terminals 70 directly to the supply terminal with the converter control 40. With emptied electrical system battery 20 and applied auxiliary power 70, without the diode 60, a current flow from the starting aid energy source via the connection 70 into the vehicle electrical system 22 and the vehicle electrical system battery 20 would result. As a result, the energy flow to the converter controller 40 is reduced so that the converter controller 40 does not receive sufficient energy to activate the DC / DC converter 30. In this case, the diode 60 blocks the undesired outflow of electrical energy from the starting aid source 70 to the onboard power supply battery 20 and the onboard power supply 22. Furthermore, the diode 60 fulfills a further function, namely the maintenance of the voltage supply of the converter control 40. If this has been successfully activated, the DC / DC converter 30 transfers energy from the traction battery 10 to the electrical system and, in particular, to the onboard power supply battery 20. Therefore, for example, at the terminals 34 of the DC / DC converter 30, there is a preferably regulated standard voltage, for example 12 V, which is also provided by the external starting aid at the terminals 70. Even if the applied jump start at the terminals 70 has a low voltage or is no longer connected, the diode 60 supplies in the forward direction the converter control 40 with the voltage which is present at the output 34 of the DC / DC converter 30 and also at the onboard power supply battery 20 is applied. In the flow direction, the diode 60 therefore serves to self-sustain the supply of the converter control 40. If, by successful activation of the DC / DC converter 30, the energy balance of the electrical system and the on-board battery 20 is balanced, the switch 24 can be actuated, which is preferably designed as a start relay to supply the starter 50 with power. The power may be generated entirely by the DC / DC converter 30, to a part of the DC / DC converter 30 and to a part of the onboard power supply battery 20 or, after the DC / DC converter 30, the battery 20 sufficiently, partially or has completely charged, essentially from the on-board battery 20. In order not to overload the DC / DC converter 30 in that it serves both for charging the onboard power supply battery 20 and for supplying the starter current, a guard time interval can be provided which ensures that the onboard power supply battery 20 can provide a substantial portion of the starter current. The converter 30 preferably comprises an internal control or Control, which is preferably powered by the traction battery 10 with voltage. FIG. 2 shows the course of action of the cascade, which is provided by the method according to the invention. The amounts of energy or Amounts of benefit that are relevant to the process are shown as dashed areas. The size of the area corresponds to the amount of power or Energy stored or necessary for operation. The size of the area of the open rectangle, in which the hatched areas are accommodated, corresponds to the maximum capacity or the maximum power consumption of the respective component. Denoted by reference numeral 170 is a mobile booster that has a relatively small capacity (open rectangle area) and in which a small amount of energy (shaded area) is stored. The starter battery 120 should initially be insufficiently charged, represented by a shaded area which is below the level N1 and N2. The level N1 is the voltage level or Power supply level, which is necessary for the operation of the starter device, and the level N2 corresponds to the voltage level, from which a controller 140 of a DC / DC converter 130 can be operated. Although a traction battery 110 contains sufficient energy, it can not

Page 1872 of 2306
Petitioner ADC (IPR2024-00671) EXHIBIT 1002

be transferred to the onboard power supply 120 because the converter 130 can not be activated. The auxiliary power 170 is not used to fill an energy penalty in the onboard power supply 120, but is routed directly to the converter control 140. This requires a significantly lower amount of energy. As a result, as already described, the converter control 140 is activated, which in turn activates the DC / DC converter 130, at least for a short period of time, thereby enabling energy flow from the traction battery 110 to the onboard power supply battery 120. Thereby, the power loss in the on-board battery 120 can be compensated, whereby the levels N1 and N2 are achieved. Upon reaching the level N2, the power requirement of the converter controller 140 may be borne by the system itself, whereby the supply of energy by an external start-up aid 170 is no longer necessary. As a result of the one-time activation by means of the external energy source 170, a first conservation function can be realized, represented by the arrow A. The energy of the traction battery 110 is transferred to the on-board battery 120 so that it can be charged, but the traction battery is discharged in the long term. To prevent this, a second self-sustaining stage is initiated by supplying fuel energy 150 to the system. The amount of energy 150 can thus represent the fuel in the tank of the motor vehicle. This is used to by means of the internal combustion engine and the alternator or the e-machine to generate energy. For this purpose, internal combustion engine 160 is started by means of energy from the onboard power supply battery 120 and / or from the traction battery 110 (converted by the DC / DC converter 130, for example via an electric starter, so that the energy balance of the traction battery 110 and the energy balance of the vehicle electrical system battery 120 via the power supply lines B and C is balanced. After the auxiliary power source 170 has been used in a first cascade stage to use the traction battery 110 as an energy source for the onboard power supply battery 120 and in particular for the converter control 140, a second cascade stage is to start the engine 160 with the aid of the onboard power supply battery 120. A first self-preservation mechanism associated with the first cascade stage is represented by the arrow A according to which, after the DC / DC converter 130 is activated, the converter controller 140 can be energized by the DC / DC converter 130 and thus derived from the traction battery 110. As the second self-sustaining mechanism associated with the second cascade stage, the energy generated by the combustion motor 160 is used to power the traction battery 110 and / or the on-board battery 120. In particular, the supply of the electrical system battery 120 via the connection B is necessary to ensure that the electrical system has sufficient energy to ensure the engine control and in particular the ignition of the engine. Thus, according to the second self-sustaining mechanism, a part of the power generated by the internal combustion engine 160 is used to maintain the operation of the internal combustion engine itself. Although the areas shown in Figure 2 and their equivalents (amount of energy, capacity) are not to scale, it can be seen that with a very low energy 170, a mechanism can be triggered with which a large amount of energy in the electrical system battery 120 can be compensated. It is therefore possible to trigger a two-stage mechanism via the first and the second cascade stage with the small amount of energy 170, at whose end, instead of the auxiliary energy 170, the entire energy of the fuel tank 150 is activated and mobilized. In the first cascade stage, the DC / DC converter 130 is activated, thereby mobilizing the energy of the traction battery 110, wherein in the second cascade stage, the engine 160 is activated (by starting) and thus the energy of the fuel tank 150 is mobilized and the entire system is available. The mobilization of the respective energies (1. : from the traction battery 110, 2. : from the fuel tank 150) is also used for self-preservation, d. H. for supplying power to the component (1. : Converter control, 2. : Internal combustion engine), which directly or indirectly provides for the mobilization of the respective energy. According to one embodiment, the circuit according to the invention comprises a circuit breaker, preferably a main contactor, which is provided between the traction battery and the input of the DC / DC converter. In particular, the main contactor is arranged together with the traction battery in a battery case. The main contactor is designed as a closer, which connects the traction battery with the Tranktionsbatterieanschluss and thus with the rest of the high-voltage network when activated. According to the invention, the main contactor is closed when the auxiliary power source is connected or connected. The main contactor is therefore driven directly or indirectly (via another controller) by the converter control to connect the DC / DC converter with its activation with the traction battery. As a starter, an electric motor or a starter relay can be used, the or which is intended only for this purpose. The use of a starter motor in addition to the electric motor of the electric drive (which is preferably also mechanically connected to start the internal combustion engine with this) leads to redundancy and thus to higher availability. However, there are cost savings if, instead of a separate starter, the electric motor of the electric drive of the hybrid drive used for starting, which also generates the traction energy when the hybrid drive uses the

Page 1873 of 2306

Petitioner ADC (IPR2024-00671) EXHIBIT 1002

traction battery to propel the vehicle. In this case, the electric motor is connected to the internal combustion engine and transmits a starter torque or Rotation energy via a clutch and / or a transmission to the engine or at the crankshaft. If the electric motor of the drive is used as a starter, then it is sufficient that the converter control initially activates only the main contactor so that the intended as a traction electric motor starter (i. R. the traction electric motor) receives the energy directly from the traction battery. In addition, to supply the electronics of the internal combustion engine (spark generator, control of the fuel supply, ignition control, etc.) the u. a. is needed to start the engine, the DC / DC converter can be activated. In this case, not all of the energy for starting the internal combustion engine is taken from the traction battery via the DC / DC converter in the corresponding cascade, but only the part which is needed to control the internal combustion engine (and further components of the 12 V vehicle electrical system) , The other part for generating the rotational energy for the starting process is fed directly from the traction battery. The inventive control thus includes not only the activation of the DC / DC converter, but also the AnSteuerung the electric motor so that this energy of the traction battery directly converts into mechanical rotational energy to start the engine. The converter control activates in this case first the main contactor, whereupon a start control of the electric motor, the internal combustion engine and the DC / DC converter is activated. The converter control is thus preferably connected directly to the main contactor or to a main contactor control. Alternatively, the starting operation may be performed by the drive's electric motor after or with the activation of the DC / DC converter to provide a starting control with 12V operating voltage, if desired. The converter control may be connected directly to the main contactor via a main contactor control, or via a control line passing through the DC / DC converter. If the starting operation is performed by the electric motor fed directly from the traction battery (via the main contactor), then the DC / DC converter can be designed for a lower load, which substantially corresponds to the load by the engine control, for example approx , 200W or <500 W. According to the invention relates to the supply of the starter by the traction battery starting the engine in normal operation, the supply of the control of the internal combustion engine by means of activated DC / DC converter. Another aspect of starting is then generating the rotational energy by the electric motor fed directly from the traction battery. Furthermore, in addition to the electric motor and other components can be fed directly from the high-voltage traction battery, eg. a power steering or a (air) compressor. These components can be designed by the higher operating voltage for significantly lower currents; this also applies to associated switches or drive circuits. Preferably, such additional components are initially deactivated until the internal combustion engine has started and, for example, has reached a desired rotational speed. After the engine can contribute to maintaining the energy balance (i.e., after startup), these additional components can be reactivated or activated as needed. In the above case, in which the starter is supplied directly from the traction battery, a circuit, as shown in Fig. 1, would result in the wiring of the starter, which is not connected to the 12-board electrical system, but on the traction battery or another point of the high-voltage network operated by the traction battery, eg. the input of the DC / DC converter. Preferably, in this case, a switching element would be provided between the high-voltage network and the starter, which is controlled by a high-voltage starter control or another controller (for example, by the converter control). The switching element and / or the associated control can in principle be supplied directly by the traction battery, or by the DC / DC converter, which is activated in this case before the starting process as described above. In particular, the definition of starting in claim 1 relates to the supply of the engine control via the DC / DC converter and the supply of the starter via the DC / DC converter or directly via the traction battery, depending on whether the starter from the electrical system and thus from DC / DC converter is powered, or the starter (and optionally a starter control) is powered by the traction battery network.

Page 1874 of 2306

Petitioner ADC (IPR2024-00671) EXHIBIT 1002

Description Original

Language: (German)

Ansprüche

Ansprüche

1. Verfahren zum Starten eines Hybridantriebs mittels einer Hilfsenergiequelle mit den Schritten:

Vorsehen einer E-Maschine und eines Verbrennungsmotors, die zusammen zur Erzeugung von Bewegungsenergie in dem Hybridantrieb vorgesehen sind;

Vorsehen einer Traktionsbatterie (10) zur Versorgung des E-Maschine mit Traktionsenergie, einem Bordnetz zum Starten des Verbrennungsmotors im Normalbetrieb, und einer Wandlersteuerung (40) eines DC/DC-Wandlers (30), der zur Versorgung des Bordnetzes aus der Traktionsbatterie (10) vorgesehen ist, wobei das Bordnetz die Wandlersteuerung versorgt; und, wenn im Notfallbetrieb aufgrund eines Energiefehlbetrags im Bordnetz die im Bordnetz verbliebene Energie weder für den Betrieb der Wandlersteuerung (40) noch zum Starten des Verbrennungsmotors ausreicht: Zuführen eines externen Hilfsenergiebetrags, der kleiner als der Energiefehlbetrag ist, zur Wandlersteuerung (40), um den Betrieb der Wandlersteuerung (40) zumindest kurzfristig zu gewährleisten, Aktivieren des

DC/DC-Wandlers (30) durch Ansteuerung mittels der Wandlersteuerung (40) und Einspeisen eines von der Traktionsbatterie (10) stammenden Startvorgang-Energiebetrags, der zusammen mit der im Bordnetz verbliebene Energie zum Starten des Verbrennungsmotors ausreicht, in das Bordnetz durch den DC/DC-Wandlers (30); wobei das Verfahren ferner umfasst: Starten des Verbrennungsmotors durch Übertragen von Rotationsenergie vom Starter.

2. Verfahren nach Anspruch 1, wobei das Starten umfasst: Starten des Verbrennungsmotors mittels eines Versorgungsstroms einer Bordnetzbatterie (20), die an das Bordnetz angeschlossen ist, und/oder mittels eines vom DC/DC- Wandler (30) erzeugten Stroms, und Versorgen der Wandlersteuerung (40) durch Leiten von Strom von dem DC/DC- Wandler (30) an das Bordnetz, nachdem der externen Hilfsenergiebetrags der Wandlersteuerung (40) zugeführt wurde, wobei der externe Hilfsenergiebetrag direkt oder über das Bordnetz der Wandlersteuerung (40) zugeführt wird.

3. Verfahren nach einem der vorangehenden Ansprüche, wobei während dem Zuführen des externen Hilfsenergiebetrags zumindest eine Last von dem Bordnetz für zumindest ein Schutzzeitintervall abgetrennt ist, das mit dem Zuführen beginnt, wobei die zumin-dest eine Last umfasst: ein Beleuchtungselement, ein Belüftungselement, ein elektrisches Heizelement, ein elektrischer Servoantrieb, eine elektronische Unterhaltungskomponente, eine durch geringen Ladezustand als Last wirkende Batterie, eine Aufladevorrichtung für eine Batterie oder für eine Bordnetzbatterie (20) oder eine Kombination hiervon.

4. Verfahren nach Anspruch 3, wobei das Starten des Verbrennungsmotors während des Schutzintervalls, am Ende des Schutzintervalls, nach dem Ende des Schutzintervalls oder zu einem Zeitpunkt ausgeführt wird, an dem das Bordnetz eine Energiemenge speichert, die zum erfolgreichen Starten des Verbrennungsmotor ausreicht, oder an dem das Bordnetz eine Energiebilanz aufweist, die zum erfolgreichen Starten des Verbrennungsmotor ausreicht.

5. Verfahren nach Anspruch 4, wobei das Schutzzeitintervall nach einem vorbestimmten Schutzintervall endet oder dann endet, wenn der Strom, der vom DC/DC-Wandler (30) in das Bordnetzes fliesst, einen Schwellwert unterschreitet und/oder eine interner Spannung des Bordnetzes einen Schwellwert überschreitet.

6. Verfahren nach einem der vorangehenden Ansprüche, wobei das Gewährleisten des Betriebs der Wandlersteuerung (40) im wesentlichen durch Zuführen externer Hilfsenergie vorgesehen wird, wobei das Zuführen externer Hilfsenergie das Zuführen von elektrischer Leistung umfasst, mit der im wesentlichen nur die Wandlersteuerung (40) zumindest kurzfristig betrieben und/oder eine zum Betrieb der Wandlersteuerung (40) notwendige Bordnetzspannung zumindest kurzfristig erreicht wird, und/oder die zum Starten notwendige Energie im wesentlichen von dem DC/DC-Wandler (30) alleine oder von dem DC/DC-Wandler (30) in Kombination mit dem Bordnetz stammt, wobei die Menge der externen Hilfsenergie und/oder die durch die Hilfsenergie vorgesehene Versorgungsdauer des Bordnetzes einem Bruchteil derjenigen Energiemenge bzw. derjenigen Versorgungsdauer entspricht, die das Starten beansprucht.

7. Notversorgungsschaltung zur Versorgung einer Wandlersteuerung eines Hybridantriebs, wobei die Wandlersteuerung (40) eingerichtet ist, einen DC/DC-Wandler (30) zur Versorgung eines Bordnetzes aus einer Traktionsbatterie (10) des Hybridantriebs zu steuern, wobei die

Notversorgungsschaltung einen Anschluss für eine externe Hilfsenergiequelle und eine und eine elektrische Verbindung zu einem Versorgungsanschluse der Wandlersteuerung (40) vorsieht, wobei die elektrische Verbindung für den Strombedarf der Wandlersteuerung (40) ausgelegt ist. 8.

Notversorgungsschaltung nach Anspruch 7, die ferner eine Diode (60) und/oder einen Trennschalter umfasst, die bzw. der den Versorgungsanschluss der Wandlersteuerung gerichtet bzw. steuerbar mit weiteren Verbrauchern, mit Teilen des Bordnetzes, dem gesamten Bordnetz verbindet oder einer Bordnetzbatterie (20) verbindet, wobei der Trennschalter einen Umschalter, einen elektronischen Schalter oder ein Relais umfasst und eingerichtet ist, mittels manueller Betätigung oder mittels eines Steuersignal angesteuert zu werden, und die elektrische Verbindung eine direkte Verbindung ist, die mit dem Versorgungsanschluss bei geöffnetem Trennschalter verbunden ist.

9. Mobile Starthilfe-Energiequelle für Hybridfahrzeuge, deren Traktionsbatterie (10) eingerichtet ist, das Bordnetz über einen DC/DC-Wandler (30) zu versorgen, dessen Wandlersteuerung (40) vom Bordnetz versorgt wird, wobei die mobile Starthilfebatterie einen maximalen Norm-Entladestrom aufweist, der geeignet ist, die Spannung des Bordnetzes auf eine Spannung innerhalb eines zulässigen Betriebsspannungsbereiches der Wandlersteuerung zu erhöhen, wobei der Norm-Entladestrom nur einem Bruchteil des Strombetrags entspricht, der für einen Start eines Verbrennungsmotors erforderlich ist.

10. Mobile Starthilfe-Energiequelle für Hybridfahrzeuge nach Anspruch 9, die eine Nennkapazität aufweist, die einer Versorgungsdauer für das Bordnetzes von weniger als 1

Minute, weniger als 10 sec, weniger als 5 sec, weniger als 3 sec. oder weniger als 1 sec. entspricht.

1. Verfahren zum Starten eines Hybridantriebs mittels einer Hilfsenergiequelle mit den Schritten:

Vorsehen einer E-Maschine und eines Verbrennungsmotors, die zusammen zur Erzeu- gung von Bewegungsenergie in dem Hybridantrieb vorgesehen sind;

Vorsehen einer Traktionsbatterie (10) zur Versorgung des E-Maschine mit Traktionsenergie, einem Bordnetz zum Starten des Verbrennungsmotors im Normalbetrieb, und einer Wandlersteuerung (40) eines DC/DC-Wandlers (30), der zur Versorgung des Bordnetzes aus der Traktionsbatterie (10) vorgesehen ist, wobei das Bordnetz die Wandlersteuerung versorgt; und, wenn im Notfallbetrieb aufgrund eines Energiefehlbetrags im Bordnetz die im Bordnetz verbliebene Energie weder für den Betrieb der Wandlersteuerung (40) noch zum Starten des Verbrennungsmotors ausreicht: Zuführen eines externen Hilfsenergiebetrags, der kleiner als der Energiefehlbetrag ist, zur Wandlersteuerung (40), um den Betrieb der Wandlersteuerung (40) zumindest kurzfristig zu gewährleisten, Aktivieren des

DC/DC-Wandlers (30) durch Ansteuerung mittels der Wandlersteuerung (40) und Einspeisen eines von der Traktionsbatterie (10) stammenden Startvorgang-Energiebetrags, der zusammen mit der im Bordnetz verbliebene Energie zum Starten des Verbrennungsmotors ausreicht, in das Bordnetz durch den DC/DC-Wandlers (30); wobei das Verfahren ferner umfasst: Starten des Verbrennungsmotors durch Übertragen von Rotationsenergie vom Starter.

2. Verfahren nach Anspruch 1, wobei das Starten umfasst: Starten des Verbrennungsmotors mittels eines Versorgungsstroms einer Bordnetzbatterie (20), die an das Bordnetz angeschlossen ist, und/oder mittels eines vom DC/DC- Wandler (30) erzeugten Stroms, und Versorgen der Wandlersteuerung (40) durch Leiten von Strom von dem DC/DC- Wandler (30) an das Bordnetz, nachdem der externen Hilfsenergiebetrags der Wandlersteuerung (40) zugeführt wurde, wobei der externe Hilfsenergiebetrag direkt oder über das Bordnetz der Wandlersteuerung (40) zugeführt wird.

3. Verfahren nach einem der vorangehenden Ansprüche, wobei während dem Zuführen des externen Hilfsenergiebetrags zumindest eine Last von dem Bordnetz für zumindest ein Schutzzeitintervall abgetrennt ist, das mit dem Zuführen beginnt, wobei die zumin- dest eine Last umfasst: ein Beleuchtungselement, ein Belüftungselement, ein elektrisches Heizelement, ein elektrischer Servoantrieb, eine elektronische Unterhaltungskomponente, eine durch geringen Ladezustand als Last wirkende Batterie, eine Aufladevorrichtung für eine Batterie oder für eine Bordnetzbatterie (20) oder eine Kombina- tion hiervon.

4. Verfahren nach Anspruch 3, wobei das Starten des Verbrennungsmotors während des Schutzintervalls, am Ende des Schutzintervalls, nach dem Ende des Schutzintervalls oder zu einem Zeitpunkt ausgeführt wird, an dem das Bordnetz eine Energiemenge speichert, die zum erfolgreichen Starten des Verbrennungsmotor ausreicht, oder an dem das Bordnetz eine Energiebilanz aufweist, die zum erfolgreichen Starten des Verbrennungsmotor ausreicht.

Page 1876 of 2306

Petitioner ADC (IPR2024-00671) EXHIBIT 1002

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

5. Verfahren nach Anspruch 4, wobei das Schutzzeitintervall nach einem vorbestimmten Schutzintervall endet oder dann endet, wenn der Strom, der vom DC/DC-Wandler (30) in das Bordnetzes fließt, einen Schwellwert unterschreitet und/oder eine interner Spannung des Bordnetzes einen Schwellwert überschreitet.

6. Verfahren nach einem der vorangehenden Ansprüche, wobei das Gewährleisten des Betriebs der Wandlersteuerung (40) im wesentlichen durch Zuführen externer Hilfs- energie vorgesehen wird, wobei das Zuführen externer Hilfsenergie das Zuführen von elektrischer Leistung umfasst, mit der im wesentlichen nur die Wandlersteuerung (40) zumindest kurzfristig betrieben und/oder eine zum Betrieb der Wandlersteuerung (40) notwendige Bordnetzspannung zumindest kurzfristig erreicht wird, und/oder die zum Starten notwendige Energie im wesentlichen von dem DC/DC-Wandler (30) alleine o- der von dem DC/DC-Wandler (30) in Kombination mit dem Bordnetz stammt, wobei die Menge der externen Hilfsenergie und/oder die durch die Hilfsenergie vorgesehene Versorgungsdauer des Bordnetzes einem Bruchteil derjenigen Energiemenge bzw. derjenigen Versorgungsdauer entspricht, die das Starten beansprucht.

7. Notversorgungsschaltung zur Versorgung einer Wandlersteuerung eines Hybridantriebs, wobei die Wandlersteuerung (40) eingerichtet ist, einen DC/DC-Wandler (30) zur Versorgung eines Bordnetzes aus einer Traktionsbatterie (10) des Hybridantriebs zu steuern, wobei die Notversorgungsschaltung einen Anschluss für eine externe Hilfs- energiequelle und eine und eine elektrische Verbindung zu einem Versorgungsanschluss der Wandlersteuerung (40) vorsieht, wobei die elektrische Verbindung für den Strombedarf der Wandlersteuerung (40) ausgelegt ist.

8. Notversorgungsschaltung nach Anspruch 7, die ferner eine Diode (60) und/oder einen Trennschalter umfasst, die bzw. der den Versorgungsanschluss der Wandlersteuerung gerichtet bzw. steuerbar mit weiteren Verbrauchern, mit Teilen des Bordnetzes, dem gesamten Bordnetz verbindet oder einer Bordnetzbatterie (20) verbindet, wobei der Trennschalter einen Umschalter, einen elektronischen Schalter oder ein Relais umfasst und eingerichtet ist, mittels manueller Betätigung oder mittels eines Steuersignal angesteuert zu werden, und die elektrische Verbindung eine direkte Verbindung ist, die mit dem Versorgungsanschluss bei geöffnetem Trennschalter verbunden ist.

9. Mobile Starthilfe-Energiequelle für Hybridfahrzeuge, deren Traktionsbatterie (10) eingerichtet ist, das Bordnetz über einen DC/DC-Wandler (30) zu versorgen, dessen Wandlersteuerung (40) vom Bordnetz versorgt wird, wobei die mobile Starthilfebatterie einen maximalen Norm-Entladestrom aufweist, der geeignet ist, die Spannung des Bordnetzes auf eine Spannung innerhalb eines zulässigen Betriebsspannungsbereiches der Wandlersteuerung zu erhöhen, wobei der Norm-Entladestrom nur einem Bruchteil des Strombetrags entspricht, der für einen Start eines Verbrennungsmotors erforderlich ist.

10. Mobile Starthilfe-Energiequelle für Hybridfahrzeuge nach Anspruch 9, die eine Nenn- kapazität aufweist, die einer Versorgungsdauer für das Bordnetzes von weniger als 1

Minute, weniger als 10 sec, weniger als 5 sec, weniger als 3 sec. oder weniger als 1 sec. entspricht.

Page 1877 of 2306

Language: (English)

claims

1. A method for starting a hybrid drive by means of an auxiliary power source with the steps:

Providing an electric machine and an internal combustion engine provided together for generating kinetic energy in the hybrid drive;

Providing a traction battery (10) for supplying the electric motor with traction energy, a vehicle electrical system for starting the internal combustion engine in normal operation, and a converter control (40) of a DC / DC converter (30) for supplying the electrical system from the traction battery (10) is provided, wherein the electrical system supplies the converter control; and, if, in an emergency operation due to an energy loss in the electrical system, the energy remaining in the electrical system is sufficient neither for the operation of the converter control (40) nor to start the engine: supplying an external auxiliary energy amount, which is smaller than the power loss to the converter control (40) to ensure the operation of the converter control (40) at least in the short term, activating the

DC / DC converter (30) by driving means of the converter control (40) and feeding a of the traction battery (10) originating starting energy amount, which is sufficient together with the energy remaining in the electrical system to start the engine, in the electrical system through the DC / DC converter (30); the method further comprising: starting the internal combustion engine by transmitting rotational energy from the initiator.

2. The method of claim 1, wherein the starting comprises: starting the internal combustion engine by means of a supply current of a vehicle electrical system battery (20) which is connected to the electrical system, and / or by means of a DC / DC converter (30) generated electricity, and supply the converter controller (40) by supplying current from the DC / DC converter (30) to the on-board network after the external auxiliary power amount has been supplied to the converter controller (40), the external auxiliary energy amount being supplied to the converter controller (40) directly or via the vehicle electrical system becomes.

3. The method according to claim 1, wherein during the supply of the external auxiliary energy amount, at least one load is disconnected from the vehicle electrical system for at least one protection time interval starting with the supply, the at least one load comprising: a lighting element, a ventilation element, an electric heating element, an electric servo drive, an electronic entertainment component, a low-load battery, a battery charger or an on-board battery (20), or a combination thereof.

4. The method of claim 3, wherein the starting of the internal combustion engine is performed during the guard interval, at the end of the guard interval, after the end of the guard interval or at a time at which the electrical system stores an amount of energy sufficient to successfully start the internal combustion engine, or where the electrical system has an energy balance sufficient to successfully start the engine.

5. The method of claim 4, wherein the guard time interval ends after a predetermined guard interval or ends when the current flowing from the DC / DC converter (30) in the electrical system, below a threshold and / or an internal voltage of the electrical system Threshold exceeds.

A method according to any one of the preceding claims, wherein the operation of the converter controller (40) is substantially provided by supplying external auxiliary power, the supply of external auxiliary power comprising supplying electric power, substantially only the converter controller (40). operated at least in the short term and / or necessary for operation of the converter control (40) board voltage is achieved at least in the short term, and / or necessary for starting energy substantially from the DC / DC converter (30) alone or from the DC / DC converter (30) comes in combination with the electrical system, wherein the amount of external auxiliary power and / or provided by the auxiliary power supply duration of the electrical system corresponds to a fraction of that amount of energy or the duration of supply, which claims the start.

7. Emergency supply circuit for supplying a converter control of a hybrid drive, wherein the converter controller (40) is arranged to control a DC / DC converter (30) for supplying an electrical system from a traction battery (10) of the hybrid drive, wherein the emergency supply circuit has a connection for a external auxiliary power source and one and an electrical connection to a supply terminal of the converter control (40) provides, wherein the electrical connection for the power requirement of the converter control (40) is designed. 8th.

Emergency supply circuit according to claim 7, further comprising a diode (60) and / or a circuit breaker, the or the supply terminal of the converter control directed or controllably connected to other consumers, with parts of the electrical system, the entire electrical system or an on-board battery (20) connects, wherein the circuit breaker comprises a switch, an electronic switch or a relay and is arranged to be controlled by means of manual operation or by means of a control signal, and the electrical connection is a direct connection, which is connected to the supply terminal with the disconnector open.

9. Mobile jump-start power source for hybrid vehicles, the traction battery (10) is adapted to supply the electrical system via a DC / DC converter (30) whose converter control (40) is powered by the electrical system, the mobile booster battery has a maximum standard Discharge current, which is adapted to increase the voltage of the electrical system to a voltage within an allowable operating voltage range of the converter control, wherein the standard discharge current corresponds to only a fraction of the amount of current that is required for a start of an internal combustion engine.

10. Mobile jump-start power source for hybrid vehicles according to claim 9, which has a nominal capacity that a supply duration for the electrical system of less than 1

Minute, less than 10 seconds, less than 5 seconds, less than 3 seconds, or less than 1 second.

Page 1878 of 2306

Petitioner ADC (IPR2024-00671) EXHIBIT 1002

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/820,040	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 H02J7/00302 H02J7/00309 H02J7/00306 Y02T90/14 Y02T10/7072 Y02T10/70 H02J2310/46	08/31/2021	MD

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
320	105	08/31/2021	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
	16/820,040	NOOK et al.
	Examiner	Art Unit
	M'BAYE DIAO	2859

Search Notes		
Search Notes	**Date**	**Examiner**
SEARCH(SEARCH Notes Attached)	08/31/2021	MD
Inventor Name and Assignee Search (SEARCH).	08/31/2021	MD
Parent Applications Noted.	08/31/2021	MD
IPR2018-00503 Reviewed Petition for Inter Partes Review of U.S. Patent No. 9,007,015.	08/31/2021	MD
IPR2020-00944 Reviewed Petition for Inter Partes Review of U.S. Patent No. 9,007,015.	08/31/2021	MD
IPR2020-01387 Reviewed Petition for Inter Partes Review of U.S. Patent No. 9,007,015.	08/31/2021	MD
IPR2021-00309 Reviewed Petition for Inter Partes Review of U.S. Patent No. 9,007,015.	08/31/2021	MD
(307/150 Text Search Only -- see attached Search Printout).	08/31/2021	MD
IP.com PAT and NPL Search Conducted.	08/31/2021	MD
Updated Search Above.	03/10/2022	MD
Dialog ProQuest Search Conducted.	03/10/2022	MD
Updated Search Above.	08/04/2022	MD

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**

/M BAYE DIAO/ Primary Examiner, Art Unit 2859	

Notice of References Cited	Application/Control No. 16/820,040	Applicant(s)/Patent Under Reexamination NOOK et al.	
	Examiner M'BAYE DIAO	Art Unit 2859	Page 1 of 1

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
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	B					
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	P					
	Q					
	R					
	S					
	T					

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	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.

Search History_16820040

Report Run Date: 2022-07-30 UTC
Searches: 3
Markers: 0

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

Search #	Timestamp	Results	Page
1	2022-07-30 17:09 UTC	12,882,640	3
2	2022-07-30 17:16 UTC	11,631,387	4
3	2022-07-30 17:20 UTC	541,457	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 **2022-07-30 17:09 UTC | 12,882,640 results from**

De-Dup: None | **Cut-off:** None | **Sort:** Relevance

Main Concept: Text

A jump starting device for boosting or charging a depleted or discharged battery having a positive battery terminal and a negative battery terminal, the jump starting device comprising: a power supply; a positive battery connector for electrically connecting the jump starter device to the positive battery terminal of the depleted or discharged battery; a negative battery connector for electrically connecting the jump starter device to the negative battery terminal of the depleted or discharged battery; a power switch or switch circuit connected in circuit with the power supply and the positive and negative battery connectors, the power switch or switch circuit configured to switch power on or off from the power supply to boost or charge the depleted or discharged battery when connected between the positive and negative battery connectors; a USB input connector; and a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit comprising a DC-DC converter configured to up- convert voltage from the USB input connector to the power supply

Concept Modifiers: None

Filters: None

2 **2022-07-30 17:16 UTC | 11,631,387 results from**

De-Dup: None | **Cut-off:** None | **Sort:** Relevance

Main Concept: Text
A jump starting device for boosting or charging a depleted or discharged battery having a positive battery terminal and a negative battery terminal, the jump starter device comprising: a power supply; a positive battery connector for electrically connecting the jump starter device to the positive battery terminal of the depleted or discharged battery; a negative battery connector for electrically connecting the jump starter device to the negative battery terminal of the depleted or discharged battery; a power switch or switch circuit in circuit with the power supply and the positive and negative battery connectors, the power switch or switch circuit configured to switch power on from the power supply to boost or charge the depleted or discharged battery when connected between the positive and negative battery connectors; a USB input connector; a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit configured to up-convert voltage from a USB charger power source connected to the USB input connector to the power supply using a DC-DC converter; a USB output connector; and a USB output circuit electrically connecting the power supply to the USB output connector

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

3 **2022-07-30 17:20 UTC | 541,457 results from**

De-Dup: None | **Cut-off:** None | **Sort:** Relevance

Main Concept: Text
A jump starting device for boosting or charging a depleted or discharged battery having a positive battery terminal and a negative battery terminal, the jump starter device comprising: a power supply; a positive battery connector for electrically connecting the jump starter device to the positive battery terminal of the depleted or discharged battery; a negative battery connector for electrically connecting the jump starter device to the negative battery terminal of the depleted or discharged battery; a power switch or switch circuit in circuit with the power supply and the positive and negative battery connectors, the power switch or switch circuit configured to switch power on from the power supply to boost or charge the depleted or discharged battery when connected between the positive and negative battery connectors; a USB input connector; a USB charge circuit electrically connecting the USB input connector to the power

Page 1885 of 2306

Petitioner ADC (IPR2024-00671) EXHIBIT 1002

supply, the USB charge circuit configured to up-convert voltage from a USB charger power source connected to the USB input connector to the power supply using a DC-DC converter; a USB output connector; and a USB output circuit electrically connecting the power supply to the USB output connector

Concept Modifiers: None

Filters: None

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
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16820040
Filing Date	2020-03-16
First Named Inventor	NOOK
Art Unit	2859
Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-02-02

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EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16820040
	Filing Date	2020-03-16
	First Named Inventor	NOOK
	Art Unit	2859
	Examiner Name	DIAO
	Attorney Docket Number	054985-000055-US-02-02

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	Examiner Name	DIAO
	Attorney Docket Number	054985-000055-US-02-02

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EXHIBIT 1002
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Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-02-02

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If you wish to add additional U.S. Patent citation information please click the Add button. Add

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EXHIBIT 1002
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	Examiner Name	DIAO
	Attorney Docket Number	054985-000055-US-02-02

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EXHIBIT 1002
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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]
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EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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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

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Attorney Docket Number	054985-000055-US-02-02

/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.
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Art Unit	2859
Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-02-02

/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.
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	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
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	22	D28 affidavit of the manager of the requesting party, 2013.

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.D/

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Petitioner ADC (IPR2024-00671)

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(Not for submission under 37 CFR 1.99)

Application Number	16820040
Filing Date	2020-03-16
First Named Inventor	NOOK
Art Unit	2859
Examiner Name	DIAO
Attorney Docket Number	054985-000055-US-02-02

/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.
	28	THE NOCO COMPANY, INC. v. SHENZHEN CHANGXINYANG TECHNOLOGY CO., LTD., Case No. 1:17-cv-02209, Defendents' Amended Final Invalidity and Unenforceability Contents, In the US District Court of Northern Ohio, Eastern District. The Powerall PBJS12000RD Jump Starter ("Powerall Jump Starter"), offered For sale by Gryphon Mobile Electronics at least as early 11/5/13; The Lightning 12V Jump Starter ("Lightning Jump Starter), offered for sale by Pilot, Inc. at least as early 3/14; The L3 Model Jump Starter, offered for sale by Shenzhen Tsevie Co as Early
	29	Notification of Material filed under Section 27, Australian Government IP Australia, November 8, 2016 (3 pages); Declaration of Sheridan Lee (8 pages); Annexure SL-1 (8 pages); Annexure SL-2 (10 pages); Annexure SL-3 (9 pages); Annexure SL-4 (18 pages); Annexure SL-5, JP 3185027 (14 pages); Annexure SL-6 of English Translation of JP 3185027 (17 pages) and US 2004/0130298 (14 pages).
	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.

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EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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/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.
	42	QVC, Inc., U.S. International Trade Commission, Investigation No. 337-1256, RESPONSE OF QVC, INC. TO THE SECOND AMENDED COMPLAINT AND NOTICE OF INVESTIGATION, pages 144-145.
	43	In re Certain Portable Battery Jumpstarters and Components Thereof, 3370TA01256, United States International Trade Commission (March 17, 2021); Respondents Initial Invalidity Contentions, 14pages
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/M.D/	45	Xysemi XR3403
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Examiner Signature	/M BAYE DIAO/	Date Considered	08/04/2022

*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.

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EXHIBIT 1002
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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
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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

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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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/M.D/	29	20100173182		2010-07-08	BAXTER	
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	8	2001069673	JP	A	2001-03-16	HITACHI LTD	English Abstract attached	☒
	9	2011023249	JP	A	2011-02-03	NISSAN MOTOR	English Abstract attached	☒

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	17	2019/021007	WO	A1	2019-01-31	INTERCAL (UK) LTD		☐
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/M.D/	21	2016/025869	WO	A1	2016-02-18	SCHUMACHER ELECTRIC CORP		☐
	22	202918052	CN	U	2013-05-01	LEI XINGLIANG	English Abstract attached	☒
	23	204113515	CN	U	2015-01-21	ZHANG KAILONG	English Abstract attached	☒
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EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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

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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]
/M.D/	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	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.	
	4	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).	
	5	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.	
	6	DEFENDANT TII TRADING INC.'S INVALIDITY CONTENTIONS	
	7	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.	
	8	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	
	9	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.	

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.D/

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	Attorney Docket Number	054985-000055-US-05

/M.D/	10	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
	11	FARAH et al., "New Analog Li-ion Battery Charger Using Pulsed Charging Method, 2018, IEEE, Pps. 1-4 (Year: 2018).
	12	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)
	13	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
	14	Statement of Defence and Counterclaim - Defendant: Canadian Tire Corporation, Limited, Court File No. T-343-20, 17 pages, August 4, 2020.
	15	Copy of Australian Office Action for AU Patent Application No.: AU2020201224, mailed October 26, 2021.
	16	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
	17	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
	18	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
	19	Exhibit 1004 from IPR2021-00309; PTAB Decision Denying Institution of Inter Partes Review of the '015 patent in Case IPR2018-00503
	20	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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EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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	Examiner Name	DIAO
	Attorney Docket Number	054985-000055-US-05

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	08/04/2022

*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.

EFS Web 2.1.18

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.D/

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/820,040	03/16/2020	Jonathan Lewis NOOK	054985-000055-US-02-02	1056

20230 7590 08/10/2022

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	

NOTIFICATION DATE	DELIVERY MODE
08/10/2022	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patlaw@vorys.com
vorys_docketing@cardinal-ip.com

PTOL-90A (Rev. 04/07)

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

Office Action Summary	Application No. 16/820,040	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 --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 06/15/2022.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ 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.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 24-80 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 24-80 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, 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.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 03/16/2020 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ 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)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date 06/15/2022.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

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 final rejection. 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, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 06/15/2022 has been entered.

3. Claims 24-30,32-43,45-49,54,59-61, and 71 are currently amended, claims 1-23 have been canceled while claims 72-80 have been newly added. By this amendment, **claims 24-80 are now pending in the application.**

Information Disclosure Statement

4. The information disclosure statement (IDS) filed on 06/15/2022 has been considered and placed of record. An initialed copy is attached herewith.

Claim Objections

5. Claim 24, line 5, the underlined limitations of, "a positive battery connector for electrically connecting the jump starter device" lack antecedent basis and should read for examination purpose -- a positive battery connector for electrically connecting the jump starting device --. Additionally, in claim 24, line 13, the limitations "...the positive and negative battery connectors;" **should be underlined** as it was not present on the last claim 24 presented on 02/07/2022.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

6. Additionally, in claim 41, line 1, the limitations of "The device according to claim 37..." should read -- The device according to claim 37...-- **should be underlined** as it was not present on the last claim 41 presented on 02/07/2022 or change it back to --The device according to claim 39--as it was presented on 02/07/2022.

7.

8. In claim 29, the limitations of, "wherein the DC-DC converter is configured to convert 5VDC from at the USB input connector to at least 11.1VDC for the power supply when an active USB power source is connected to the USB input connector" should and would read for examination purpose --wherein the DC-DC converter is configured to convert 5VDC from ~~at~~ the USB input connector to at least 11.1VDC for the power supply when an active USB power source is connected to the USB input connector --

9. Similarly, in claim 80, lines 2-3, the underlined limitations of, "the jump starter device comprising:" lack antecedent basis and should read for examination purpose -- the jump starting device comprising:--

10. Appropriate correction is required.

Claim Rejections - 35 USC § 103

11. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

12. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

13. The factual inquiries for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

14. This application currently names joint inventors. In considering patentability of the claims the examiner presumes that the subject matter of the various claims was commonly owned as of the effective filing date of the claimed invention(s) absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and effective filing dates of each claim that was not commonly owned as of the effective filing date of the later invention in order for the examiner to consider the applicability of 35 U.S.C. 102(b)(2)(C) for any potential 35 U.S.C. 102(a)(2) prior art against the later invention.

15. **Claims 24-28,31-32,36-58,60,63-68,71,74-80 are rejected under 35 U.S.C. 103 as being unpatentable over Richardson et al., (Richardson) US 2009/0174362 (Exhibit 1010 IPR2020-01387) in view of Butler et al., (Butler) USPAT 10,087,904**.

8. Regarding claim 24, Richardson discloses a jump starting device**(10)(Abstract; ¶[0001])** for boosting or charging a depleted or discharged battery **(battery of vehicle 28)(¶[0006])** having a positive battery terminal **(Red clamp; Fig. 2.C)** and a negative battery terminal **(black clamp)(Note-jumper cable 60 has red (positive) and black (negative) clamps. EX1010 at ¶[0020]); Richardson discloses "a pair of conductive leads for connecting the supplemental**

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

power to an engine electrical system), the jump starting device**(10)** comprising: a power supply **(jump starter batteries 22 provide power to the battery of the vehicle(28) to be jump started; see ¶[0006] and Fig. 2C**); a positive battery connector **(labeled Red clamp; Fig. 2C)** for electrically connecting**(via cables 60; note the cables are electric conductor)** the jump starter device**(10)** to the positive battery terminal of the depleted or discharged battery**(battery of vehicle 28)**; a negative battery connector **(labeled black clamp; Fig. 2C)** for electrically connecting**(via cables 60; note- the cables are electric conductor)** the jump starter device**(10)** to the negative battery terminal of the depleted or discharged battery**(battery of vehicle 28)**; a power switch or switch circuit **((contact relay 34); see Figs. 1 and 2C)** connected in circuit with the power supply**(jump starter batteries 22)** and the positive and negative battery connectors**(Red and Black clamps; see Figs. 1 and 2C)**, the power switch or switch circuit **(contact relay 34)** configured to switch power on from the power supply**(jump starter batteries 22)** to boost or charge the depleted or discharged battery**(battery of vehicle 28)**when connected between the positive and negative battery connectors**(Red and Black clamps; see Figs. 1 and 2C)(note-Only after the reverse polarity and battery presence tests have been conducted at steps 214 and 252 does the process proceed to step 268 where microprocessor 12 sends a signal to close contact relay 34. (See also Fig. 3, Fig. 6, ¶[0014] and [0027] to turning on the power switch or circuit(34)(see ¶[0014])(note- Richardson also makes clear that the microcontroller only closes relay 34 if the reverse polarity sensor 24 and vehicle voltage sensor 30 indicate the presence of a vehicle battery connected with proper polarity. For example, Richardson states that "when the jump starter 10 is initially powered on 200, the microprocessor initializes the hardware . . . . then performs a self-test operation 208 where . . . all sensors 20, 24, 30, 32, 38, 40 . . . are tested". Richardson further discloses the process**

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

of measuring the vehicle battery voltage necessarily entails detecting the presence of a vehicle battery connected to the positive and negative output ports of the discharged or depleted battery since reading a sufficiently low voltage would indicate either the absence of a vehicle battery or a battery with a voltage below a required threshold for detection. Only after the reverse polarity and battery presence tests have been conducted at steps 214 and 252 does the process proceed to step 268 where microprocessor 12 sends a signal to close contact relay 34 for power transfer from the power supply (22) to the depleted battery (See also Fig. 3, Fig. 6, see also ¶[0006],[0014] and [0027]).

9. Richardson does not expressly teach the limitations of,

- a USB input connector; and

a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit comprising a DC-DC converter configured to up-convert voltage from the USB input connector to the power supply.

10. However, Butler discloses factual evidence of, a USB input connector **(156)** and a USB charge circuit**(USB port)(see col. 5, lines 54-67; col. 12, lines 8-12)** electrically connecting the USB input connector to the power supply**(150)**, the USB charge circuit**(sepic circuit 302)** (col. 13, lines 13-34 & 62-65); comprising a DC-DC converter**(sepic 302 is a DC to DC type converter)(see col. 12, lines 5-35)** configured to up-convert voltage from the USB input connector**(156) (see col. 5, lines 54-67)** to the power supply**(150).**

16. Richardson and Butler are battery booster analogous art. Therefore it would have been obvious to one having ordinary skill in the art before the effective filing date of the claimed invention to avail of the teachings of Butler in having incorporated, a USB input connector; and a USB charge circuit electrically connecting the USB input connector to the

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

power supply, the USB charge circuit comprising a DC-DC converter configured to up-convert voltage from the USB input connector to the power supply, into the jump starting device of Richardson so as to thereby enable the internal battery recharging functionality via a USB port and ensuring a source of UPS for the jump starting device, as per the teachings of Butler**(col. 6, lines 16-26; col. 12, lines 23-27)** .

17. Accordingly claim 24 would have been obvious.

18. Regarding claim 80, Richardson at least discloses and shows in **Fig. 2C**, A jump starting device**(10)(Abstract; ¶[0001])** for boosting or charging a depleted or discharged battery**(battery of vehicle 28)(¶[0006])** having a positive battery terminal**(Red clamp; Fig. 2C)** and a negative battery terminal**(black clamp)(Note-jumper cable 60 has red (positive) and black (negative) clamps. EX1010 at ¶[0020]); Richardson discloses "a pair of conductive leads for connecting the supplemental power to an engine electrical system)**, the jump start~~er~~ing device**(10)** comprising: a power supply**(jump starter batteries 22 provide power to the battery of the vehicle(28) to be jump started; see ¶[0006] and Fig. 2C)**; a positive battery connector**(labeled Red clamp; Fig. 2C)** for electrically connecting the jump start~~er~~ing device**(10)** to the positive battery terminal of the depleted or discharged battery**(battery of vehicle 28)**; a negative battery connector**(labeled Black clamp; Fig. 2C)** for electrically connecting the jump start~~er~~ing device to the negative battery terminal of the depleted or discharged battery**(battery of vehicle 28)**; a power switch or switch circuit**((contact relay 34); see Figs. 1 and 2C)** in circuit with the power supply**(jump starter batteries 22 provide power to the battery of the vehicle(28) to be jump started; see ¶[0006] and Fig. 2C)** and the positive and negative battery connectors**(Red and Black Clamps)**, the power switch or switch circuit**(34)** configured to switch power on from the power supply**(22)** to boost or charge the depleted or

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

discharged battery**(battery of vehicle 28)** when connected between the positive and negative battery connectors**(Red and Black Clamps)**;

19. However, Richardson does not expressly teach the limitations:

- a USB input connector; a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit configured to up-convert voltage from a USB charger power source connected to the USB input connector to the power supply using a DC-DC converter; a USB output connector; and a USB output circuit electrically connecting the power supply to the USB output connector.

10. However, Butler discloses factual evidence of, a USB input connector **(156)**; a USB charge circuit**(USB port)(see col. 12, lines 8-12)** electrically connecting the USB input connector to the power supply**(150)**, the USB charge circuit**(sepic circuit 302) (see Butler col. 5, lines 8-27)** configured to up-convert voltage from a USB charger power source **(input 154)** connected to the USB input connector**(156)(see col. 5, lines 54-67 and col. 6, lines 1-15)** to the power supply**(150)** using a DC-DC converter**(compact battery charger employs a SEPIC circuit 302; SEPIC 302 is a DC/DC converter; (see col. 12, lines 5-35; col. 13, lines 13-34 & 62-65)**; a USB output connector**(136)**; and a USB output circuit electrically connecting the power supply**(150)** to the USB output connector**(136) (see connection wires connecting element 150 to element 136 in Fig. 1).**

20. Richardson and Butler are battery booster analogous art. Therefore it would have been obvious to one having ordinary skill in the art before the effective filing date of the claimed invention to avail of the teachings of Butler in having incorporated, a USB input connector; a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit configured to up-convert voltage from a USB charger power source

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

connected to the USB input connector to the power supply using a DC-DC converter; a USB output connector; and a USB output circuit electrically connecting the power supply to the USB output connector, into the jump starting device of Richardson in order to enable the internal battery recharging functionality via a USB port and ensuring a source of UPS for the jump starting device, as per the teachings of Butler**(col. 6, lines 16-26; col. 12, lines 23-27;** col. 13, lines 13-34).

21. Accordingly claim 80 would have been obvious.

11. Regarding claim 25, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 24. Butler further discloses, wherein the power switch or switch circuit **(34)** is controlled to turn on power to the depleted or discharged battery**(battery of vehicle 28)** only when the jump starting device**(10)** is connected with correct polarity to the depleted or discharged battery**(battery of vehicle 28)(note-Only after the reverse polarity and battery presence tests have been conducted at steps 214 and 252 does the process proceed to step 268 where microprocessor 12 sends a signal to close contact relay 34. (See also Fig. 3, Fig. 6, ¶[0014] and [0027] to turning on the power switch or circuit(34)(see ¶[0014])(note-Richardson also makes clear that the microcontroller only closes relay 34 if the reverse polarity sensor 24 and vehicle voltage sensor 30 indicate the presence of a vehicle battery connected with proper polarity. For example, Richardson states that "when the jump starter 10 is initially powered on 200, the microprocessor initializes the hardware . . . . then performs a self-test operation 208 where . . . all sensors 20, 24, 30, 32, 38, 40 . . . are tested". Richardson further discloses the process of measuring the vehicle battery voltage necessarily entails detecting the presence of a vehicle battery connected to the positive and**

negative output ports of the discharged or depleted battery since reading a sufficiently low voltage would indicate either the absence of a vehicle battery or a battery with a voltage below a required threshold for detection. Only after the reverse polarity and battery presence tests have been conducted at steps 214 and 252 does the process proceed to step 268 where microprocessor 12 sends a signal to close contact relay 34 for power transfer from the power supply (22) to the depleted battery (See also Fig. 3, Fig. 6, see also ¶[0006],[0014] and [0027]).

12. Regarding claim 26, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 24. Richardson further discloses, wherein the power supply is an internal power supply**(10) (battery 22 of Richardson is internal)(internal battery 150 of Butler) (Richardson; ¶[0014])**.

13. Regarding claim 27, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 24. Butler further discloses, wherein the USB charging circuit(**302**) and power supply(**150**) are located within the jump starting device((**300**); **Fig. 3 of Butler**)

14. Regarding claim 28, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 27. Butler further discloses, wherein the DC-DC converter is one or more DC-DC converters**(compact charger 102 employs SEPIC converter 302 which is a DC to DC type converter)(see col. 12, lines 5-35)).**

15. Regarding claim 31, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 24. Butler further teaches, wherein the DC-DC converter(**302**) is configured to be turned on and off via a circuit**(duty cycle of semiconductor switches; see Butler col. 12, lines 8-27 and col. 13, lines 17-61)** by an output from a

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

microcontroller**(128)(see Butler, Fig. 3)(note-The output power may be controlled by software (e.g., via a relay, MOSFET, and/or a silicon-controlled rectifier; see col. 17, lines 38-55)**.

16. Regarding claim 32, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 31. Butler further discloses, wherein the power supply is a rechargeable battery**(see Butler; col. 5, lines 30-33; col 13, line 62 to col. 14, line 38)**, and wherein microcontroller software**(as embedded into microprocessor 128)** can turn charge off if the rechargeable battery voltage is measured to be too high by an A/D input**(see col. 20, lines 11-60 note the microprocessor utilizes an analog signal and convert it to digital signal as input)**.

17. Regarding claim 36, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 24. Butler further discloses, further comprising a USB output**(output at 156)** connector for providing a power output **(via output 136)** from the power supply**(150)** to a USB-chargeable device**(via USB output 156 and DC output 136 terminal)**.

18. Regarding claim 37, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 36. Butler further discloses, wherein the USB output connector **(output USB interface 156 inherently has an output port)** is electrically connected to a USB output circuit**(see Figs. 1 and 3 of Butler)**, the USB output circuit connecting the power supply**(150)** to the USB output connector**(156).**

19. Regarding claim 38, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 36. Butler further discloses, wherein the USB output connector**(output of USB 156)** at least partially defines a USB output port **(156)(see Figs. 1 and 3 of Butler).**

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

20. Regarding claim 39, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 37. Butler further discloses, wherein the USB output comprises a USB output connector **(156)** and the USB output circuit define a USB output port(**see Figs. 1 and 3 of Butler**).

21. Regarding claim 40, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 39. Butler further discloses, wherein the USB output port **(156)** is configured to provide a portable charger**(102)** for charging smartphones, tablets, music players, and other rechargeable electronic devices**(note-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, see col. 10, lines 59-67; col. 14, lines 32-38)**

22. Regarding claim 41, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 39. Butler further discloses, further comprising a microcontroller**(128)(Fig. 3 of Butler)** with a control circuit**(310)**, the control circuit for the microcontroller allows the USB output circuit**(156)** to be turned on and off by software control to prevent the power supply getting too low in capacity**(note-The output power may be controlled by software (e.g., via a relay, MOSFET, and/or a silicon-controlled rectifier; see col. 17, lines 38-55**).

23. Regarding claim 42, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 39. Butler further discloses, wherein the USB output port **(156)** is accessible from an outside of the jump charge device**(102)** using the USB output connector**(see Fig. 1 of Butler)**

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

24. Regarding claim 43, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 42. Butler further discloses, wherein the USB connector includes a voltage divider configured to enable charge to certain smartphones that require the voltage divider**(see col. 10, lines 59-67)**

25. Regarding claim 44, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 24. Richardson further discloses, wherein the power supply**(22)** is a rechargeable battery disposed within the jump starter device**(10)(Richardson; ¶[0014])**.

26. Regarding claim 45, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 24. Richardson further discloses, wherein the power switch**(34)** or switch circuit comprises at least power switch or switch circuit**(12)** configured to turn power on from the power supply**(22)** to the depleted or discharged battery**(battery of vehicle 28)** when connected to the positive and negative battery connectors**(Red and Black clamps)((see¶[0012],[0014])(Note- Richardson discloses that the power switch is turned on to cause the internal power supply to be connected to the output port in response to signals from the sensors indicating (1) the presence of a vehicle battery at said output port and (2) proper polarity connection of positive and negative terminals of said vehicle battery with said positive and negative polarity outputs. Richardson also discloses or teaches that the power switch is not turned on when signals from the sensors indicate either the absence of a vehicle battery at the output port or improper polarity connection of positive and negative terminals of the vehicle battery with the positive and negative polarity outputs. Richardson discloses in FIGS. 3-8 "flow charts of the processing steps of the portable power source of the present invention." Ex. 1006, ¶0010. This sequence of processing steps involves several**

checks performed by the microcontroller before turning on the power switch to jump start the vehicle. As discussed below, these checks include detecting (1) the presence of a vehicle battery at said output port and (2) proper polarity connection of positive and negative terminals of said vehicle battery with said positive and negative polarity outputs).

27. Regarding claim 46, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 45. Richardson further discloses, wherein the power switch or switch circuit**(12)** comprises one or more sensors**(30,24)** configured to detect whether the positive and negative battery connectors are properly connected to the depleted or discharged battery prior to switching on the power switch or switch circuit**(Richardson discloses in FIGS. 3-8 "flow charts of the processing steps of the portable power source of the present invention." Ex. 1006, ¶0010. This sequence of processing steps involves several checks performed by the microcontroller before turning on the power switch to jump start the vehicle. As discussed below, these checks include detecting (1) the presence of a vehicle battery at said output port and (2) proper polarity connection of positive and negative terminals of said vehicle battery with said positive and negative polarity outputs. 77. Richardson discloses that the reverse voltage sensor 24 detects whether jumper cables that have been manually connected to the vehicle battery have been properly connected or if there is a reverse connection. Richardson discloses or teaches that the power switch for charging the vehicle battery cannot be turned on unless there is a proper connection of the cables. For example, referring to FIG. 3 (a portion of which is reproduced below), Richardson states: If the system does not detect a battery charging voltage 212, once jumper cables 60 have been manually connected to the vehicle to be started 28, the voltage is measured by the reverse voltage sensor 24 to determine if the cables have been properly**

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

connected to the vehicle 214. If the voltage measured is significantly less than the voltage of the jump starter capacitors 21 and batteries 22, then a reverse polarity connection of the jumper cables to the vehicle is determined and an error flag is set and the event saved in nonvolatile memory 216. A "Reverse Polarity" error message is displayed 218 on the LCD 46, and the reverse voltage LED 48 is illuminated 216. Any further jump starter action by the operator is ignored until the reverse polarity. Furthermore, Richardson further discloses (see ¶[0015]) that the microcontroller receives signals from the vehicle voltage sensor 30 and the reverse voltage sensor 24 and that it generates a control signal 58(activated output signal, as per claim 11) which controls the contact relay 34 to connect the jump starter batteries 22 to the vehicle to be started 28. Richardson also makes clear that the microcontroller only closes relay 34(activate switch or turn on switch) if the reverse polarity sensor 24 and vehicle voltage sensor 30 indicate the presence of a vehicle battery connected with proper polarity

28. Regarding claim 47, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 46. Richardson further discloses, wherein the power switch or switch circuit**(12)** is configured to detect presence**(via vehicle voltage sensor 30 and reverse polarity sensor 24 which indicate the presence of a vehicle battery connected with proper polarity)** of the depleted or discharged battery**(battery of vehicle 28)** when connected between the positive and negative battery connectors**(Red and Black clamps) (see also Fig. 3, Fig. 6, ¶[0014] and [0027])**.

29. Regarding claim 48, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 46. Richardson further discloses, wherein the power switch or switch circuit is configured to detect polarity**(via reverse polarity detection sensor 24**

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

; see also Fig. 3, Fig. 6, ¶[0014] and [0027]) of the depleted or discharged battery**(battery of vehicle 28)** when connected between the positive and negative battery connectors**(Black and Red clamps).**

30. Regarding claim 49, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 46. Richardson further discloses, wherein the power switch or switch circuit is configured to detect presence **(via voltage sensor 30)**of the depleted or discharged battery**(vehicle of battery 28)** when connected between the positive and negative battery connectors**(Red and Black clamps)**, and configured to detect polarity**(via reverse polarity detection 24)** of the depleted or discharged battery when connected between the positive and negative battery connectors, wherein the power switch or switch circuit**(12)** switches on **(by closing relay 34)** the power supply**(22)** to connect the power supply to the depleted or discharged battery only when the depleted or discharged battery is present when connected between the positive and negative battery connectors and the depleted or discharged battery is connected with correct polarity between the positive and negative battery terminals**(note-((see¶[0012],[0014])(Note- Richardson discloses that the power switch is turned on to cause the internal power supply to be connected to the output port in response to signals from the sensors indicating (1) the presence of a vehicle battery at said output port and (2) proper polarity connection of positive and negative terminals of said vehicle battery with said positive and negative polarity outputs. Richardson also discloses or teaches that the power switch is not turned on when signals from the sensors indicate either the absence of a vehicle battery at the output port or improper polarity connection of positive and negative terminals of the vehicle battery with the positive and negative polarity outputs. Richardson discloses in FIGS. 3-8 "flow charts of the processing steps of**

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

the portable power source of the present invention." Ex. 1006, ¶0010. This sequence of processing steps involves several checks performed by the microcontroller before turning on the power switch to jump start the vehicle. As discussed below, these checks include detecting (1) the presence of a vehicle battery at said output port and (2) proper polarity connection of positive and negative terminals of said vehicle battery with said positive and negative polarity outputs. 77. Richardson discloses that the reverse voltage sensor 24 detects whether jumper cables that have been manually connected to the vehicle battery have been properly connected or if there is a reverse connection. Richardson discloses or teaches that the power switch for charging the vehicle battery cannot be turned on unless there is a proper connection of the cables. For example, referring to FIG. 3 (a portion of which is reproduced below), Richardson states: If the system does not detect a battery charging voltage 212, once jumper cables 60 have been manually connected to the vehicle to be started 28, the voltage is measured by the reverse voltage sensor 24 to determine if the cables have been properly connected to the vehicle 214. If the voltage measured is significantly less than the voltage of the jump starter capacitors 21 and batteries 22, then a reverse polarity connection of the jumper cables to the vehicle is determined and an error flag is set and the event saved in nonvolatile memory 216. A "Reverse Polarity" error message is displayed 218 on the LCD 46, and the reverse voltage LED 48 is illuminated 216. Any further jump starter action by the operator is ignored until the reverse polarity condition is corrected 220, at which point processing returns to the start of the main processing loop 210." Richardson, ¶([0014],[0020]). Thus, the "Reverse Polarity" error message on the LCD 46 and illuminated LED 48 warn a user when a vehicle battery is connected with reverse polarity, prompting the user to correct the connection).

Additionally, Richardson discloses (see ¶[0015]) that the microcontroller receives signals from the vehicle voltage sensor 30 and the reverse voltage sensor 24 and that it generates a control signal 58(activated output signal) which controls the contact relay 34 to connect the jump starter batteries 22 to the vehicle to be started 28. Richardson also makes clear that the microcontroller only closes relay 34(activate switch or turn on switch) if the reverse polarity sensor 24 and vehicle voltage sensor 30 indicate the presence of a vehicle battery connected with proper polarity).

31. Regarding claim 50, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 45. Richardson further discloses, wherein the power switch or switch circuit comprises a microcontroller**(microcontroller 12)** configured for providing an output**(contact relay control output 58)** controlling the power switch**(34)(see Fig. 1)(see Exhibit 1010, ¶[0014])** or switch circuit.

32. Regarding claim 51, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 50. Richardson further discloses, wherein the microcontroller**(12)** receives input from one or more sensors**(battery presence sensor 30; reverse polarity sensor 24; 20,32,temperature sensor 38, and 40)** 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**(Richardson ¶[0010]-[0015] and [0027])**.

33. Regarding claim 52, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 51. Richardson further discloses, wherein the one or more sensors**(battery presence sensor 30; reverse polarity sensor 24; 20,32,temperature sensor 38, and 40)** includes one sensor**(30)** configured to detect presence of the depleted or discharged

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

battery(**battery of vehicle 28**) when connected between the positive and negative battery connectors(**Red and Black clamps**), and another sensor(**24**) configured to detect polarity of the depleted or discharged battery when connected between the positive and negative battery connectors (**Richardson ¶[0010]-[0015],[0020] and [0027]-[0028]**).

34. Regarding claim 53, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 52. Richardson further discloses, wherein the one or more sensors(**24,30,38,40**) is one or more sensing circuits(**see circuits in Fig. 2B**).

35. Regarding claim 54, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 50. Richardson further discloses, wherein the microcontroller(**12**) switches the power switch(**contact relay 34**) or switch circuit on to provide power from the power supply(**22**) to the depleted or discharged battery(**battery of vehicle 28**) only when the depleted or discharged battery is determined by the microcontroller to be present and connected with correct polarity(**Richardson ¶[0010]-[0015] and [0027]**) to the positive and negative battery connectors(**Red and Black clamps**).

36. Regarding claim 55, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 50. Richardson further discloses, wherein the microcontroller(**12**) is a programmable microcontroller configured to allow updates in functionality and system parameters(**Richardson; ¶[0011]**).

37. Regarding claim 56, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 55. Richardson further discloses, wherein the programmable microcontroller(**12**) comprises a memory(**see Richardson; ¶[0011]**).

38. Regarding claim 57, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 24. Richardson further discloses, wherein the positive

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

battery connector comprises a positive battery cable(**cable 60 has Red(positive battery cable) and Black(negative battery cable); see Fig. 2C**), and the negative battery connector comprises a negative battery cable.

39. Regarding claim 58, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 57. Richardson further discloses, wherein the positive battery cable comprises a positive battery clamp(**Red clamp of 60; see Fig. 2C**)) and the negative battery cable comprises a negative battery clamp(**Black clamp of 60; see Fig. 2C**)).

40. Regarding claim 60, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 51. Richardson further discloses, wherein the one or more sensors is a presence sensor(**30**) configured for detecting presence of the depleted or discharged battery(**battery of vehicle 28**) when connected between the positive and negative battery connectors(**Red and Black clamps**), and a reverse polarity sensor(**24**) (**see ¶[0011],[0014]-[0015]**) configured to detect polarity of a connection of the positive and negative battery connectors of the jump starting device with the depleted or discharge battery**.**

41. Regarding claim 63, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 24. Richardson discloses, further comprising an output port(**see annotated Fig. 2C below**) providing positive and negative polarity outputs(**as respectively corresponding to Red and Black clamps of cable 60; see Fig. 2C below**) to the positive and negative battery connectors.

42. Regarding claim 64, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 50. Richardson further discloses further comprising a temperature sensor(**38**)(**see ¶[0013] and Fig. 1**) configured to detect temperature of the power supply(**22**) and to provide a temperature signal to the microcontroller(**12**).

43. Regarding claim 65, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 50. Richardson further discloses, a voltage measurement circuit**(20)** configured to measure output voltage of the power supply**(22)** and to provide a voltage measurement signal to the microcontroller**(12) (12)(see ¶[0012] and Fig. 1)**.

44. Regarding claim 66, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 24. Richardson discloses, 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 device**(10)(note-(Fig. 2A; regulator LM7805 is a 5V regulator although not labeled)**.

45. Regarding claim 67, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 60. Richardson discloses, further comprising a manual override switch**(push button switch 44)** configured to activate a manual override mode to enable a user to connect jump start power to the positive and negative battery connectors when the one sensor**(30)** configured for detecting presence of the depleted or discharged battery**(battery of vehicle 28)** is unable to detect presence of the depleted or discharged battery**(see ¶[0013]-[0015],[0026])**.

46. Regarding claim 68, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 67. Richardson discloses, wherein the microcontroller**(12)** is configured to detect actuation of the manual override switch**(44)** for at least a predetermined period of time before activation of the manual override mode**(see ¶[0039])**.

47. Regarding claim 71, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 24. Richardson further discloses, wherein the power switch**(34)** or switch circuit**(12)** is configured to switch power on only when the jump starting

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

device is properly(**see ¶[0012],[0014]**) connected to the depleted or discharged battery.(**Note-Richardson discloses that the power switch is turned on to cause the internal power supply to be connected to the output port in response to signals from the sensors indicating (1) the presence of a vehicle battery at said output port and (2) proper polarity connection of positive and negative terminals of said vehicle battery with said positive and negative polarity outputs. Richardson also discloses or teaches that the power switch is not turned on when signals from the sensors indicate either the absence of a vehicle battery at the output port or improper polarity connection of positive and negative terminals of the vehicle battery with the positive and negative polarity outputs. Richardson discloses in FIGS. 3-8 "flow charts of the processing steps of the portable power source of the present invention." Ex. 1006, ¶0010. This sequence of processing steps involves several checks performed by the microcontroller before turning on the power switch to jump start the vehicle. As discussed below, these checks include detecting (1) the presence of a vehicle battery at said output port and (2) proper polarity connection of positive and negative terminals of said vehicle battery with said positive and negative polarity outputs. 77. Richardson discloses that the reverse voltage sensor 24 detects whether jumper cables that have been manually connected to the vehicle battery have been properly connected or if there is a reverse connection. Richardson discloses or teaches that the power switch for charging the vehicle battery cannot be turned on unless there is a proper connection of the cables. For example, referring to FIG. 3 (a portion of which is reproduced below), Richardson states: If the system does not detect a battery charging voltage 212, once jumper cables 60 have been manually connected to the vehicle to be started 28, the voltage is measured by the reverse voltage sensor 24 to determine if the cables have been properly**

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

connected to the vehicle 214. If the voltage measured is significantly less than the voltage of the jump starter capacitors 21 and batteries 22, then a reverse polarity connection of the jumper cables to the vehicle is determined and an error flag is set and the event saved in nonvolatile memory 216. A "Reverse Polarity" error message is displayed 218 on the LCD 46, and the reverse voltage LED 48 is illuminated 216. Any further jump starter action by the operator is ignored until the reverse polarity condition is corrected 220, at which point processing returns to the start of the main processing loop 210." Richardson, ¶([0014],[0020]). Thus, the "Reverse Polarity" error message on the LCD 46 and illuminated LED 48 warn a user when a vehicle battery is connected with reverse polarity, prompting the user to correct the connection). Additionally, Richardson discloses (see ¶[0015]) that the microcontroller receives signals from the vehicle voltage sensor 30 and the reverse voltage sensor 24 and that it generates a control signal 58(activated output signal, as per claim 11) which controls the contact relay 34 to connect the jump starter batteries 22 to the vehicle to be started 28. Richardson also makes clear that the microcontroller only closes relay 34(activate switch or turn on switch) if the reverse polarity sensor 24 and vehicle voltage sensor 30 indicate the presence of a vehicle battery connected with proper polarity).

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

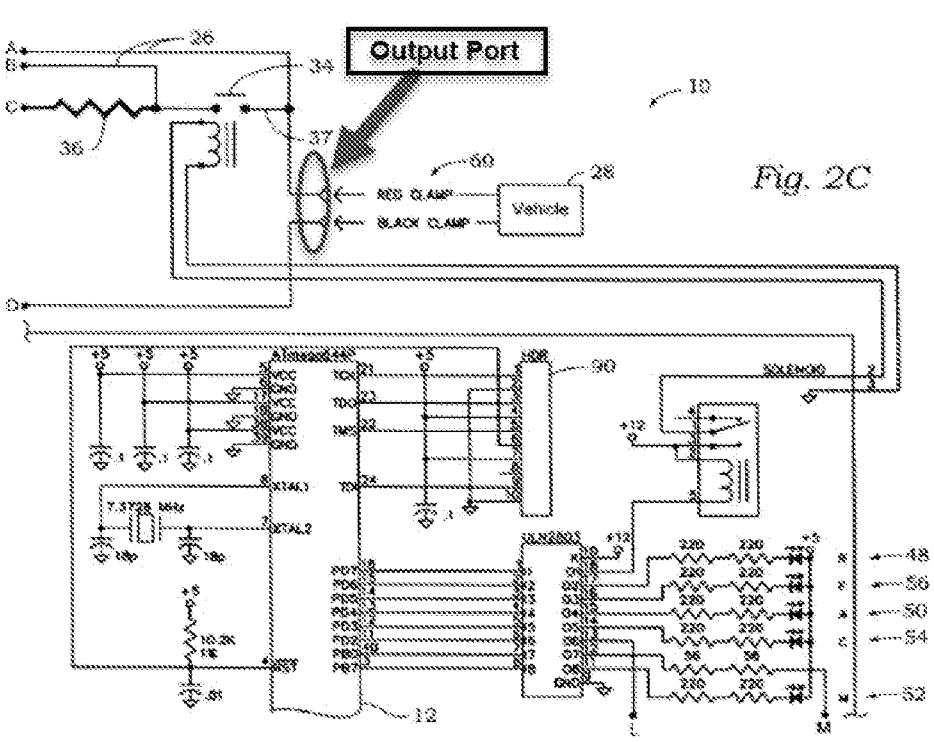


Fig. 2C

Patent Application Publication Jul. 9, 2009 Sheet 4 of 12 US 2009/0174362 A1

22. Regarding claim 74, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 24. Butler further discloses, wherein the power supply is a rechargeable lithium battery pack **(see Butler; col. 5, lines 30-53; col. 14, lines 32-38).**

23. Regarding claim 75, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 74. Butler further discloses, wherein the rechargeable lithium battery pack is an internal power supply **(150) (see Butler; col. 5, lines 30-53; col. 14, lines 32-38).**

24. Regarding claim 76, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 74. Butler further discloses, wherein the USB charge

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

circuit is configured to convert power from a USB charger **power source (such as wall power 148 or DC input terminal 154; see col. 5, lines 54-col. 6, line 35; see col. 13, lines 17-34).**

25. Regarding claim 77, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 74. Butler discloses, further comprising a rechargeable lithium battery pack voltage measurement circuit**(304/128)** configured to monitor the rechargeable lithium battery pack**(150)** to prevent voltage potential from rising too high during a charging operation and from dropping too low during a discharge operation**(note- 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; see col. 13, lines 17-34)**.

26. Regarding claim 78, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 74. Butler discloses further comprising a fuel gauge LEDS for indicating a charge level of the rechargeable lithium battery pack**(150)(see col. 6, lines 55-65; col. 8, lines 1-21 and 41-51; col. 12, lines 3-7)**.

27. Regarding claim 79, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 24. Richardson further discloses, wherein the power switch**(34)** or switch circuit**(12)** is a smart switch, or comprises a smart switch**(note-it is clear that microcontroller (12) comprises a smart switch)**.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

48. **Claim 35 is rejected under 35 U.S.C. 103 as being unpatentable over Richardson et al., (Richardson) US 2009/0174362 (Exhibit 1010 IPR2020-01387) in view of Butler et al., (Butler) USPAT 10,087,904 and in further view of Tinaphong US 2011/0175461**

49. Regarding claim 35, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 25. Butler further discloses, wherein the USB port is a USB connector(**156).**

50. However, Tinaphong discloses factual evidence of, wherein the USB port is a micro-USB connector **(note-Figs. 2 and 9 show a mini USB connector 24; see ¶[0073]-[0074] as evidenced by secondary evidences and knowledge of one of ordinary skill in the art as taught by Tinaphong US 2011/0175461**).

51. Therefore it would have been obvious to one having ordinary skill in the art before the effective filing date of the claimed invention to modify Richardson in view of Butler by having configured the connector to be a micro-USB connector, since market demand, rather than scientific literature, can drive design trends and may show obviousness and that that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims and furthermore any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed. It would have further been an obvious matter of design choice and the need presented before the effective filing date of the claimed invention to have chosen the USB connector of Richardson as modified by Butler to micro-USB connector since a patent claim can be proved obvious by showing that the claimed combination of elements was "obvious to try," particularly when there is a design need or market pressure to solve a problem and there are a

finite number of identified, predictable solutions such that a POSITA would have had good reason to pursue the known options within his or her technical grasp.

52. **Claims 69-70 are rejected under 35 U.S.C. 103 as being unpatentable over Richardson et al., (Richardson) US 2009/0174362 (Exhibit 1010 IPR2020-01387) in view of Butler (cited above) and Brown USPAT 8,076,900 and in further view of Waldron US 2011/0068734.**

53. Regarding claim 69, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 24. However the combination of Richardson and Butler fails to expressly teach the limitations of, "wherein the positive and negative battery connectors are defined by a jumper cable device including a plug configured to plug into an output port of the jump starting device, a pair of cables integrated with the plug at one respective end of the pair of cables and being configured to be connected to positive and negative battery terminals of the depleted or discharged battery at an opposite end of the pair of cables".

54. Brown discloses and shows in **Figs. 1-2**, factual evidence of, wherein the positive**(94)** and negative battery connectors**(96)** are defined by a jumper cable device**(90)** including a plug**(92)** configured to plug into an output port**(84)** of the jump starting device**(handheld battery charger booster device (10))**, a pair of cables**(booster cable 90)** integrated with the plug**(92)(see Figs. 1-2)** at one respective end of the pair of cables and being configured to be connected to positive and negative battery terminals**((94) and (96) respectively)** of the depleted or discharged battery at an opposite end of the pair of cables**(at the size of the alligators clips)(see col. 4, lines 22-41).**

55. Richardson, Butler and Brown are battery charger analogous art. It would have been obvious to one having ordinary skill in the art to incorporate the teachings of Brown into the

device of Richardson as modified by Butler, wherein the positive and negative battery connectors are defined by a jumper cable device including a plug configured to plug into an output port of the jump starting device, a pair of cables integrated with the plug at one respective end of the pair of cables and being configured to be connected to positive and negative battery terminals of the depleted or discharged battery at an opposite end of the pair of cables, as recited, so as to tethered the cable to one end of the plug. The advantage for doing so is to improve portability and decrease the chance of having the cables entangled with each other and to fit to the compartment of the carrying case.

56. The combination of Richardson, Butler and Brown does not expressly teach, the limitations of:

57. a pair of cables having cable ends integrated with the plug at one respective end of the pair of cables.

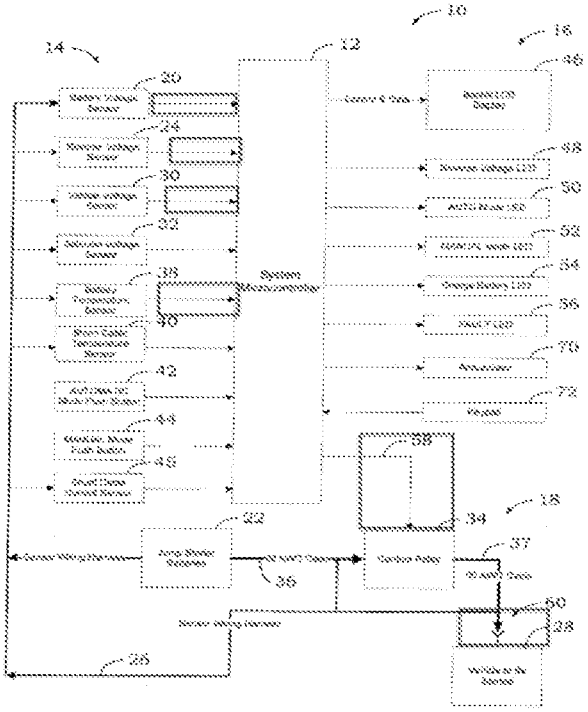
58. Waldron is an analogous art and pertains to the same field of endeavor, namely battery jumping devices. Waldron discloses factual evidence of a pair of cables **(44)** having cable ends integrated with the plug **(46)** at one respective end of the pair of cables **([0023]; Fig. 1).**

59. Therefore it would have been obvious to one having ordinary skill in the art at the time of the effective filing date of the claimed invention to have had the pair of cables ends of the jumper cable device of Richardson as modified by Butler and Brown integrated with the plug at one respective end of the pair of cables so as to tethered the cable to one end of the plug. The advantage for doing so is to improve portability and decrease the chance of having the cables entangled with each other and to fit to the compartment of the carrying case, in which some items are form fitting compartments and are thus configured to the shape of the item to be carried, as per the teachings of Waldron **([0012]).**

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

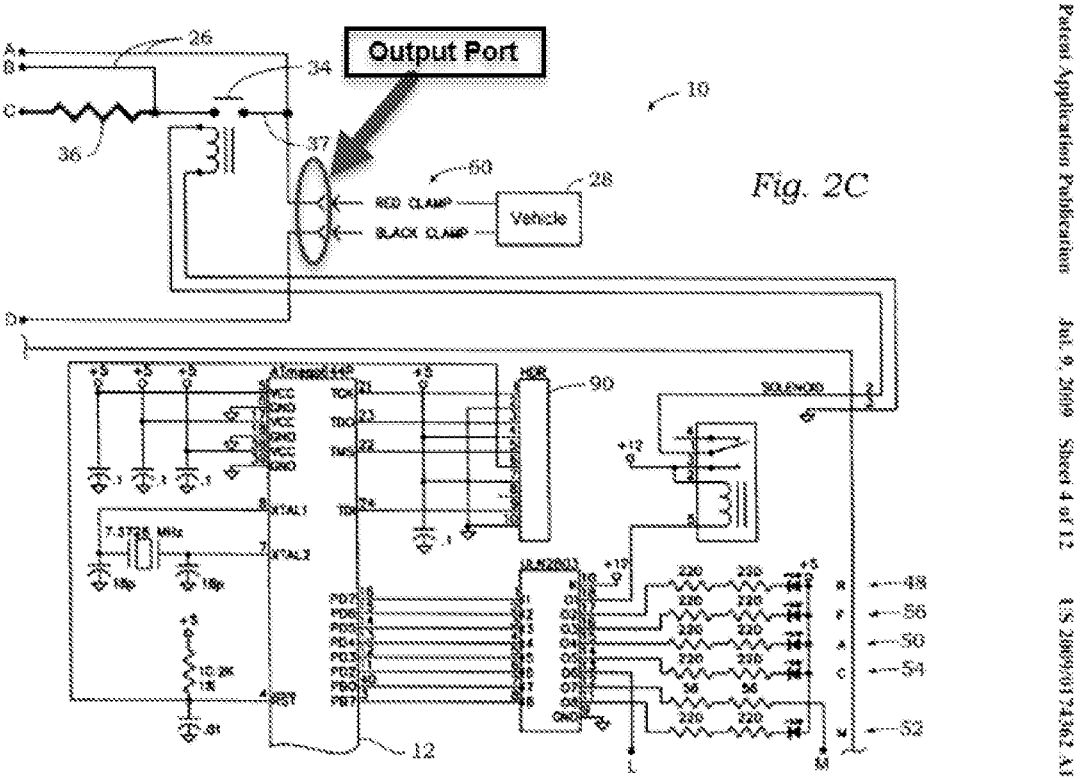
60. Regarding claim 70, Richardson as modified by Butler, Brown and Waldron discloses all the claimed invention as set forth and discussed above in claim 69. Brown further discloses, wherein the output port**(84)** and the plug**(92)** are dimensioned so that the plug will fit into the output port only in one specific orientation**(see Figs. 1-2)**.

61. Accordingly, claims 69-70 would have been obvious.



Richardson's *Fig. 1* reproduced above

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)



62. **Claims 29-30,72-73 are rejected under 35 U.S.C. 103 as being unpatentable over Richardson et al., (Richardson) US 2009/0174362 (Exhibit 1010 IPR2020-01387) in view of Butler et al., (Butler) USPAT 10,087,904 and in further view of Xinfang USPAT 9,506,446 (Exhibit 1008 IPR2020-01387).**

63. Regarding claim 29, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 24**(see Butler col. 5, lines 8-27)**. However, the combination of Richardson and Butler does not expressly teach, "wherein the DC-DC converter is configured to convert 5VDC from ~~at~~ the USB input connector to at least 11.1VDC for the power supply when an active USB power source is connected to the USB input connector".

64. However, Xinfang discloses factual evidence of, wherein the DC-DC converter is configured for up-converting the input voltage received by the USB connector**(38,40) (included in battery circuit board 44)(note- The battery circuit board 44 may be provided with**

voltage boosting circuitry to step up the output voltage from the battery cell 42 to the ignition output port 46 to provide an output voltage higher than about 13.6V which meets the requirements of "converting 5VDC from at the USB input connector to at least 11.1VDC for the power supply when an active USB power source is connected to the USB input connector"; see col. 5, lines 29-40 and Fig. 2).

65. Xinfang further discloses, wherein the input voltage is 5V**(inherent for a standard USB connector)** that is up-converted to 13.6 VDC(which meets at least 11.1 VDC) for charging the power supply. Richardson in view Butler and Xinfang differs from the claimed invention in that the input voltage is up-converted 13.6V to instead of 11.1V. It would have been an obvious matter of design choice to configure the output of the voltage boosting circuit of Xinfang to up-convert the 5V input of the USB connector to 11.1V as recited since such modification is an obvious matter of design choice to meet load power requirements. Furthermore, when a device or technology is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or in a different one, so that if a person of ordinary skill can implement a predictable variation, the variation is likely obvious.

66. Accordingly claim 29 would have been obvious.

67. Regarding claim 30, Richardson in view Butler and Xinfang discloses all the claimed invention as set forth and discussed above in claim 29. Butler further discloses, wherein the USB charger **(156)** power source is a USB charger **(USB port 156 is able to charge power to both the external battery 104 of a depleted vehicle or the internal battery 150; see col. 11, lines 57-63)**, and the USB charging circuit is configured to convert**(via SEPIC converter 302)** power from the USB charger **(156)** to charge voltage and current for supplying power or charging the power supply **(150).**

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

68. Regarding claim 72, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 29. Butler further discloses, wherein the USB charging source is a USB charger **(156 in combination of sepic converter 302 provide boost voltage to internal battery 150 and to external accessories via output port 136 as well).**

69. Regarding claim 73, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 72. Butler further discloses, wherein the USB charger is a standard USB charger **(156).**

70.

71. **Claims 33-34 are rejected under 35 U.S.C. 103 as being unpatentable over Richardson et al., (Richardson) US 2009/0174362 (Exhibit 1010 IPR2020-01387) in view of Butler et al., (Butler) USPAT 10,087,904 and in further view of Nakamoto et al., (Nakamoto) USPAT 9,601,800**

72. Regarding claim 33, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim32. Butler further discloses, wherein the rechargeable battery**(150)** is a rechargeable lithium battery**(see Butler; col. 5, lines 30-34)** and further comprising a rechargeable lithium battery controller**(304/128 combination)(see Butler; see col. 13, lines 17-34).**

73. However, the combination of Richardson and Butler does not expressly teach:

- a lithium battery charge controller configured to provide charge balance to internal lithium battery cells of the lithium battery.

74. Nakamoto discloses factual evidence of, further comprising a rechargeable lithium battery charge controller**(5)** configured to provide charge balance**(via balance circuit 6)** to

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

internal lithium battery cells**(100A)(see Fig. 9)** of the lithium battery**(100)(see col. 10, line 49 to col. 11, line 14).**

75. Therefore it would have been obvious to one having ordinary skill in the art before the effective filing date of the claimed invention to incorporate the teachings of Nakamoto by having the lithium battery of Richardson as modified by Butler further comprising a lithium battery charge controller configured to provide charge balance to internal lithium battery cells, as recited, so as to reduce variations in battery voltage between the electric cells.

76. Accordingly claim 33 would have been obvious.

77. Regarding claim 34, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 33. Butler further discloses, wherein the rechargeable lithium battery charge controller**(304/128)** is also configured to provide safety redundancy for eliminating over discharge of the rechargeable lithium battery**(150)(see Butler; see col. 13, lines 17-67 and col. 14, lines 1-31).**

78. **Claims 59,61 are rejected under 35 U.S.C. 103 as being unpatentable over Richardson et al., (Richardson) US 2009/0174362 (Exhibit 1010 IPR2020-01387) in view of Butler et al., (Butler) USPAT 10,087,904 and in further view of Krieger US 2004/0130298(Exhibit 1009 on IPR2020-00944).**

79. Regarding claim 59, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 24. However, the combination of Richardson and Balmefrezol does not expressly teach, wherein said power switch or switch circuit comprises a plurality of FETs in parallel.

80. Krieger discloses factual evidence of, wherein said power switch or switch circuit comprises a plurality of FETs in parallel**(12a,12b,12c,12d)**.

81. Richardson, Butler and Krieger are battery jump starter apparatus analogous art.

82. It would have been obvious to one having ordinary skill in the art before the effective filing date of the claimed invention to have substituted the relay of Richardson as modified by Butler by a plurality of FETs in parallel as disclosed by Krieger for the advantages of their fast switching speed, their low loss and their low on-resistance type that FETs present over relay switches.

83. Accordingly claim 59 would have been obvious.

84. Regarding claim 61, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 60. However the combination of Richardson and Butler fails to expressly disclose, wherein the presence sensor and the reverse polarity sensor comprise optically coupled isolator phototransistors.

85. Krieger teaches factual evidence of, wherein the presence circuit(**16**)comprises a first optically coupled isolator phototransistor(**22**) and the polarity circuit(**also performed by 16**) comprises a second optically coupled isolator phototransistor(**22**)(**[0033]**)(**note- the opto-isolator (16) only turns on when it is properly biased "as a result of a correct polarity connection being made between the boosting battery (2) and the depleted battery (11). By detecting the correct connection of the depleted battery (11), Krieger also necessarily and implicitly detects that the depleted battery (11) is present; See [0033]-[0034],[0038],[0048]).**

86. Richardson and Krieger are battery jump starter apparatus analogous art.

87. It would have been obvious to one having ordinary skill in the art before the effective filing date of the claimed invention to incorporate the teaching of Krieger into the jump starter apparatus of Richardson as modified by Butler, wherein the presence sensor and the reverse polarity sensor comprise optically coupled isolator phototransistors, as recited, so as to prevent

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

the battery assembly from providing a discharge output to the external load, as recited, for the advantages of providing a safe delivery of power to the depleted battery of the vehicle that need to be jump started while preventing a potentially dangerous situation that could result when an improper polarity connection is made between the boosting battery and the depleted battery, as per the teachings of Krieger **(¶[0034]).** It would have further been obvious to one having ordinary skill in the art before the effective filing date of the claimed invention was made to include in the jump starter apparatus of Richardson as modified by Butler, wherein the presence sensor and the reverse polarity sensor comprises a first optically coupled isolator phototransistor and the polarity circuit comprises optically coupled isolator phototransistors since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. St. Regis Paper Co. v. Bemis Co., 193 USPQ 8.

88. **Claims 62 is rejected under 35 U.S.C. 103 as being unpatentable over Richardson et al., (Richardson) US 2009/0174362 (Exhibit 1010 IPR2020-01387) in view in view of Butler et al., (Butler) USPAT 10,087,904 and in further view of Kim USPAT 5,867,007.**

89. Regarding claim 62, Richardson in view of Butler discloses all the claimed invention as set forth and discussed above in claim 24, but fails to expressly teach the limitations of, further comprising a plurality of power diodes coupled between the positive and negative battery connectors and the power supply to prevent back-charging of the power supply from an electrical system connected to the depleted or discharged battery.

90. Kim teaches**(col. 3, lines 46-55)** and shows in **Fig. 1,** factual evidence of, further comprising a plurality of power diodes**(31)(which comprises diodes D1 and D2)** coupled between the positive and negative battery connectors**((10) and (20)** and the power supply**(32)** to

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

prevent back-charging of the power supply from an electrical system**(33)** connected to the depleted or discharged battery.

91. Richardson, Butler and Kim are battery powered devices analogous art.

92. Therefore it would have been obvious to one having ordinary skill in the art before the effective filing date of the claimed invention to incorporate in the device of Richardson as modified by Butler, a plurality of power diodes coupled between the positive and negative battery connectors and the power supply to prevent back-charging of the power supply from an electrical system connected to the depleted or discharged battery, as recited, so as to provide a safety measure and protection to the battery by preventing a reverse current flow back to the power supply which might damage both the batteries and the connected load.

Response to Arguments

93. Applicant's arguments with respect to claim(s) 24-80 have been considered but are moot because the new ground of rejection does not rely on any reference applied in the prior rejection of record for any teaching or matter specifically challenged in the argument.

Citation of Prior Art

94. For a list of related prior art references not mentioned above but disclose related apparatus or method, see Form PTO-892.

95. WO 2009/059852 to Gollub et al., (Gollub) discloses a starting method for hybrid drives.

Conclusion

96. 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.

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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.

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
August 4, 2022

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

Electronic Acknowledgement Receipt

EFS ID:	46611751
Application Number:	16820040
International Application Number:	
Confirmation Number:	1056
Title of Invention:	PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION
First Named Inventor/Applicant Name:	Jonathan Lewis NOOK
Customer Number:	20230
Filer:	Joseph McGowan Sauer/Erin Rosenfelder
Filer Authorized By:	Joseph McGowan Sauer
Attorney Docket Number:	054985-000055-US-02-02
Receipt Date:	14-SEP-2022
Filing Date:	16-MAR-2020
Time Stamp:	09:19:17
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	Signed_PoA.pdf	363666 5c8d78e590a1f1cf76b59996d8c1b9d73b896cf0	no	1

Warnings:

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Information:					
2	Assignee showing of ownership per 37 CFR 3.73	aia0096.pdf	190630 3f572023b4fc67d976725429322718ce643f49ed	no	3
Warnings:					
Information:					
3	Application Data Sheet	ADS.pdf	341572 5a9aefbf41dee03d793a9c1f86ff60a897ab3d8a	no	9
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
			Total Files Size (in bytes):	895868	

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 a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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

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

New International Application Filed with the USPTO as a Receiving Office

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

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PTO/AIA/80 (07-17)
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

[X] Practitioners associated with Customer Number: 20583

OR

[ ] Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

[X] The address associated with Customer Number: 20583

OR

[ ]

Firm or individual name		
Address		
City	State	Zip
Country		
Telephone	Email	

Assignee name and address: The Noco Company
30339 Diamond Parkway, #102
Glenwillow, OH 44139

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee.

Signature	Date September 12, 2022
Name Jonathan L. Nook	Telephone 440-703-9065
Title President	

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 18 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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Petitioner ADC (IPR2024-00671)

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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: The Noco Company

Application No./Patent No.: 16/820,040 Filed/Issue Date: 03/16/2020

Titled: PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION

The Noco Company, a Corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 048539, Frame 0629, or for which a copy thereof is attached.

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

   1. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.

   2. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). 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 1.11 and 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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STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

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6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Joseph M. Sauer/	14 September 2022
Signature	Date
Joseph M. Sauer	47919
Printed or Typed Name	Title or Registration 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 (IPR2024-00671)

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	054985-000055-US-02-01
	Application Number	
Title of Invention	PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Jonathan	Lewis	NOOK	

Residence Information (Select One) ● US Residency Non US Residency Active US Military Service

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Mailing Address of Inventor:

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Address 2	
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State/Province	OH
Postal Code	44139
Country	US

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
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Residence Information (Select One) ◉ US Residency Non US Residency Active US Military Service

City	State/Province	Country of Residence
Shaker Heights	OH	US

Mailing Address of Inventor:

Address 1	c/o The Noco Company, 30339 Diamond Parkway, #102
Address 2	
City	Glenwillow
State/Province	OH
Postal Code	44139
Country	US

Inventor 3 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	James	Richard	STANFIELD	

Residence Information (Select One) ◉ US Residency Non US Residency Active US Military Service

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	054985-000055-US-02-01
	Application Number	
Title of Invention	PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION	

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City	Glenwillow	State/Province	OH
Postal Code	44139	Country	US

Inventor 4 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Derek	Michael	UNDERHILL	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Tempe	State/Province	AZ	Country of Residence	US

Mailing Address of Inventor:

Address 1	c/o The Noco Company, 30339 Diamond Parkway, #102		
Address 2			
City	Glenwillow	State/Province	OH
Postal Code	44139	Country	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	20230		
Email Address	Patlaw@vorys.com	Add Email	Remove Email

Application Information:

Title of the Invention	PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION		
Attorney Docket Number	054985-000055-US-02-01	Small Entity Status Claimed	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	13	Suggested Figure for Publication (if any)	

PTO/AIA/14 (11-15)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	054985-000055-US-02-01
	Application Number	
Title of Invention	PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	● Customer Number	US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	20230		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	15691884	2017-08-31

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	054985-000055-US-02-01
	Application Number	
Title of Invention	PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION	

Prior Application Status	Patented	Remove

Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
15691884	Continuation of	14619655	2015-02-11	9770992	2017-09-26

Prior Application Status	Patented	Remove

Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14619655	Division of	14325938	2014-07-08	9007015	2015-04-14

Prior Application Status	Pending	Remove

Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14325938	Continuation of	PCT/US14/45434	2014-07-03

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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	Application Number	
Title of Invention	PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1 — Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

● Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.	Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	THE NOCO COMPANY		
Mailing Address Information For Applicant:			
Address 1	30339 Diamond Parkway, #102		
Address 2			
City	Glenwillow	**State/Province**	OH
Country	US	Postal Code	44139
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

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Title of Invention	PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION	

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☒

Organization Name	THE NOCO COMPANY

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1	30339 Diamond Parkway, #102		
Address 2			
City	Glenwillow	**State/Province**	OH
Country i	US	Postal Code	44139
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

Signature:

Remove

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/William L. Klima/			Date (YYYY-MM-DD)	2020-03-16
First Name	William L.	Last Name	Klima	Registration Number	32422

Additional Signature may be generated within this form by selecting the Add button. Add

PTO/AIA/14 (11-15)
Approved for use through 04/30/2017. OMB 0651-0032
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	054985-000055-US-02-01
	Application Number	
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This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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.**

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 the Freedom of Information Act requires disclosure of these records.

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 CooperationTreaty.

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 inspections 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.

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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/820,040	03/16/2020	Jonathan Lewis NOOK	054985-000055-US-02-02

CONFIRMATION NO. 1056

20583
Jones Day
250 Vesey Street
New York, NY 10281-1047

POA ACCEPTANCE LETTER

OC000000136340827

Date Mailed: 09/21/2022

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/14/2022.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/sibrahim/

Electronic Patent Application Fee Transmittal

Application Number:	16820040
Filing Date:	16-Mar-2020
Title of Invention:	PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION
First Named Inventor/Applicant Name:	Jonathan Lewis NOOK
Filer:	Joseph McGowan Sauer/Erin Rosenfelder
Attorney Docket Number:	054985-000055-US-02-02

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	2806	1	130	130
		Total in USD ($)		**130**

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

PCT

(43) Internationales Veröffentlichungsdatum
14. Mai 2009 (14.05.2009)

(10) Internationale Veröffentlichungsnummer
WO 2009/059852 A2

(51) Internationale Patentklassifikation:
B60W 20/00 (2006.01) *H02K 47/12* (2006.01)
H02H 7/12 (2006.01) *B60W 10/26* (2006.01)

(21) Internationales Aktenzeichen: PCT/EP2008/063199

(22) Internationales Anmeldedatum:
2. Oktober 2008 (02.10.2008)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
102007052750.2
6. November 2007 (06.11.2007) DE

(71) Anmelder *(für alle Bestimmungsstaaten mit Ausnahme von US)*: **ROBERT BOSCH GMBH** [DE/DE]; Postfach 30 02 20, 70442 Stuttgart (DE).

(72) Erfinder; und
(75) Erfinder/Anmelder *(nur für US)*: **GOLLUB, Dirk** [DE/DE]; Lerchenstr. 4, 71701 Schwieberdingen (DE). **THULKE, Mirko** [DE/DE]; Am Maurener Berg 16, 71254 Ditzingen (DE).

(74) Gemeinsamer Vertreter: **ROBERT BOSCH GMBH**; Postfach 30 02 20, 70442 Stuttgart (DE).

(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, CN, CO, CR, CU, CZ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID,

[Fortsetzung auf der nächsten Seite]

(54) Title: STARTING METHOD FOR HYBRID DRIVES

(54) Bezeichnung: STARTVERFAHREN FÜR HYBRIDANTRIEBE

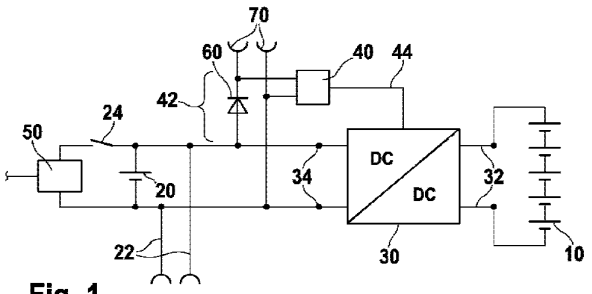


Fig. 1

(57) Abstract: The invention relates to a method for starting a hybrid drive by means of an auxiliary energy source, said method comprising the following steps: an electric motor and an internal combustion engine are both provided in the hybrid drive for generating kinetic energy; a traction battery for supplying the electric motor with traction energy, an on-board supply system for starting the internal combustion engine under normal operation, and a converter control system for controlling a DC/DC converter which is used to supply the on-board supply system from the traction battery, are provided, the on-board supply system supplying the converter control system. If the energy remaining in the on-board supply system is not sufficient for the operation of the converter control system nor for starting the internal combustion engine, during an emergency operation caused by an insufficient amount of energy in the on-board supply system, an external auxiliary energy quantity smaller than the amount of energy deficit is supplied to the converter control system in order to at least temporarily ensure the operation of the converter control system. The DC/DC converter is activated by the converter control system, and a quantity of start process energy from the traction battery is fed into the on-board supply system via the DC/DC converter, which, together with the energy remaining in the on-board supply system, is sufficient for starting the internal combustion engine. As a result, the internal combustion engine is started. The invention also relates to an associated emergency supply circuit, and to a mobile auxiliary starting battery.

(57) Zusammenfassung: Die Erfindung betrifft ein Verfahren zum Starten eines Hybridantriebs mittels einer Hilfsenergiequelle mit den Schritten: Vorsehen einer E-Maschine und eines Verbrennungsmotors, die zusammen zur Erzeugung von Bewegungsenergie in dem Hybridantrieb vorgesehen sind; Vorsehen einer Traktionsbatterie zur Versorgung

[Fortsetzung auf der nächsten Seite]

WO 2009/059852 A2

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Bestimmungsstaaten *(soweit nicht anders angegeben, für jede verfügbare regionale Schutzrechtsart)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), eurasisches (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Veröffentlicht:

— *ohne internationalen Recherchenbericht und erneut zu veröffentlichen nach Erhalt des Berichts*

des E-Maschine mit Traktionsenergie, einem Bordnetz zum Starten des Verbrennungsmotors im Normalbetrieb, und einer Wandlersteuerung eines DC/DC-Wandlers, der zur Versorgung des Bordnetzes aus der Traktionsbatterie vorgesehen ist, wobei das Bordnetz die Wandlersteuerung versorgt. Wenn im Notfallbetrieb aufgrund eines Energiefehlbetrags im Bordnetz die im Bordnetz verbliebene Energie weder für den Betrieb der Wandlersteuerung noch zum Starten des Verbrennungsmotors ausreicht wird ein externer Hilfsenergiebetrags, der kleiner als der Energiefehlbetrag ist, der Wandlersteuerung zugeführt, um den Betrieb der Wandlersteuerung zumindest kurzfristig zu gewährleisten. Der DC/DC-Wandler wird durch Ansteuerung mittels der Wandlersteuerung aktiviert und ein von der Traktionsbatterie stammender Startvorgang-Energiebetrag wird in das Bordnetz durch den DC/DC-Wandlers eingespeist, der zusammen mit der im Bordnetz verbliebene Energie zum Starten des Verbrennungsmotors ausreicht. Daraufhin wird der Verbrennungsmotor gestartet. Die Erfindung betrifft ferner ein zugehörige Notversorgungsschaltung sowie eine mobile Starthilfebatterie.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

Beschreibung

Titel

Startverfahren für Hybridantriebe

Stand der Technik

Die Erfindung geht aus von bekannten Startverfahren zum Starten eines Hybridantriebs. Fahrzeuge mit Hybridantrieben umfassen eine Traktionsbatterie, die den E-Motor des Antriebs mit Strom versorgt. Die Traktionsbatterie wird gemäß dem bekannten Hybridverfahren von dem Verbrennungsmotor des Antriebs aufgeladen und weist eine deutlich höhere Betriebsspannung (größer 300 V) als das Bordnetz (12 V, 24 V) des Fahrzeugs auf. Während das Bordnetz von einer Bordnetzbatterie gespeist wird, beispielsweise einem Bleiakkumulator, wie er auch für übliche Verbrennungsmotor-Kraftfahrzeuge vorgesehen ist, und somit nahezu alle Komponenten des Fahrzeugs mit Strom versorgt, dient die Traktionsbatterie lediglich der Stromzufuhr für den Elektromotor. Bis auf den Elektromotor sind alle Komponenten des Fahrzeugs auf die Betriebsspannung des Bordnetzes ausgelegt, wodurch Komponenten von üblichen Verbrennungsmotor-Fahrzeugen verwendet werden können.

Es sind Hybridantriebe bekannt, die einen Gleichstrom/Gleichstrom-Wandler (DC/DC-Wandler) haben, der die Spannung der Traktionsbatterie dazu verwendet, nach Umwandlung der Spannung das Bordnetz zu speisen. Ein derartiger DC/DC-Wandler wird, wie nahezu alle weiteren Komponenten des Antriebs, von dem Bordnetz gespeist. Üblicherweise ist die Wandlersteuerung des DC/DC-Wandlers ein Teil einer Steuerung, die den elektrischen Energiehaushalt in dem Kraftfahrzeug steuert und beispielsweise auch die Lichtmaschine und ähnliches ansteuert. Eine derartige Steuerung ist, wie auch die gesteuerten Komponenten, auf eine Betriebsspannung von 12 V ausgelegt. Neben der unterschiedlichen Leistungsfunktionen zwischen Bordnetzbatterie und Traktionsbatterie ist die lebensgefährlich hohe Spannung der Traktionsbatterie der Grund dafür, dass beide Kreise strickt voneinander getrennt sind.

Daher kann bei bekannten Hybridantrieben der Fall eintreten, dass die Traktionsbatterie zwar ausreichend aufgeladen ist, jedoch keine elektrische Leistung an eine entleerte Bordnetzbatterie bzw. an ein zu unterstützendes Bordnetz übertragen werden kann, weil die Steuerung des DC/DC-Wandlers, der zur Übertragung der Leistung eingerichtet ist, auf

Grund der zu geringen Betriebsspannung im Bordnetz nicht aktiviert werden kann. Wie bereits bemerkt ist es hinsichtlich der Isolation und der Konzeption sehr schwierig, die Wandlersteuerung sowie weitere Steuerungselemente im Netz der Traktionsbatterie unterzubringen.

Die Druckschrift DE 41 38 943 C1 beschreibt zwei Speicher, d.h. einen Speicher für ein Bordnetz und einen Startspeicher zur Versorgung eines Starters, um die Auswirkungen des Starters auf dessen Versorgungsnetz von dem Bordnetz zu trennen. Diese Druckschrift betrifft jedoch die Spannungsversorgung eines üblichen Verbrennungsmotorantriebs, der keine Traktionsbatterie, aufweist, die von dem Bordnetz getrennt ist.

Die Druckschrift DE 101 00 889 A1 umfasst ebenfalls die Spannungsversorgung eines Verbrennungsmotorantriebs. Die Druckschrift schlägt vor, zwei Teilversorgungsnetze als Bordnetz zu verwenden, um für den Startvorgang eine Redundanz vorzusehen. Die Druckschrift beschreibt jedoch ebenso wie die oben genannte Druckschrift keine Schaltungsstruktur, wie sie für einen Hybridmotor typisch ist,, und diskutiert keine mit dieser Struktur zusammenhängenden spezifischen Situationen.

Es ist eine Aufgabe der Erfindung, einen Mechanismus vorzugeben, mit dem der Verbrennungsmotor eines Hybridantriebs bei zu geringer Bordnetzspannung gestattet werden kann.

Offenbarung der Erfindung

Mittels des erfindungsgemäßen Verfahrens lässt sich der mit einer Starthilfe verbundene Aufwand deutlich verringern, wobei die Erfordernisse an eine externe Starthilfe deutlich verringert werden. Die Starthilfe kann mit dem erfindungsgemäßen Verfahren deutlich preiswerter, leichter und kleiner vorgesehen werden. Gleichzeitig eignen sich, im Gegensatz zu Starthilfen gemäß dem Stand der Technik, Energiespeicher mit geringer Kapazität und Leistung. Darüber hinaus sind die notwendigen Ströme um ein Vielfaches geringer als im Stand der Technik, so dass nahezu jedes beliebige Kabel verwendet werden kann. Ferner ist es durch die geringe Stromstärke nicht notwendig, die Bordnetzbatterie direkt zu kontaktieren. Vielmehr können zahlreiche mit Sicherungen geschützte Bordnetzkontakte verwendet werden, beispielsweise die Zigarettenanzünderbuchse. Im Vergleich zum Stand der Technik sind die Anforderungen an die externe Starthilfe hinsichtlich Versorgungsdauer und Versorgungsleistung deutlich verringert. Mit dem erfindungsgemäßen Verfahren und der erfindungsgemäßen Vorrichtung kann ein Hybridmotor mit einer Starthilfe geschaltet werden, die nur sehr kurz Energie liefert, beispielsweise kürzer als die Versorgungsdauer des Starters beim Startvorgang, und die einen sehr geringen Strom liefert, der deutlich geringer als der Versorgungsstrom des Starters ist.

Es wurde erkannt, dass sich bei Versorgungssystemen gemäß dem Stand der Technik Systemverklemmungen ergeben, so dass trotz vorhandener Energie kein Übertrag (und somit kein Startvorgang) stattfinden kann, da die Funktion des Elements, dass die Übertragung steuert, von dem Zustand des Bordnetzes abhängt. Erfindungsgemäß wird die Systemverklemmung dadurch gelöst, dass die Steuerung des Energieübertrags mittels Hilfsenergie aktiviert wird, wodurch die vorhandene Energie mit geringem Aufwand mobilisiert wird. Im Gegensatz hierzu zielen Verfahren gemäß Stand der Technik nicht auf die Mobilisierung vorhandener Energie ab, sondern führen dem System von außen eine hohe Energiemenge zu, die dem Fehlbetrag entspricht, um so bei schwachem Bordnetz starten zu können. Gemäß dem erfindungsgemäßen Verfahren tritt somit die Energie der Traktionsbatterie an die Stelle einer herkömmlichen externen Starthilfebatterie, wie sie bei herkömmlichen Verfahren verwendet wird.

Während im Stand der Technik die Starthilfe den Zweck hatte, den Energiefehlbetrag, der der Bordnetzbatterie zu einem erfolgreichem Startvorgang fehlt, vollständig zu liefern, liegt der Erfindung das Konzept zu Grunde, eine Selbsthilfekaskade vorzusehen, die durch Aktivierung des Elements mit dem kleinsten Verbrauch gestartet wird. Durch die Aktivierung wird Energie (die der Traktionsbatterie) mobilisiert, die für den Startvorgang verwendet werden kann. Die für den Startvorgang erforderliche Energie wird erfindungsgemäß nahezu vollständig von der Traktionsbatterie geliefert. Die Erfindung ist daher nicht auf die Energiebereitstellung fokussiert, sondern sieht einen Mechanismus zur Mobilisierung der Energie vor, die in der Traktionsbatterie gespeichert ist. Erfindungsgemäß wird nicht der Startvorgang selbst sondern die Mobilisierung vorhandener Energiereserven unterstützt, wobei erkannt wurde, dass dies sehr wirksam erreicht werden kann, indem weder der Starter, noch die Bordnetzbatterie, noch der DC/DC-Wandler in Betrieb genommen werden muss, sondern lediglich die Wandlersteuerung. Erfindungsgemäß wird durch die Aktivierung der Wandlersteuerung eine Kaskade ausgelöst, die automatisch zur ausreichenden Stromversorgung des Starters führt. Erfindungsgemäß wird daher mit einem geringen Strombetrag nur für eine kurze Zeit die Wandlersteuerung in Betrieb genommen, in dem diese mittels einer externen Energiequelle für eine kurze Dauer mit Strom versorgt wird. Daraufhin wird automatisch der DC/DC-Wandler in Betrieb genommen, der einen hohen Leistungsfluss von der Traktionsbatterie in das Bordnetz hinein die dauerhafte, selbst erhaltende Inbetriebnahme der Wandlersteuerung vorsieht. Die Wandlersteuerung muss daher nur so lange mit Energie versorgt werden, bis der Wandler selbst ausreichend Leistungen von der Traktionsbatterie in das Bordnetz und insbesondere an die Wandlersteuerung liefert. Um die Energiebilanz auszugleichen, wird erfindungsgemäß als weiterer Kaskadenschritt der Verbren-

nungsmotor gestartet, so dass sowohl Traktionsbatterie als auch Bordnetz bzw. Bordnetzbatterie ihre Energiebilanz ausgleichen können.

Daher sieht das erfindungsgemäße Verfahren vor, die Wandlersteuerung mittels eines externen Hilfsenergiebetrags zu aktivieren, wobei der Hilfsenergiebetrag unter der Energiemenge liegt, die zum Starten zusätzlich aufgebracht werden muss. Die Energie wird nur für eine Zeitdauer bereitgestellt, die der Aktivierung des DC/DC-Wandlers entspricht, und die somit kleiner als die Zeitdauer ist, für die der Starter für einen erfolgreichen Startvorgang mit elektrischer Leistung versorgt werden muss. Bei der Aktivierung der Wandlersteuerung kann diese selbst direkt mit der Hilfsenergie versorgt werden, oder kann über das Bordnetz oder über Teile des Bordnetzes, an die die Wandlersteuerung angeschlossen ist, aktiviert werden.

Vorzugsweise werden nicht alle Lasten, die an dem Bordnetz angeschlossen sind, gleichzeitig mit der Versorgung der Wandlersteuerung mit Strom versorgt. In einer bevorzugten Ausführung wird der Stromfluss derart gesteuert, dass vornehmlich die Wandlersteuerung von der Hilfsenergiequelle elektrische Leistung erhält. Dies kann beispielsweise dadurch vorgesehen werden, dass ein Anschluss für die Hilfsenergiequelle direkt mit der Wandlersteuerung verbunden ist, wohingegen das restliche Bordnetz über eine Stromlenkungs- oder Stromsteuerungseinrichtung mit der Wandlersteuerung verbunden ist. Beispielsweise kann zwischen der Wandlersteuerung und dem restlichen Bordnetz eine Diode vorgesehen sein, die in Durchlassrichtung von dem Bordnetz zur Wandlersteuerung hin in der Verbindung zwischen Wandlersteuerung und Bordnetz vorgesehen ist. Bei normalem Betrieb, d.h. wenn Bordnetz Nennspannung hat, fließt somit Versorgungsstrom vom Bordnetz an die Wandlersteuerung, wohingegen bei geringer Bordnetzspannung selbst dann kein Strom von der Wandlersteuerung in das Bordnetz hineinfließt, wenn diese direkt Nennspannung erhält. Daher wird das der Erfindung zu Grunde liegende Konzept umgesetzt von einer Versorgungsschaltung für die Wandlersteuerung oder für eine Steuerung, die die Wandlersteuerung umfasst, und die zwar den Stromfluss ausgehend vom Bordnetz zur Wandlersteuerung hin zulässt, jedoch ein Stromfluss von dem Versorgungsanschluss der Wandlersteuerung in das Bordnetz verhindert. Vorzugsweise wird hierzu eine Diode vorgesehen, beispielsweise eine Schottky-Diode.

Wenn eine Wandlersteuerung über eine derartige Verbindung mit dem Bordnetz verbunden ist, so kann gemäß dem erfindungsgemäßen Verfahren eine Hilfstromquelle bzw. Starthilfe-Energiequelle an die Wandlersteuerung angekoppelt werden, ohne dass elektrische Leistung von der Hilfsenergiequelle in das Bordnetz und an andere Lasten fließt. Vielmehr wird dadurch gewährleistet, dass der gesamte Anteil der elektrischen Leistung oder zumindest ein Großteil hiervon, von der Hilfsenergiequelle auch tatsächlich an die Wandlersteuerung

fließt. Somit wird die Hilfsenergiequelle geschützt und kann mit einer geringen Kapazität ausgelegt werden. Gleichzeitig wird verhindert, dass die Hilfsenergiequelle mit anderen Lasten als die Wandlersteuerung belastet wird, wodurch die Hilfsenergie wirksam und maßgeblich zur Aktivierung der Wandlersteuerung eingesetzt wird. Hierzu kann ebenso ein Trennschalter verwendet werden, der in einer Notfallsituation mit zu geringer Bordnetzspannung die Lasten bzw. das Bordnetz von der Wandlersteuerung trennt, um zu gewährleisten, dass die Hilfsenergie im Wesentlichen vollständig nur zur Versorgung der Wandlersteuerung verwendet wird. Wenn nach Aktivierung der Wandlersteuerung der DC/DC-Wandler versorgt wird, kann der Trennschalter wieder umgelegt werden, so dass die Wandlersteuerung von dem Bordnetz, dass nun eine ausreichende Spannung aufweist, mit Strom versorgt wird. In gleicher Weise ermöglicht die Diode, dass beim Erreichen einer Nennbetriebsspannung des Bordnetzes die Wandlersteuerung wieder in üblicher Weise vom Bordnetz versorgt wird. Die Zuleitung zwischen einem Anschluss für die Hilfsenergiequelle und der Wandlersteuerung kann für geringe Ströme ausgelegt werden, d.h. für übliche Ströme, die beim Betrieb der Wandlersteuerung auftreten. Insbesondere eignen sich bereits vorgesehene, gesicherte Verbindungen, beispielsweise Verbindungen, mit denen die Zigarettenanzünderbuchse mit dem Bordnetz verbunden ist, da diese zur Versorgung der Wandlersteuerung ausreichen. Im Gegensatz hierzu sieht der Stand der Technik vor, einen Starterstrom direkt in das Bordnetz einzuspeisen, wobei auf Grund der Höhe des eingespeisten Stroms keine gesicherten Verbindungen verwendet werden können und zumindest die Zigarettenanzünderbuchse auf Grund des hohen Starterstroms hierfür nicht verwendet werden kann.

Die Wandlersteuerung umfasst typischerweise einen Mikroprozessor mit Software oder eine Logikschaltung, die zur Aktivierung des DC/DC-Wandlers eine Stromversorgung von kleiner als 1 A und typischerweise zwischen 1 mA und 100 mA erfordert. Demgemäß ist die erfindungsgemäße Hilfsenergiequelle mit einer Kapazität versehen, die eine Mindestspannung, beispielsweise 10 V, 11 V oder 11,5 V für einen Zeitraum liefert, die die Wandlersteuerung zum Abgeben eines Aktivierungssignals an den DC/DC-Wandlers braucht. Im Falle einer fest verdrahteten Logikschaltung beträgt somit die minimale Versorgungsdauer durch die Hilfsenergiequelle kleiner 1 Sekunde, typischerweise zwischen 5 und 100 Millisekunden. Wird die Wandlersteuerung durch einen Mikroprozessor und entsprechend darauf ablaufender Software vorgesehen, so können ebenfalls ähnliche Werte erreicht werden, wobei es, abhängig vom Initialisierungsvorgang der Wandlersteuerung, erforderlich sein kann, den Betrieb der Wandlersteuerung für mindestens 1 Sekunde, jedoch weniger als 3 Sekunden aufrechtzuerhalten. Versorgt die Hilfsenergiequelle die Wandlersteuerung mit einer Spannung, die jederzeit über einer Minimalbetriebsspannung liegt, d.h. nie unter 10 V, 11 V, oder 11,5 V fällt, so kann dadurch der DC-Wandler aktiviert werden, der das Bordnetz und die Wandlersteuerung versorgt. Vorzugsweise sieht die Hilfsenergiequelle eine Spannung

von 12 V bei einer Belastung von 10-100 mA für typischerweise 1, 3, 5 oder 10 Sekunden vor. Aus Kostengründen und zur besseren Handhabung ist jedoch die Hilfsenergiequelle vorzugsweise eingerichtet, die Versorgung für maximal 10 Sekunden, maximal 30 Sekunden, maximal 1 Minute oder maximal 5 Minuten bei einem Strom von 10-100 mA vorzusehen. Die Hilfsenergiequelle kann somit ein Elektrolytkondensator mit hoher Kapazität (größer 0,1 F), ein Goldcap-Kondensator mit entsprechender Kapazität, vorzugsweise eine Reihenschaltung galvanischer Zellen, die wiederaufladbar oder nicht-wiederaufladbar sind, beispielsweise Alkali-Mangan-Batterien, Zink-Luft-Batterien, Lithiumzellen oder ähnliche Primärzellen sein, oder können Sekundärzellen wie Bleiakkumulatoren, Nickelkadmiumakkumulatoren, Nickelmetallhydridakkumulatoren, Lithiumionakkumulatoren oder ähnliche Akkumulatoren sein, die feste oder flüssige Elektrolyte haben können. Insbesondere eignen sich 12-V-Batterien auf Alkali- oder Lithiumbasis mit geringer Kapazität, wie sie beispielsweise für mobile Geräte eingesetzt werden. Die Nennspannung der Reihenschaltung aus galvanischen Zellen beträgt vorzugsweise ca. 12 V, mindestens 12 V oder mindestens 14 V. Ferner kann eine Kombination aus einer Batteriegruppe und einem Aufwärtswandler verwendet werden, wobei die Batteriegruppe eine geringere Spannung als 12 V liefert, beispielsweise 3,6 V oder 9 V, und der Aufwärtswandler eingerichtet ist, die Batteriespannung in eine Spannung zu verwandeln, mit der die Wandlersteuerung betrieben werden kann, beispielsweise durch Verwendung eines Aufwärtswandlers mit einer geregelten Ausgangsspannung von 10-14 V oder ca. 12 V. Das Hilfsstromelement ist vorzugsweise nicht für den Dauerbetrieb ausgelegt, sondern nur für einen kurzen Betrieb von weniger als 1 Minute oder weniger als 10 Sekunden Dauer. Wenn ein Aufwärtswandler verwendet wird, um die Nennspannung der Wandlersteuerung zu erzielen, wird ferner vorzugsweise ein Bedienungselement vorgesehen, um den Wandler nur während des Betriebs mit der Batterie zu verbinden, um eine Entladung durch den Ruhestrom des Aufwärtswandlers zu vermeiden. In einer weiteren Ausführungsform wird anstatt oder in Kombination mit einer Batterie ein Handdynamo verwendet, der geeignet ist, eine Spannung von 12 V vorzusehen, beispielsweise auf Grund der Windungszahl oder auf Grund eines Aufwärtswandlers. Da zur Aktivierung der Wandlersteuerung nur ein geringer Betriebsstrom für kurze Zeit notwendig ist, sind Handgeneratoren, wie sie auch für Mobilfunkgeräte verwendet werden, zum kurzfristigen Betrieb der Wandlersteuerung geeignet. Ferner können Solarzellen verwendet werden, gegebenenfalls in Kombination mit einem Aufwärtswandler, die eine Nennausgangsleistung von 10-100 mA bei 12 V vorsehen. Ferner ist es grundsätzlich möglich, die Stromversorgung eines USB-Anschlusses, beispielsweise eines Laptops zu verwenden, um aus der Betriebsspannung von 5 V mittels eines Aufwärtswandlers eine Spannung von 12 V zu erreichen. Daher kann die erfindungsgemäße Hilfsstromquelle auch mittels eines Adapters vorgesehen werden, der Versorgungsstrom eines USB-Anschlusses auf eine Spannung von 12 V umsetzt, um beispielsweise bei einer Belastung von 50 mA die Wandlersteuerung kurz-

fristig zu betreiben. Gegebenenfalls können neben dem Aufwärtswandler in der oben genannten Ausführungsform auch Zwischenpufferspeicher vorgesehen werden, die einen Betrieb von beispielsweise weniger als 3 Sekunden kurzfristig unterstützen.

In einer besonders bevorzugten Ausführungsform umfasst die mobile Starthilfe-Energiequelle, die einen Hilfsenergiebetrag bereitstellt, eine Anordnung von 2-8 Zink/Kohle-Batterien, Alkaline-Batterien, Nickelmetallhydrid-Akkumulatoren oder Nickelkadmium-Akkumulatoren, beispielsweise in Form von Mignonzellen, die in Kombination mit einem Aufwärtswandler eine Ausgangsspannung von 12 V bei 20, 50 oder 100 mA bereitstellen. Der Aufwärtswandler kann entfallen, wenn 8 oder mehr Alkaline- oder Zink/Kohle-Batterien verwendet werden, oder wenn 10 oder mehr Nickelmetallhydrid oder Nickelkadmium-Akkumulatoren verwendet werden. Der Aufwärtswandler umfasst vorzugsweise ein Betätigungselement wie einen Schalter, der den Aufwärtswandler vollständig von den Batteriezellen trennt und bei Betätigung mit diesen verbindet.

Der Begriff „Hilfsenergiequelle" ist hier gleichbedeutend zu „Starthilfe-Energiequelle" und bezeichnet einen (externen) Energiespeicher, der einen Hilfsenergiebetrag speichert und an die Wandlersteuerung abgeben kann.

Um die Hilfsenergiequelle bzw. um die Starthilfe-Energiequelle nicht unnötig zu belasten, werden vorzugsweise Lasten des Bordnetzes wie Beleuchtung, Belüftung, Heizung, Servoantrieb, Hi-Fi-Komponente oder ähnliches abgeschaltet, vorzugsweise mittels einer gemeinsam zu betätigenden Schaltungsvorrichtung. Diese Schaltungsvorrichtung kann beispielsweise zwischen der Versorgung der Wandlersteuerung und dem restlichen Bordnetz vorgesehen sein, um das Bordnetz während der Aktivierung der Wandlersteuerung abzuschalten. Alternativ oder in Kombination hierzu wird der Starter, der eine starke Last darstellt, blockiert bzw. nicht aktiviert, um die hierzu unzureichende Hilfsenergiequelle nicht unnötig zu belasten bzw. zu entleeren. Hierzu kann beispielsweise ein Schutzintervall vorgesehen sein, das während des Aktivierungsvorgangs der Wandlersteuerung das Zuführen von Strom an den Starter blockiert, wobei das Schutzintervall ein vorgegebenes Schutzintervall sein kann, das sich nach der üblichen Länge des Aktivierungsvorganges der Wandlersteuerung richtet, oder kann ein Schutzintervall mit variablem Ende sein, das dann endet, wenn erfasst wird, dass das Bordnetz durch den Energieübertrag aus der Traktionsbatterie ausreichend Energie zum Starten bereithält. Vorzugsweise wird hierzu erfasst, ob das Bordnetz bzw. die Bordnetzbatterie ausreichend Energie aufweist, indem ein Batteriestrom erfasst wird oder indem die Spannung erfasst wird, die an dem Akkumulator anliegt. Kriterien zur Beendigung des Schutzintervalls sind daher ein geringer Ladestrom, der auf ein ausreichendes Ladeniveau der Bordnetzbatterie hinweist, und/oder eine Klemmspannung an dem Akkumulator, die

eine bestimmte Höhe erreicht, aus der sich ebenfalls auf ein hohes Ladeniveau der Bordnetzbatterie hinweist. Ebenso kann das Schutzintervall beendet werden, wenn erfasst wird, dass der DC/DC-Wandler das Bordnetz ausreichend unterstützt, beispielsweise indem erfasst wird, ob der DC/DC-Wandler ausreichend Strom bzw. eine ausreichende Leistung erzeugt, um das Bordnetz auf eine ausreichende Spannung zu bringen. Insbesondere kann erfasst werden, ob eine Zerhackerschaltung innerhalb des DC/DC-Wandlers eine Wechselspannung erzeugt, wobei dies als Signal gewertet wird, das ausreichend elektrische Leistung für das Bordnetz erzeugt wird, so dass keine weitere Versorgung der Wandlersteuerung durch die Hilfsenergiequelle notwendig ist.

Kurze Beschreibung der Zeichnungen

Ausführungsbeispiele der Erfindung sind in den Zeichnungen dargestellt und in der nachfolgenden Beschreibung näher erläutert.

Es zeigen

Figur 1 ein Schaltungsprinzip zum Verbinden der erfindungsgemäßen Starthilfe-Energiequelle mit der Wandlersteuerung und dem Bordnetz; und

Figur 2 einen Wirkungsablauf der Kaskade, die von dem erfindungsgemäßen Verfahren vorgesehen wird.

Ausführungsformen der Erfindung

In der Figur 1 ist ein Schaltungsprinzip dargestellt, das zur Beschreibung des erfindungsgemäßen Verfahrens verwendet werden kann. Die Schaltung von Figur 1 umfasst eine Traktionsbatterie 10, eine Bordnetzbatterie 20, einen DC/DC-Wandler 30, der die Traktionsbatterie 10 mit der Bordnetzbatterie 20 verbindet, sowie eine Wandlersteuerung 40, die den DC/DC-Wandler 30 ansteuert. Die Ansteuerung des DC/DC-Wandlers 30 durch die Wandlersteuerung 40 wird über eine Wandlersteuerung-Anschlussleitung 44 vorgesehen. Der Wandler wird ferner über einen Eingang 32 von der Traktionsbatterie 10 mit Spannung versorgt, um diese umzuwandeln und an einem Ausgang 34 des DC/DC-Wandlers 30 auszugeben. Auf diese Weise kann elektrische Energie von der Traktionsbatterie in ein Bordnetz und insbesondere in die Bordnetzbatterie 20 eingespeist werden, die mit dem Bordnetz verbunden ist. Beispielsweise an den Anschlüssen 22 kann sich ein Bordnetz mit den zugehörigen Lasten anschließen. Der Bordnetzanschluss 22 ist parallel zu der Bordnetzbatterie 20 geschaltet, wobei das Bordnetz neben den Lasten wie Beleuchtung, Heizung, Ventilation, weitere Steuerungen, Zündspannungsgenerator und ähnliches auch einen Stromgenera-

tor umfasst, beispielsweise eine Lichtmaschine, um die Bordnetzbatterie 20 in einer Weise aufzuladen, wie sie von verbrennungsmotorgetriebenen Fahrzeugen bekannt ist. Die Bordnetzbatterie 20 ist ferner über einen Schalter 24 mit einem Starter 50 verbunden, der unter Zufuhr eines Starterstroms (typischerweise deutlich mehr als 20 A) ein Drehmoment erzeugt, das direkt an den Verbrennungsmotor übertragen wird und diesen startet. Zwischen dem DC/DC-Wandler 30 und der Bordnetzbatterie 20 kann ferner ein Strombegrenzer oder eine Sicherung vorgesehen sein.

Die Wandlersteuerung 40 wird über eine Verbindungsschaltung 42 von der Bordnetzbatterie 20 mit elektrischer Energie versorgt, um den Betrieb der Steuerung 40 zu gewährleisten. Die Steuerung 40 kann ausschließlich die Funktion haben, den DC/DC-Wandler 30 anzusteuern, wodurch ein minimaler Stromverbrauch erreicht wird. Ferner ist es möglich, dass die Wandlersteuerung 40 Teil einer Steuerung ist, die weitere Funktionen umfasst, beispielsweise Energiemanagement und anderes. Vorzugsweise ist die Funktion der Wandlersteuerung einzeln aktivierbar, um im Falle einer Starthilfe zugeführte Hilfsenergie nicht unnötigerweise an weitere Funktionen abgeben zu müssen. Die Primärfunktion der Wandlersteuerung ist es, den DC/DC-Wandler 30 zu aktivieren, um Energie von der Traktionsbatterie 10 in das Bordnetz und insbesondere in die Batterie 20 zu leiten. Insbesondere ist es Aufgabe der Wandlersteuerung 40, ein Aktivierungssignal an den DC/DC-Wandler 30 zu senden, der daraufhin Energie erzeugt, mit dem sich die Wandlersteuerung 40 selbst mit Energie versorgen kann. Durch diese Selbsterhaltung ist es möglich, Starthilfe mit sehr kleinen Energiebeträgen durchführen zu können, insbesondere mit Energiebeträgen, die im Wesentlichen nur zur Abgabe eines Aktivierungssignals an den DC/DC-Wandler 30 ausreichen. Der darauf eintretende Selbsthaltungseffekt, gespeist aus der Traktionsenergie 10, ermöglicht eine fortdauernde Aktivierung der Schaltung. In einer alternativen Ausführungsform, die nicht in Figur 1 dargestellt ist, übernimmt eine externe Starthilfe die Funktion der Wandlersteuerung 40 und gibt ein Aktivierungssignal direkt in die Leitung 44 ab, so dass das Aktivierungssignal direkt an den DC/DC-Wandler 30 abgegeben wird. Dadurch wird aus der Traktionsbatterie 10 elektrische Energie in das Bordnetz und insbesondere an die Wandlersteuerung 40 abgegeben.

Die Verbindung 42, die den Stromversorgungseingang der Wandlersteuerung 40 mit dem Bordnetz verbindet, umfasst vorzugsweise eine Diode 60, die die Funktion hat, eine externe Energiequelle, die über die Anschlüsse 70 direkt mit dem Versorgungsanschluss mit der Wandlersteuerung 40 verbunden wird, zu schützen. Bei entleerter Bordnetzbatterie 20 und angelegter Hilfsenergie 70 würde sich ohne die Diode 60 ein Stromfluss von der Starthilfe-Energiequelle über den Anschluss 70 in das Bordnetz 22 und die Bordnetzbatterie 20 hinein ergeben. Dadurch wird der Energiefluss an die Wandlersteuerung 40 verringert, so dass die

Wandlersteuerung 40 nicht ausreichend Energie erhält, um den DC/DC-Wandler 30 zu aktivieren. In diesem Fall sperrt die Diode 60 den unerwünschten Abfluss von elektrischer Energie ausgehend von der Starthilfequelle 70 zu der Bordnetzbatterie 20 und dem Bordnetz 22. Ferner erfüllt die Diode 60 eine weitere Funktion, nämlich die Aufrechterhaltung der Spannungsversorgung der Wandlersteuerung 40. Falls diese erfolgreich aktiviert wurde, überträgt der DC/DC-Wandler 30 Energie von der Traktionsbatterie 10 an das Bordnetz und insbesondere an die Bordnetzbatterie 20. Daher ergibt sich, beispielsweise an den Anschlüssen 34 des DC/DC-Wandlers 30, eine vorzugsweise geregelte Normspannung, beispielsweise 12 V, die auch von der externen Starthilfe an den Anschlüssen 70 vorgesehen wird. Selbst wenn die angelegte Starthilfe an den Anschlüssen 70 eine geringe Spannung aufweist oder nicht mehr angeschlossen ist, versorgt die Diode 60 in Durchlassrichtung die Wandlersteuerung 40 mit der Spannung, die an dem Ausgang 34 des DC/DC-Wandlers 30 und auch an der Bordnetzbatterie 20 anliegt. In Flussrichtung dient die Diode 60 daher zur Selbsterhaltung der Versorgung der Wandlersteuerung 40.

Falls durch erfolgreiche Aktivierung des DC/DC-Wandlers 30 die Energiebilanz des Bordnetzes und der Bordnetzbatterie 20 ausgeglichen ist, kann der Schalter 24 betätigt werden, der vorzugsweise als Startrelais ausgebildet ist, um den Starter 50 mit Strom zu versorgen. Der Strom kann vollständig von dem DC/DC-Wandler 30 erzeugt sein, zu einem Teil vom DC/DC-Wandler 30 und zu einem Teil von der Bordnetzbatterie 20 oder, nachdem der DC/DC-Wandler 30 die Batterie 20 ausreichend, teilweise oder vollständig aufgeladen hat, im Wesentlichen von der Bordnetzbatterie 20. Um den DC/DC-Wandler 30 nicht dadurch zu überlasten, dass dieser sowohl zum Laden der Bordnetzbatterie 20 als auch zum Liefern des Starterstroms dient, kann ein Schutzzeitintervall vorgesehen sein, das gewährleistet, dass die Bordnetzbatterie 20 einen wesentlichen Anteil des Starterstroms vorsehen kann.

Der Wandler 30 umfasst vorzugsweise eine interne Steuerung bzw. Regelung, die vorzugsweise von der Traktionsbatterie 10 mit Spannung versorgt wird.

Figur 2 zeigt den Wirkungsablauf der Kaskade, die von dem erfindungsgemäßen Verfahren vorgesehen wird. Die Energiemengen bzw. Leistungsbeträge, die relevant für das Verfahren sind, sind als gestrichelte Flächen dargestellt. Die Größe der Fläche entspricht der Menge an Leistung bzw. Energie, die gespeichert ist oder zum Betrieb notwendig ist. Die Größe der Fläche des offenen Rechtecks, indem die schraffierten Flächen untergebracht sind, entspricht der maximalen Kapazität oder dem maximalen Leistungsverbrauch der jeweiligen Komponente. Mit dem Bezugszeichen 170 ist eine mobile Starthilfe dargestellt, die eine relativ geringe Kapazität hat (Fläche des offenen Rechtecks), und in der eine geringe Menge an Energie (schraffierter Bereich) gespeichert ist. Die Starterbatterie 120 soll zunächst unzurei-

chend geladen sein, dargestellt durch einen schraffierten Bereich, der unterhalb von dem Niveau N1 und N2 ist. Das Niveau N1 ist das Spannungsniveau bzw. Energieversorgungsniveau, das zum Betrieb der Startervorrichtung notwendig ist, und das Niveau N2 entspricht dem Spannungsniveau, ab dem eine Steuerung 140 eines DC/DC-Wandlers 130 betrieben werden kann. Obwohl eine Traktionsbatterie 110 ausreichend Energie enthält, kann diese nicht in die Bordnetzbatterie 120 übertragen werden, da der Wandler 130 nicht aktiviert werden kann. Die Hilfsenergie 170 wird nicht zum Füllen eines Energiefehlbetrags in der Bordnetzbatterie 120 verwendet, sondern wird direkt an die Wandlersteuerung 140 geleitet. Dies erfordert einen deutlich geringeren Energiebetrag. Dadurch wird, wie bereits beschrieben, die Wandlersteuerung 140 aktiviert, die wiederum zumindest für einen kurzen Zeitraum den DC/DC-Wandler 130 aktiviert, wodurch Energiefluss von der Traktionsbatterie 110 zur Bordnetzbatterie 120 ermöglicht wird. Dadurch kann der Energiefehlbetrag in der Bordnetzbatterie 120 ausgeglichen werden, wodurch die Niveaus N1 und N2 erreicht werden. Bei Erreichen des Niveaus N2 kann der Energiebedarf der Wandlersteuerung 140 durch das System selbst getragen werden, wodurch die Zuführung von Energie durch eine äußere Starthilfe 170 nicht mehr notwendig ist. Durch die einmalige Aktivierung mittels der externen Energiequelle 170 lässt sich so eine erste Erhaltungsfunktion realisieren, dargestellt durch den Pfeil A. Die Energie der Traktionsbatterie 110 wird so auf die Bordnetzbatterie 120 übertragen, damit diese aufgeladen werden kann, wobei jedoch die Traktionsbatterie auf lange Sicht entladen wird. Um dies zu verhindern, wird eine zweite Selbsterhaltungsstufe in Gang gesetzt, indem dem System Treibstoffenergie 150 zugeführt wird. Der Energiebetrag 150 kann somit den Treibstoff im Tank des Kraftfahrzeugs darstellen. Dieser wird verwendet, um mittels des Verbrennungsmotors und der Lichtmaschine bzw. der E-Maschine Energie zu erzeugen. Hierzu wird Verbrennungsmotor 160 mittels Energie aus der Bordnetzbatterie 120 und/oder aus der Traktionsbatterie 110 (umgewandelt durch den DC/DC-Wandler 130 gestartet, beispielsweise über einen Elektrostarter, so dass die Energiebilanz der Traktionsbatterie 110 und die Energiebilanz der Bordnetzbatterie 120 über die Energiezuführungen B und C ausgeglichen wird.

Nachdem in einer ersten Kaskadenstufe die Hilfsenergiequelle 170 dazu verwendet wurde, um die Traktionsbatterie 110 als Energiequelle für die Bordnetzbatterie 120 und insbesondere für die Wandlersteuerung 140 zu verwenden, besteht eine zweite Kaskadenstufe darin, mit Hilfe der Bordnetzbatterie 120 den Verbrennungsmotor 160 zu starten. Ein erster Selbsterhaltungsmechanismus, der der ersten Kaskadenstufe zugeordnet ist, wird durch den Pfeil A dargestellt, gemäß dem, nach aktiviertem DC/DC-Wandler 130, die Wandlersteuerung 140 mit Energie versorgt werden kann, die von dem DC/DC-Wandler 130 und somit von der Traktionsbatterie 110 stammt. Als zweiter Selbsterhaltungsmechanismus, der der zweiten Kaskadenstufe zugeordnet ist, wird die Energie verwendet, die vom Verbren-

nungsmotor 160 erzeugt wird, um Traktionsbatterie 110 und/oder Bordnetzbatterie 120 zu versorgen. Insbesondere die Versorgung der Bordnetzbatterie 120 über die Verbindung B ist notwendig, um zu gewährleisten, dass das Bordnetz ausreichend Energie hat, um die Verbrennungsmotorsteuerung und insbesondere die Zündung des Verbrennungsmotors zu gewährleisten. Somit wird gemäß dem zweiten Selbsterhaltungsmechanismus ein Teil der von der Verbrennungsmaschine 160 erzeugten Energie verwendet, um dem Betrieb des Verbrennungsmotors selbst aufrecht zu erhalten.

Obwohl die in Figur 2 dargestellten Flächen und deren Entsprechungen (Energiemenge, Kapazität) nicht maßstäblich sind, lässt sich erkennen, dass mit einer sehr geringen Energie 170 ein Mechanismus ausgelöst werden kann, mit dem ein großer Energiefehlbetrag in der Bordnetzbatterie 120 ausgeglichen werden kann. Es lässt sich daher über die erste und die zweite Kaskadenstufe mit der geringen Energiemenge 170 ein zweistufiger Mechanismus auslösen, an dessen Ende anstatt der Hilfsenergie 170 die gesamte Energie des Treibstofftanks 150 aktiviert und mobilisiert ist. In der ersten Kaskadenstufe wird der DC/DC-Wandler 130 aktiviert, wodurch die Energie der Traktionsbatterie 110 mobilisiert wird, wobei in der zweiten Kaskadenstufe der Verbrennungsmotor 160 aktiviert wird (durch Starten) und somit die Energie des Treibstofftanks 150 mobilisiert wird und dem gesamten System zur Verfügung steht. Die Mobilisierung der jeweiligen Energien (1.: aus der Traktionsbatterie 110, 2.: aus dem Treibstofftank 150) wird auch zur jeweiligen Selbsterhaltung verwendet, d.h. zur Energieversorgung der Komponente (1.: Wandlersteuerung, 2.: Verbrennungsmotor), die mittelbar oder unmittelbar die Mobilisierung der jeweiligen Energie vorsieht.

Gemäß einer Ausführungsform umfasst die erfindungsgemäße Schaltung einen Trennschalter, vorzugsweise einen Hauptschütz, der zwischen Traktionsbatterie und Eingang des DC/DC-Wandlers vorgesehen ist. Insbesondere ist der Hauptschütz gemeinsam mit der Traktionsbatterie in einem Batteriegehäuse angeordnet. Der Hauptschütz ist als Schliesser ausgebildet, der bei Ansteuerung die Traktionsbatterie mit dem Tranktionsbatterieanschluss und somit mit dem restlichen Hochvoltnetz verbindet. Erfindungsgemäß wird der Hauptschütz geschlossen, wenn die Hilfsenergiequelle angeschlossen ist oder angeschlossen wird. Der Hauptschütz wird daher von der Wandlersteuerung direkt oder indirekt (über eine weitere Steuerung) angesteuert, um den DC/DC-Wandler bei dessen Aktivierung mit der Traktionsbatterie zu verbinden.

Als Starter kann ein E-Motor oder ein Starterrelais verwendet werden, der bzw. das nur für diesen Zweck vorgesehen ist. Die Verwendung eines Startermotors neben dem E-Motor des Elektroantriebs (der vorzugsweise ebenso zum Starten des Verbrennungsmotor mit diesem

mechanisch verbindbar ist) Führt zu Redundanz und somit zu höherer Verfügbarkeit. Es ergeben sich jedoch Kostenersparnisse, wenn statt eines separaten Starter jedoch der E-Motor des Elektroantriebs des Hybridantriebs zum Starten verwendet, der auch die Traktionsenergie erzeugt, wenn der Hybridantrieb die Traktionsbatterie zur Fortbewegung des Fahrzeugs verwendet. In diesem Fall ist der E-Motor mit dem Verbrennungsmotor verbunden und überträgt ein Startermoment bzw. Rotationsenergie über eine Kupplung und/oder eine Getriebe an den Verbrennungsmotor bzw. an dessen Kurbelwelle. Wenn der E-Motor des Antriebs als Starter verwendet wird, dann genügt es, dass die Wandlersteuerung zunächst nur den Hauptschütz aktiviert, so dass der als Traktions-E-Motor vorgesehene Starter (d.h. der Traktions-Elektromotor) die Energie direkt von der Traktionsbatterie erhält. Darüberhinaus kann zur Versorgung der Elektronik des Verbrennungsmotors (Zündfunkengenerator, Steuerung der Treibstoffzuführung, Zündsteuerung etc.) die u.a. zum Start des Verbrennungsmotor benötigt wird, der DC/DC-Wandler aktiviert werden. In diesem Fall wird in der entsprechenden Kaskade nicht die gesamte Energie zum Starten des Verbrennungsmotors über den DC/DC-Wandler aus der Traktionsbatterie geholt, sondern nur der Teil, der zur Steuerung des Verbrennungsmotors (und weitere Komponenten des 12 V - Bordnetzes) benötigt wird. Der andere Teil zum Erzeugen der Rotationsenergie für den Startvorgang wird direkt aus der Traktionsbatterie gespeist. Die erfindungsgemäße Steuerung umfasst somit nicht nur die Aktivierung des DC/DC-Wandlers, sonder auch die Ansteuerung des E-Motors, damit dieser Energie der Traktionsbatterie direkt in mechanische Rotationsenergie zum Starten des Verbrennungsmotors umwandelt. Die Wandlersteuerung aktiviert in diesem Fall zunächst den Hauptschütz, woraufhin eine Startsteuerung des E-Motors, der Verbrennungsmotor und der DC/DC-Wandler aktiviert wird. Die Wandlersteuerung ist somit vorzugsweise direkt mit dem Hauptschütz oder mit einer Hauptschützsteuerung verbunden. Alternativ kann der Startvorgang durch den E-Motor des Antriebs nach oder mit der Aktivierung des DC/DC-Wandlers durchgeführt werden, um gegebenenfalls eine Startsteuerung mit 12 V- Betriebsspannung zu versorgen. Die Wandlersteuerung kann direkt, über eine Hauptschützsteuerung, oder über eine Steuerleitung, die über den DC/DC-Wandler führt, mit dem Hauptschütz, verbunden sein. Wenn der Startvorgang vom E-Motor durchgeführt wird, der direkt aus der Traktionsbatterie (über den Hauptschütz) gespeist wird, dann kann der DC/DC-Wandler für eine geringere Belastung ausgelegt sein, die im wesentlichen der Belastung durch die Verbrennungsmotorsteuerung entspricht, beispielsweise ca. 200 W oder < 500 W. Erfindungsgemäß betrifft bei der Versorgung der Starters durch die Traktionsbatterie das Starten des Verbrennungsmotors im Normalbetrieb die Versorgung der Steuerung des Verbrennungsmotors mittels aktiviertem DC/DC-Wandler. Ein weiterer Aspekt des Startens ist dann das Erzeugen der Rotationsenergie durch den E-Motor, der direkt von der Traktionsbatterie bespeist wird.

Ferner können neben dem E-Motor auch weitere Komponenten direkt aus der Hochvolt-Traktionsbatterie gespeist werden, bsp. eine Servolenkung oder eine (Klima-)Kompressor. Diese Komponenten können durch die höhere Betriebsspannung für deutlich geringere Ströme ausgelegt werden; dies gilt auch für zugehörige Schalter oder Ansteuerungsschaltungen. Vorzugsweise sind derartige zusätzliche Komponenten zunächst Deaktiviert, bis der Verbrennungsmotor gestartet ist und beispielsweise eine Soll-Drehzahl erreicht hat. Nachdem der Verbrennungsmotor zur Aufrechterhaltung der Energiebilanz beitragen kann (d.h. nach dem Start) sind diese zusätzlichen Komponenten wieder aktivierbar bzw. werden bei Bedarf aktiviert.

In dem obengenannten Fall, in dem der Starter direkt von der Traktionsbatterie versorgt wird, ergäbe sich eine Schaltung, wie sie in Fig. 1 dargestellt ist, bis auf die Beschaltung des Starters, der nicht am 12-Bordnetz angeschlossen ist, sondern an der Traktionsbatterie oder einem anderen Punkt der Hochvoltnetzes, das von der Traktionsbatterie betrieben wird, bsp. der Eingang des DC/DC-Wandlers. Vorzugsweise wäre in diesem Fall zwischen Hochvoltnetz und Starter ein Schaltelement vorgesehen, das von einer Hochvolt-Startersteuerung oder einer anderen Steuerung (bsp. von der Wandlersteuerung) angesteuert wird. Das Schaltelement und/oder die zugehörige Steuerung kann prinzipiell direkt von der Traktionsbatterie versorgt werden, oder von dem DC/DC-Wandler, der in diesem Fall vor dem Startvorgang wie oben beschrieben aktiviert wird. Insbesondere die Definition des Startens in Anspruch 1 betrifft die Versorgung der Verbrennungsmotorsteuerung über den DC/DC-Wandler sowie die Versorgung des Starters über den DC/DC-Wandler oder direkt über die Traktionsbatterie, je nach dem, ob der Starter vom Bordnetz und somit vom DC/DC-Wandler gespeist wird, oder der Starter (und gegebenenfalls eine Startersteuerung) von dem Traktionsbatterienetz gespeist wird.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

Ansprüche

1. Verfahren zum Starten eines Hybridantriebs mittels einer Hilfsenergiequelle mit den Schritten:
Vorsehen einer E-Maschine und eines Verbrennungsmotors, die zusammen zur Erzeugung von Bewegungsenergie in dem Hybridantrieb vorgesehen sind;
Vorsehen einer Traktionsbatterie (10) zur Versorgung des E-Maschine mit Traktionsenergie, einem Bordnetz zum Starten des Verbrennungsmotors im Normalbetrieb, und einer Wandlersteuerung (40) eines DC/DC-Wandlers (30), der zur Versorgung des Bordnetzes aus der Traktionsbatterie (10) vorgesehen ist, wobei das Bordnetz die Wandlersteuerung versorgt; und,
wenn im Notfallbetrieb aufgrund eines Energiefehlbetrags im Bordnetz die im Bordnetz verbliebene Energie weder für den Betrieb der Wandlersteuerung (40) noch zum Starten des Verbrennungsmotors ausreicht: Zuführen eines externen Hilfsenergiebetrags, der kleiner als der Energiefehlbetrag ist, zur Wandlersteuerung (40), um den Betrieb der Wandlersteuerung (40) zumindest kurzfristig zu gewährleisten, Aktivieren des DC/DC-Wandlers (30) durch Ansteuerung mittels der Wandlersteuerung (40) und Einspeisen eines von der Traktionsbatterie (10) stammenden Startvorgang-Energiebetrags, der zusammen mit der im Bordnetz verbliebene Energie zum Starten des Verbrennungsmotors ausreicht, in das Bordnetz durch den DC/DC-Wandlers (30);
wobei das Verfahren ferner umfasst: Starten des Verbrennungsmotors durch Übertragen von Rotationsenergie vom Starter.

2. Verfahren nach Anspruch 1, wobei das Starten umfasst: Starten des Verbrennungsmotors mittels eines Versorgungsstroms einer Bordnetzbatterie (20), die an das Bordnetz angeschlossen ist, und/oder mittels eines vom DC/DC-Wandler (30) erzeugten Stroms, und Versorgen der Wandlersteuerung (40) durch Leiten von Strom von dem DC/DC-Wandler (30) an das Bordnetz, nachdem der externen Hilfsenergiebetrags der Wandlersteuerung (40) zugeführt wurde, wobei der externe Hilfsenergiebetrag direkt oder über das Bordnetz der Wandlersteuerung (40) zugeführt wird.

3. Verfahren nach einem der vorangehenden Ansprüche, wobei während dem Zuführen des externen Hilfsenergiebetrags zumindest eine Last von dem Bordnetz für zumindest ein Schutzzeitintervall abgetrennt ist, das mit dem Zuführen beginnt, wobei die zumin-

dest eine Last umfasst: ein Beleuchtungselement, ein Belüftungselement, ein elektrisches Heizelement, ein elektrischer Servoantrieb, eine elektronische Unterhaltungskomponente, eine durch geringen Ladezustand als Last wirkende Batterie, eine Aufladevorrichtung für eine Batterie oder für eine Bordnetzbatterie (20) oder eine Kombination hiervon.

4. Verfahren nach Anspruch 3, wobei das Starten des Verbrennungsmotors während des Schutzintervalls, am Ende des Schutzintervalls, nach dem Ende des Schutzintervalls oder zu einem Zeitpunkt ausgeführt wird, an dem das Bordnetz eine Energiemenge speichert, die zum erfolgreichen Starten des Verbrennungsmotor ausreicht, oder an dem das Bordnetz eine Energiebilanz aufweist, die zum erfolgreichen Starten des Verbrennungsmotor ausreicht.

5. Verfahren nach Anspruch 4, wobei das Schutzzeitintervall nach einem vorbestimmten Schutzintervall endet oder dann endet, wenn der Strom, der vom DC/DC-Wandler (30) in das Bordnetzes fließt, einen Schwellwert unterschreitet und/oder eine interner Spannung des Bordnetzes einen Schwellwert überschreitet.

6. Verfahren nach einem der vorangehenden Ansprüche, wobei das Gewährleisten des Betriebs der Wandlersteuerung (40) im wesentlichen durch Zuführen externer Hilfsenergie vorgesehen wird, wobei das Zuführen externer Hilfsenergie das Zuführen von elektrischer Leistung umfasst, mit der im wesentlichen nur die Wandlersteuerung (40) zumindest kurzfristig betrieben und/oder eine zum Betrieb der Wandlersteuerung (40) notwendige Bordnetzspannung zumindest kurzfristig erreicht wird, und/oder die zum Starten notwendige Energie im wesentlichen von dem DC/DC-Wandler (30) alleine oder von dem DC/DC-Wandler (30) in Kombination mit dem Bordnetz stammt, wobei die Menge der externen Hilfsenergie und/oder die durch die Hilfsenergie vorgesehene Versorgungsdauer des Bordnetzes einem Bruchteil derjenigen Energiemenge bzw. derjenigen Versorgungsdauer entspricht, die das Starten beansprucht.

7. Notversorgungsschaltung zur Versorgung einer Wandlersteuerung eines Hybridantriebs, wobei die Wandlersteuerung (40) eingerichtet ist, einen DC/DC-Wandler (30) zur Versorgung eines Bordnetzes aus einer Traktionsbatterie (10) des Hybridantriebs zu steuern, wobei die Notversorgungsschaltung einen Anschluss für eine externe Hilfsenergiequelle und eine und eine elektrische Verbindung zu einem Versorgungsanschluss der Wandlersteuerung (40) vorsieht, wobei die elektrische Verbindung für den Strombedarf der Wandlersteuerung (40) ausgelegt ist.

8. Notversorgungsschaltung nach Anspruch 7, die ferner eine Diode (60) und/oder einen Trennschalter umfasst, die bzw. der den Versorgungsanschluss der Wandlersteuerung gerichtet bzw. steuerbar mit weiteren Verbrauchern, mit Teilen des Bordnetzes, dem gesamten Bordnetz verbindet oder einer Bordnetzbatterie (20) verbindet, wobei der Trennschalter einen Umschalter, einen elektronischen Schalter oder ein Relais umfasst und eingerichtet ist, mittels manueller Betätigung oder mittels eines Steuersignal angesteuert zu werden, und die elektrische Verbindung eine direkte Verbindung ist, die mit dem Versorgungsanschluss bei geöffnetem Trennschalter verbunden ist.

9. Mobile Starthilfe-Energiequelle für Hybridfahrzeuge, deren Traktionsbatterie (10) eingerichtet ist, das Bordnetz über einen DC/DC-Wandler (30) zu versorgen, dessen Wandlersteuerung (40) vom Bordnetz versorgt wird, wobei die mobile Starthilfebatterie einen maximalen Norm-Entladestrom aufweist, der geeignet ist, die Spannung des Bordnetzes auf eine Spannung innerhalb eines zulässigen Betriebsspannungsbereiches der Wandlersteuerung zu erhöhen, wobei der Norm-Entladestrom nur einem Bruchteil des Strombetrags entspricht, der für einen Start eines Verbrennungsmotors erforderlich ist.

10. Mobile Starthilfe-Energiequelle für Hybridfahrzeuge nach Anspruch 9, die eine Nennkapazität aufweist, die einer Versorgungsdauer für das Bordnetzes von weniger als 1 Minute, weniger als 10 sec., weniger als 5 sec, weniger als 3 sec. oder weniger als 1 sec. entspricht.

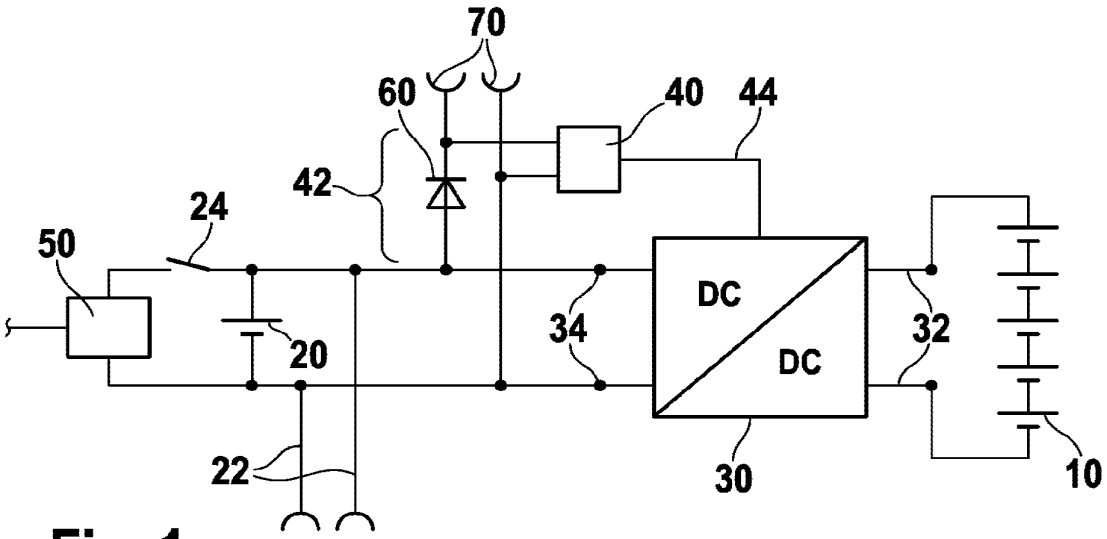


Fig. 1

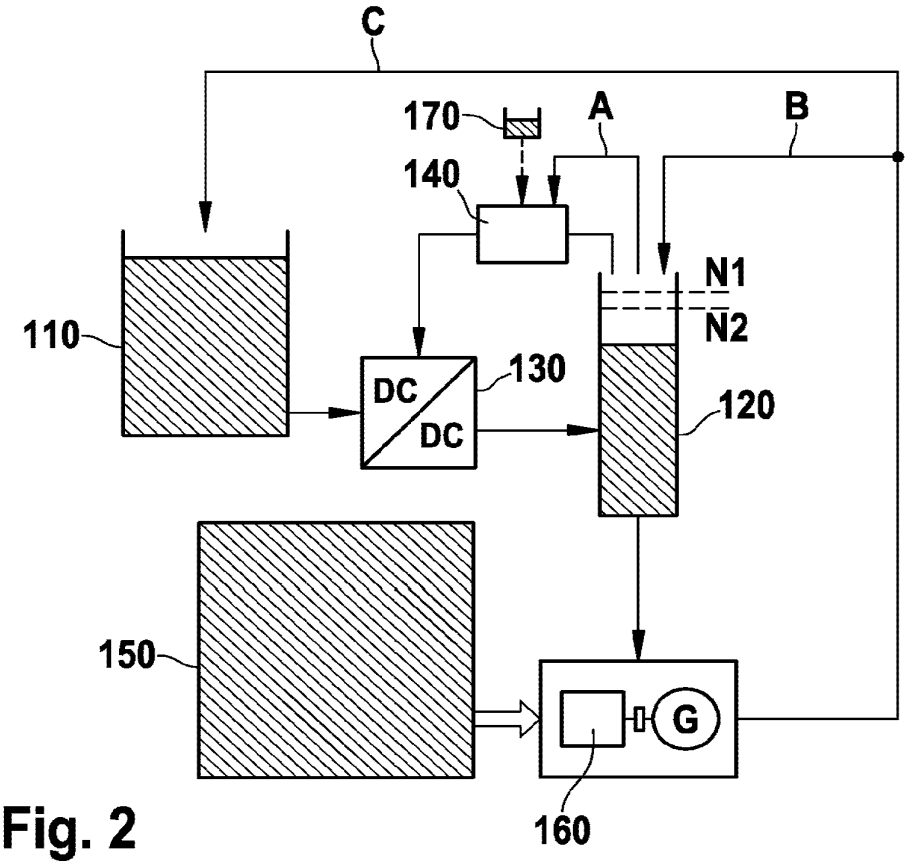


Fig. 2

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

Patents WO2009059852

Starting method for hybrid drives

Abstract

The invention relates to a method for starting a hybrid drive by means of an auxiliary energy source, said method comprising the following steps: an electric motor and an internal combustion engine are both provided in the hybrid drive for generating kinetic energy; a traction battery (10) for supplying the electric motor with traction energy, an on-board supply system for starting the internal combustion engine under normal operation, and a converter control system (40) for controlling a DC/DC converter (30) which is used to supply the on-board supply system from the traction battery (10), are provided, the on-board supply system supplying the converter control system (40). If the energy remaining in the on-board supply system is insufficient either for the operation of the converter control system (40) or for starting the internal combustion engine, during an emergency operation caused by an insufficient amount of energy in the on-board supply system, an external auxiliary energy quantity smaller than the amount of energy deficit is supplied to the converter control system (40) in order to at least temporarily ensure the operation of the converter control system. The DC/DC converter (30) is activated by the converter control system (40), and a quantity of start process energy from the traction battery (10) is fed into the on-board supply system via the DC/DC converter (30), which, together with the energy remaining in the on-board supply system, is sufficient for starting the internal combustion engine. As a result, the internal combustion engine is started. The invention also relates to an associated emergency supply circuit, and to a mobile auxiliary starting battery.

Classifications

B60L58/13 Maintaining the SoC within a determined range

View 11 more classifications

WO2009059852A2

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Claims

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claims

1. A method for starting a hybrid drive by means of an auxiliary power source with the steps:

Providing an electric machine and an internal combustion engine provided together for generating kinetic energy in the hybrid drive;

Providing a traction battery (10) for supplying the electric motor with traction energy, a vehicle electrical system for starting the internal combustion engine in normal operation, and a converter control (40) of a DC / DC converter (30) for supplying the electrical system from the traction battery (10) is provided, wherein the electrical system supplies the converter control; and, if, in an emergency operation due to an energy loss in the electrical system, the energy remaining in the electrical system is sufficient neither for the operation of the converter control (40) nor to start the engine: supplying an external auxiliary energy amount, which is smaller than the power loss to the converter control (40) to ensure the operation of the converter control (40) at least in the short term, activating the

DC / DC converter (30) by driving means of the converter control (40) and feeding a of the traction battery (10) originating starting energy amount, which is sufficient together with the energy remaining in the electrical system to start the engine, in the electrical system through the DC / DC converter (30); the method further comprising: starting the internal combustion engine by transmitting rotational energy from the initiator.

2. The method of claim 1, wherein the starting comprises: starting the internal combustion engine by means of a supply current of a vehicle electrical system battery (20) which is connected to the electrical system, and / or by means of a DC / DC converter (30) generated electricity, and supply the converter controller (40) by supplying current from the DC / DC converter (30) to the on-board network after the external auxiliary power amount has been supplied to the converter controller (40), the external auxiliary energy amount being supplied to the converter controller (40) directly or via the vehicle electrical system becomes.

3. The method according to claim 1, wherein during the supply of the external auxiliary energy amount, at least one load is disconnected from the vehicle electrical system for at least one protection time interval starting with the supply, the at least one load comprising: a lighting element, a ventilation element, an electric heating element, an electric servo drive, an electronic entertainment component, a low-load battery, a battery charger or an on-board battery (20), or a combination thereof

4. The method of claim 3, wherein the starting of the internal combustion engine is performed during the guard interval, at the end of the guard interval, after the end of the guard interval or at a time at which the electrical system stores an amount of energy sufficient to successfully start the internal combustion engine, or where the electrical system has an energy balance sufficient to successfully start the engine.

5. The method of claim 4, wherein the guard time interval ends after a predetermined guard interval or ends when the current flowing from the DC / DC converter (30) in the electrical system, below a threshold and / or an internal voltage of the electrical system Threshold exceeds.

A method according to any one of the preceding claims, wherein the operation of the converter controller (40) is substantially provided by supplying external auxiliary power, the supply of external auxiliary power comprising supplying electric power, substantially only the converter controller (40). operated at least in the short term and / or necessary for operation of the converter control (40) board voltage is achieved at least in the short term, and / or necessary for starting energy substantially from the DC / DC converter (30)

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

alone or from the DC / DC converter (30) comes in combination with the electrical system, wherein the amount of external auxiliary power and / or provided by the auxiliary power supply duration of the electrical system corresponds to a fraction of that amount of energy or the duration of supply, which claims the start.

7. Emergency supply circuit for supplying a converter control of a hybrid drive, wherein the converter controller (40) is arranged to control a DC / DC converter (30) for supplying an electrical system from a traction battery (10) of the hybrid drive, wherein the emergency supply circuit has a connection for a external auxiliary power source and one and an electrical connection to a supply terminal of the converter control (40) provides, wherein the electrical connection for the power requirement of the converter control (40) is designed. 8th

Emergency supply circuit according to claim 7, further comprising a diode (60) and / or a circuit breaker, the or the supply terminal of the converter control directed or controllably connected to other consumers, with parts of the electrical system, the entire electrical system or an on-board battery (20) connects, wherein the circuit breaker comprises a switch, an electronic switch or a relay and is arranged to be controlled by means of manual operation or by means of a control signal, and the electrical connection is a direct connection, which is connected to the supply terminal with the disconnector open.

9. Mobile jump-start power source for hybrid vehicles, the traction battery (10) is adapted to supply the electrical system via a DC / DC converter (30) whose converter control (40) is powered by the electrical system, the mobile booster battery has a maximum standard Discharge current, which is adapted to increase the voltage of the electrical system to a voltage within an allowable operating voltage range of the converter control, wherein the standard discharge current corresponds to only a fraction of the amount of current that is required for a start of an internal combustion engine.

10. Mobile jump-start power source for hybrid vehicles according to claim 9, which has a nominal capacity that a supply duration for the electrical system of less than 1

Minute, less than 10 seconds, less than 5 seconds, less than 3 seconds, or less than 1 second.

Description

description

title

Starting procedure for hybrid drives

State of the art

The invention is based on known starting method for starting a hybrid drive. Vehicles with hybrid drives include a traction battery that powers the drive's electric motor. The traction battery is charged according to the known hybrid method of the internal combustion engine of the drive and has a significantly higher operating voltage (greater than 300 V) than the electrical system (12 V, 24 V) of the vehicle. While the electrical system is powered by a board battery, such as a lead-acid battery, as is also provided for conventional internal combustion engine vehicles, and thus supplies almost all components of the vehicle with power, the traction battery is only the power supply to the electric motor.

Except for the electric motor all components of the vehicle are designed for the operating voltage of the electrical system, whereby components of conventional internal combustion engine vehicles can be used.

There are hybrid drives known which have a DC / DC converter (DC / DC converter), which uses the voltage of the traction battery to feed the electrical system after conversion of the voltage. Such a DC / DC converter is, like almost all other components of the drive, fed by the electrical system. Usually, the converter control of the DC / DC converter is part of a controller that controls the electrical energy budget in the motor vehicle and, for example, also controls the alternator and the like. Such control, like the controlled components, is designed for an operating voltage of 12V. In addition to the different performance functions between on-board battery and traction battery is the lethal high voltage of the traction battery of the reason that both circles are strictly separated.

Therefore, in the case of known hybrid drives, the case may occur that, although the traction battery is sufficiently charged, it does not supply any electrical power to a drained on-board battery or can be transmitted to a supported electrical system, because the control of the DC / DC converter, which is set up to transmit the power, can not be activated due to the low operating voltage in the electrical system. As already noted, it is very difficult in terms of isolation and design to accommodate the converter control and other control elements in the traction battery network.

The document DE 41 38 943 C1 describes two memories, d. H. a memory for a vehicle electrical system and a starting memory for supplying a starter to separate the effects of the starter on its supply network from the electrical system. However, this document relates to the power supply of a conventional engine drive, which has no traction battery, which is separated from the electrical system.

The document DE 101 00 889 A1 also includes the power supply of an internal combustion engine drive. The document proposes to use two partial supply networks as a vehicle electrical system to provide redundancy for the startup process. However, like the above-mentioned document, the document does not disclose a circuit structure typical of a hybrid engine and does not discuss specific situations associated with this structure.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

It is an object of the invention to provide a mechanism with which the internal combustion engine of a hybrid drive can be permitted if the vehicle electrical system voltage is too low.

Disclosure of the invention

By means of the method according to the invention, it is possible to connect with a starting aid

Significantly reduce effort, with the requirements for an external jump start are significantly reduced. The jump-start can be provided significantly cheaper, lighter and smaller with the inventive method. At the same time, in contrast to starting aids according to the prior art, energy storage with low capacity and power are. In addition, the necessary currents are many times lower than in the prior art, so that almost any cable can be used. Furthermore, it is not necessary due to the low current to contact the electrical system battery directly. Rather, numerous fuses protected vehicle electrical system contacts can be used, such as the cigarette lighter socket.

Compared to the prior art, the requirements for the external jump start with respect to supply duration and supply power are significantly reduced. With the method according to the invention and the device according to the invention, a hybrid motor can be switched with a starting aid which supplies energy only for a very short time, for example shorter than the supply duration of the starter during starting, and which delivers a very low current, which is significantly lower than the supply current of the starter is. It has been recognized that supply systems according to the prior art result in deadlocks, so that despite existing energy no carry (and thus no startup) can take place, since the function of the element that controls the transmission depends on the state of the electrical system.

According to the invention, the system deadlock is achieved by activating the control of the energy transfer by means of auxiliary energy, whereby the available energy is mobilized with little effort. In contrast, prior art methods are not aimed at mobilizing existing energy, but instead provide the system with a high amount of energy from outside that corresponds to the shortfall in order to be able to start with a weak on-board network. According to the inventive method, the energy of the traction battery thus takes the place of a conventional external booster battery, as used in conventional methods.

While in the prior art the jump-start had the purpose of completely supplying the power loss that the on-board battery lacks for a successful startup operation, the invention is based on the concept of providing a self-help cascade that is started by activating the element with the lowest consumption , The activation mobilizes energy (the traction battery) that can be used for the boot process. The energy required for the starting process according to the invention is almost completely supplied by the traction battery. The invention is therefore not focused on the provision of energy, but provides a mechanism for mobilizing the energy stored in the traction battery.

According to the invention, not the starting process itself but the mobilization of existing energy reserves is supported, it being recognized that this can be achieved very effectively, in that neither the starter nor the on-board battery, nor the DC / DC converter has to be put into operation, but only the converter control. According to the invention, a cascade is triggered by the activation of the converter control, which automatically leads to sufficient power supply of the starter. According to the invention, therefore, with a small amount of current, the converter control is put into operation only for a short time in which it is supplied with power by means of an external energy source for a short duration.

Then, the DC / DC converter is automatically put into operation, which provides a high power flow from the traction battery into the electrical system in the permanent, self-sustaining commissioning of the converter control. The converter control system therefore only has to be supplied with energy until the converter itself supplies sufficient power from the traction battery to the vehicle electrical system and in particular to the converter control. In order to compensate for the energy balance, according to the invention the combustion engine is started as a further cascade step, so that both traction battery and vehicle electrical system or On-board battery can balance their energy balance.

Therefore, the inventive method provides to activate the converter control by means of an external auxiliary energy amount, wherein the auxiliary energy amount is below the amount of energy that has to be additionally applied for starting. The energy is only for one

Time duration is provided, which corresponds to the activation of the DC / DC converter, and thus is less than the time period for which the starter must be supplied with electrical power for a successful startup. When the converter control is activated, it can itself be supplied directly with the auxiliary power, or it can be activated via the vehicle electrical system or via parts of the electrical system to which the converter control is connected.

Preferably, not all loads that are connected to the electrical system, simultaneously supplied with the supply of the converter control with power. In a preferred embodiment, the current flow is controlled such that primarily the converter control receives electrical power from the auxiliary power source. This can be provided, for example, by a connection for the auxiliary power source being connected directly to the converter control, whereas the rest of the on-board network is connected to the converter control via a current-steering or current-control device. For example, a diode may be provided between the converter control and the rest of the vehicle electrical system, which diode is provided in the forward direction of the vehicle electrical system for converter control in the connection between converter control and vehicle electrical system.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

In normal operation, d. H. if the vehicle electrical system has rated voltage, supply current from the on-board network then flows to the converter control, whereas with low on-board network voltage, no current flows from the converter control system into the on-board network even if it receives nominal voltage directly. Therefore, the underlying concept of the invention is implemented by a supply circuit for the converter control or for a controller that includes the converter control, and although allows the flow of current from the electrical system to converter control, but a current flow from the supply terminal of the converter control in the electrical system prevented. Preferably, a diode is provided for this purpose, for example a Schottky diode.

If a converter control is connected via such a connection to the electrical system, then according to the inventive method, an auxiliary power source or Start-up power source can be coupled to the converter control without electrical power from the auxiliary power source flows into the electrical system and other loads. Rather, this ensures that the entire portion of the electrical power or at least a large part thereof, from the auxiliary power source actually flows to the converter control. Thus, the auxiliary power source is protected and can be designed with a small capacity. At the same time it is prevented that the auxiliary power source is loaded with other loads than the converter control, whereby the auxiliary power is used effectively and significantly for the activation of the converter control.

For this purpose, a disconnect switch can be used, which in an emergency situation with too low vehicle electrical system voltage loads or disconnects the vehicle electrical system from the converter control to ensure that the auxiliary power is substantially completely used only to supply the converter control. If, after activation of the converter control, the DC / DC converter is supplied, the circuit breaker can be folded again, so that the converter control of the vehicle electrical system, which now has a sufficient voltage, is powered. In the same way, the diode allows that when a nominal operating voltage of the vehicle electrical system, the converter control is supplied again in the usual way from the electrical system.

The supply line between a connection for the auxiliary power source and the converter control can be designed for low currents, i. H. for common currents that occur during operation of the converter control. In particular, already provided, secure connections, such as connections with which the cigarette lighter socket is connected to the electrical system, since they are sufficient to supply the converter control. In contrast, the prior art provides to feed a starter current directly into the electrical system, wherein due to the height of the injected current no secure connections can be used and at least the cigarette lighter socket due to the high starter current can not be used for this purpose.

The converter control typically includes a microprocessor with software or logic circuitry that requires a power supply of less than 1 A and typically between 1 mA and 100 mA to activate the DC / DC converter. Accordingly, the auxiliary power source according to the invention is provided with a capacitor which supplies a minimum voltage, for example 10 V, 11 V or 11.5 V, for a period of time which the converter control needs to deliver an activation signal to the DC / DC converter. In the case of a hard-wired logic circuit, the minimum supply duration through the auxiliary power source is thus less than 1 second, typically between 5 and 100 milliseconds.

If the converter control is provided by a microprocessor and software running on it, similar values can also be obtained, and depending on the converter control initialization process, it may be necessary to maintain converter control operation for at least 1 second, but less than 3 seconds. Does the auxiliary power source, the converter control with a voltage that is always above a minimum operating voltage, d. H. never falls below 10 V, 11 V, or 11.5 V, this can be used to activate the DC converter, which supplies the vehicle electrical system and the converter control. Preferably, the auxiliary power source provides a voltage of 12V at a load of 10-100mA for typically 1, 3, 5 or 10 seconds.

For cost reasons and for better handling, however, the auxiliary power source is preferably configured to provide the supply for a maximum of 10 seconds, a maximum of 30 seconds, a maximum of 1 minute or a maximum of 5 minutes at a current of 10-100 mA. The auxiliary power source may thus be a high capacitance (greater than 0.1 F) electrolytic capacitor, a capacitive capacitance goldcap capacitor, preferably a series connection of galvanic cells that are rechargeable or non-rechargeable, such as alkaline manganese batteries, zinc-air batteries. May be batteries, lithium cells or similar primary cells, or may be secondary cells such as lead-acid batteries, nickel-cadmium storage batteries, nickel-metal hydride storage batteries, lithium-ion secondary batteries or similar accumulators which may have solid or liquid electrolytes.

In particular, alkaline-based 12V alkaline batteries of low capacity, such as those used for mobile devices, are suitable. The rated voltage of the series connection of galvanic cells is preferably about 12 V, at least 12 V or at least 14 V. Further, a combination of a battery pack and a boost converter may be used, with the battery pack providing a voltage lower than 12V, for example 3.6V or 9V, and the boost converter is arranged to convert the battery voltage to a voltage at which the battery packs Converter control can be operated, for example, by using a boost converter with a regulated output voltage of 10-14 V or about 12 V.

The auxiliary current element is preferably not designed for continuous operation, but only for a short operation of less than 1 minute or less than 10 seconds duration. Further, when an up-converter is used to achieve the rated voltage of the converter control, a control is preferably provided to connect the converter to the battery only during operation to prevent discharge by the quiescent current of the boost converter. In another embodiment, instead of or in combination with a battery, a hand dynamo is used, which is suitable to provide a voltage of 12 V, for example due to the number of turns or due to an up-converter.

Since only a small operating current for a short time is necessary to activate the converter control, hand generators, as they are also used for mobile devices, suitable for short-term operation of the converter control. Further, solar cells may be used, optionally in combination with a boost converter, providing a rated output power of 10-100 mA at 12V. Furthermore, it is basically possible to use the power supply of a USB port, for example a laptop, to reach a voltage of 12 V from the operating voltage of 5 V by means of an up-converter.

Therefore, the erfindungsgemäße auxiliary power source can also be provided by means of an adapter, the supply current of a USB port to a voltage of 12 V converts, for example, at a load of 50 mA to operate the converter control short-term. Optionally, in addition to the boost converter in the above-mentioned embodiment, intermediate buffer memories can also be provided which support short-term

EXHIBIT 1002
Page 1993 of 2306 Petitioner ADC (IPR2024-00671)

operation of, for example, less than 3 seconds.

In a particularly preferred embodiment, the mobile jump-start power source providing an auxiliary power amount comprises an array of 2-8 zinc / carbon batteries, alkaline batteries, nickel metal hydride batteries or nickel cadmium storage batteries, for example in the form of mignon cells, which in combination with a boost converter Provide output voltage of 12 V at 20, 50 or 100 mA. The boost converter may be eliminated if 8 or more alkaline or zinc / carbon batteries are used, or if 10 or more nickel metal hydride or nickel cadmium storage batteries are used. The boost converter preferably includes an actuator such as a switch that completely disconnects and connects the boost converter from the battery cells when actuated.

The term "auxiliary power source" is hereby equivalent to "jump-start power source" and refers to an (external) energy storage, which stores a Hilfsenergiebetrag and can deliver to the converter control.

To the auxiliary power source or In order not to unnecessarily burden the starting aid energy source, preferably loads of the electrical system such as lighting, ventilation, heating, servo drive, hi-fi component or the like are switched off, preferably by means of a jointly actuable circuit device. This circuit device can be provided, for example, between the supply of the converter control and the rest of the electrical system in order to switch off the electrical system during the activation of the converter control. Alternatively, or in combination, the starter, which is a heavy load, is blocked or not activated, so as not to unnecessarily burden the insufficient auxiliary power source or to empty.

For this purpose, for example, a guard interval can be provided which blocks the supply of power to the starter during the activation process of the converter control, wherein the guard interval may be a predetermined guard interval, which depends on the usual length of the activation process of the converter control, or may be a guard interval with variable End, which ends when it is detected that the electrical system by the energy transfer from the traction battery provides enough energy to start. Preferably, this is detected, whether the electrical system or the vehicle electrical system battery has sufficient energy by detecting a battery current or by detecting the voltage applied to the battery.

Criteria for terminating the guard interval are therefore a low charging current, which indicates a sufficient charge level of the vehicle electrical system battery, and / or a terminal voltage at the accumulator, which reaches a certain height, which also indicates a high charging level of the vehicle electrical system battery. Likewise, the guard interval can be terminated when it is detected that the DC / DC converter sufficiently supports the vehicle electrical system, for example, by detecting whether the DC / DC converter has sufficient power or generates sufficient power to bring the electrical system to a sufficient voltage.

In particular, it can be detected whether a chopper circuit generates an AC voltage within the DC / DC converter, this being evaluated as a signal that sufficient electrical power is generated for the electrical system, so that no further supply of the converter control by the auxiliary power source is necessary.

Brief description of the drawings

Embodiments of the invention are illustrated in the drawings and explained in more detail in the following description.

Show it

FIG. 1 shows a circuit principle for connecting the starting aid energy source according to the invention to the converter control and the vehicle electrical system; and FIG. 2 shows a course of action of the cascade provided by the method according to the invention.

Embodiments of the invention

FIG. 1 shows a circuit principle which can be used to describe the method according to the invention. The circuit of FIG. 1 includes a traction battery 10, an on-board battery 20, a DC / DC converter 30, which connects the traction battery 10 to the onboard power supply battery 20, and a converter controller 40, which controls the DC / DC converter 30. The control of the DC / DC converter 30 by the converter control 40 is provided via a converter control line 44. The converter is further powered by an input 32 from the traction battery 10 to convert it and output at an output 34 of the DC / DC converter 30. In this way, electrical energy can be fed from the traction battery into a vehicle electrical system and, in particular, into the vehicle electrical system battery 20, which is connected to the vehicle electrical system.

For example, at the terminals 22 can connect a vehicle electrical system with the associated loads. The vehicle electrical system connection 22 is connected in parallel to the vehicle electrical system battery 20, wherein the vehicle electrical system, in addition to the loads such as lighting, heating, ventilation, other controls, ignition voltage generator and the like also includes a Stromgenera-gate, such as an alternator to charge the electrical system battery 20 in a way as known from internal combustion engine-powered vehicles. The onboard power supply battery 20 is further connected via a switch 24 to a starter 50, which generates a torque, which is supplied directly to the internal combustion engine and starts this by supplying a starter current (typically significantly more than 20 A). Furthermore, a current limiter or a fuse can be provided between the DC / DC converter 30 and the onboard power supply battery 20.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

The converter control 40 is supplied with electrical energy via a connection circuit 42 from the onboard power supply battery 20 in order to ensure the operation of the controller 40. The controller 40 may only have the function to drive the DC / DC converter 30, whereby a minimum power consumption is achieved. Further, it is possible that the converter controller 40 is part of a controller that includes other functions, such as power management and others. Preferably, the function of the converter control can be activated individually in order not to unnecessarily have to deliver additional functions in the case of a jump-start auxiliary power supply. The primary function of the converter control is to activate the DC / DC converter 30 to transfer energy from the traction battery 10 to the on-board network, and in particular to the battery 20.

In particular, it is the task of the converter controller 40 to send an activation signal to the DC / DC converter 30, which thereupon generates energy with which the converter controller 40 can supply itself with energy. By this self-preservation, it is possible to be able to start-jump with very small amounts of energy, in particular with amounts of energy that are sufficient essentially only for delivering an activation signal to the DC / DC converter 30. The ensuing self-holding effect, fed from the traction energy 10, allows a continuous activation of the circuit. In an alternative embodiment, which is not shown in FIG. 1, an external jump-start function takes over the function of the converter control 40 and outputs an activation signal directly into the line 44, so that the activation signal is output directly to the DC / DC converter 30.

As a result, electrical energy is emitted from the traction battery 10 into the electrical system and, in particular, to the converter controller 40.

The connection 42, which connects the power supply input of the converter control 40 to the vehicle electrical system, preferably comprises a diode 60, which has the function of protecting an external power source, which is connected via the terminals 70 directly to the supply terminal with the converter control 40. With emptied electrical system battery 20 and applied auxiliary power 70, without the diode 60, a current flow from the starting aid energy source via the connection 70 into the vehicle electrical system 22 and the vehicle electrical system battery 20 would result. As a result, the energy flow to the converter controller 40 is reduced so that the converter controller 40 does not receive sufficient energy to activate the DC / DC converter 30. In this case, the diode 60 blocks the undesired outflow of electrical energy from the starting aid source 70 to the onboard power supply battery 20 and the onboard power supply 22.

Furthermore, the diode 60 fulfills a further function, namely the maintenance of the voltage supply of the converter control 40. If this has been successfully activated, the DC / DC converter 30 transfers energy from the traction battery 10 to the electrical system and, in particular, to the onboard power supply battery 20. Therefore, for example, at the terminals 34 of the DC / DC converter 30, there is a preferably regulated standard voltage, for example 12 V, which is also provided by the external starting aid at the terminals 70. Even if the applied jump start at the terminals 70 has a low voltage or is no longer connected, the diode 60 supplies in the forward direction the converter control 40 with the voltage which is present at the output 34 of the DC / DC converter 30 and also at the onboard power supply battery 20 is applied.

In the flow direction, the diode 60 therefore serves to self-sustain the supply of the converter control 40.

If, by successful activation of the DC / DC converter 30, the energy balance of the electrical system and the on-board battery 20 is balanced, the switch 24 can be actuated, which is preferably designed as a start relay to supply the starter 50 with power. The power may be generated entirely by the DC / DC converter 30, to a part of the DC / DC converter 30 and to a part of the onboard power supply battery 20 or, after the DC / DC converter 30, the battery 20 sufficiently, partially or has completely charged, essentially from the on-board battery 20. In order not to overload the DC / DC converter 30 in that it serves both for charging the onboard power supply battery 20 and for supplying the starter current, a guard time interval can be provided which ensures that the onboard power supply battery 20 can provide a substantial portion of the starter current.

The converter 30 preferably comprises an internal control or Control, which is preferably powered by the traction battery 10 with voltage.

FIG. 2 shows the course of action of the cascade, which is provided by the method according to the invention. The amounts of energy or Amounts of benefit that are relevant to the process are shown as dashed areas. The size of the area corresponds to the amount of power or Energy stored or necessary for operation. The size of the area of the open rectangle, in which the hatched areas are accommodated, corresponds to the maximum capacity or the maximum power consumption of the respective component. Denoted by reference numeral 170 is a mobile booster that has a relatively small capacity (open rectangle area) and in which a small amount of energy (shaded area) is stored.

The starter battery 120 should initially be insufficiently charged, represented by a shaded area which is below the level N1 and N2. The level N1 is the voltage level or Power supply level, which is necessary for the operation of the starter device, and the level N2 corresponds to the voltage level, from which a controller 140 of a DC / DC converter 130 can be operated. Although a traction battery 110 contains sufficient energy, it can not be transferred to the onboard power supply 120 because the converter 130 can not be activated. The auxiliary power 170 is not used to fill an energy penalty in the onboard power supply 120, but is routed directly to the converter control 140. This requires a significantly lower amount of energy.

As a result, as already described, the converter control 140 is activated, which in turn activates the DC / DC converter 130, at least for a short period of time, thereby enabling energy flow from the traction battery 110 to the onboard power supply battery 120. Thereby, the power loss in the on-board battery 120 can be compensated, whereby the levels N1 and N2 are achieved. Upon reaching the level N2, the power requirement of the converter controller 140 may be borne by the system itself, whereby the supply of energy by an external start-up aid 170 is no longer necessary. As a result of the one-time activation by means of the external energy source 170, a first conservation function can be realized, represented by the arrow A.

EXHIBIT 1002
Page 1995 of 2306 Petitioner ADC (IPR2024-00671)

The energy of the traction battery 110 is transferred to the on-board battery 120 so that it can be charged, but the traction battery is discharged in the long term. To prevent this, a second self-sustaining stage is initiated by supplying fuel energy 150 to the system. The amount of energy 150 can thus represent the fuel in the tank of the motor vehicle. This is used to by means of the internal combustion engine and the alternator or the e-machine to generate energy.

For this purpose, internal combustion engine 160 is started by means of energy from the onboard power supply battery 120 and / or from the traction battery 110 (converted by the DC / DC converter 130, for example via an electric starter, so that the energy balance of the traction battery 110 and the energy balance of the vehicle electrical system battery 120 via the power supply lines B and C is balanced.

After the auxiliary power source 170 has been used in a first cascade stage to use the traction battery 110 as an energy source for the onboard power supply battery 120 and in particular for the converter control 140, a second cascade stage is to start the engine 160 with the aid of the onboard power supply battery 120. A first self-preservation mechanism associated with the first cascade stage is represented by the arrow A according to which, after the DC / DC converter 130 is activated, the converter controller 140 can be energized by the DC / DC converter 130 and thus derived from the traction battery 110. As the second self-sustaining mechanism associated with the second cascade stage, the energy generated by the combustion motor 160 is used to power the traction battery 110 and / or the on-board battery 120.

In particular, the supply of the electrical system battery 120 via the connection B is necessary to ensure that the electrical system has sufficient energy to ensure the engine control and in particular the ignition of the engine. Thus, according to the second self-sustaining mechanism, a part of the power generated by the internal combustion engine 160 is used to maintain the operation of the internal combustion engine itself.

Although the areas shown in Figure 2 and their equivalents (amount of energy, capacity) are not to scale, it can be seen that with a very low energy 170, a mechanism can be triggered with which a large amount of energy in the electrical system battery 120 can be compensated. It is therefore possible to trigger a two-stage mechanism via the first and the second cascade stage with the small amount of energy 170, at whose end, instead of the auxiliary energy 170, the entire energy of the fuel tank 150 is activated and mobilized.

In the first cascade stage, the DC / DC converter 130 is activated, thereby mobilizing the energy of the traction battery 110, wherein in the second cascade stage, the engine 160 is activated (by starting) and thus the energy of the fuel tank 150 is mobilized and the entire system is available. The mobilization of the respective energies (1. : from the traction battery 110, 2. : from the fuel tank 150) is also used for self-preservation, d. H. for supplying power to the component (1. : Converter control, 2. : Internal combustion engine), which directly or indirectly provides for the mobilization of the respective energy.

According to one embodiment, the circuit according to the invention comprises a circuit breaker, preferably a main contactor, which is provided between the traction battery and the input of the DC / DC converter. In particular, the main contactor is arranged together with the traction battery in a battery case. The main contactor is designed as a closer, which connects the traction battery with the Tranktionsbatterieanschluss and thus with the rest of the high-voltage network when activated. According to the invention, the main contactor is closed when the auxiliary power source is connected or connected. The main contactor is therefore driven directly or indirectly (via another controller) by the converter control to connect the DC / DC converter with its activation with the traction battery.

As a starter, an electric motor or a starter relay can be used, the or which is intended only for this purpose. The use of a starter motor in addition to the electric motor of the electric drive (which is preferably also mechanically connected to start the internal combustion engine with this) leads to redundancy and thus to higher availability. However, there are cost savings if, instead of a separate starter, the electric motor of the electric drive of the hybrid drive used for starting, which also generates the traction energy when the hybrid drive uses the traction battery to propel the vehicle. In this case, the electric motor is connected to the internal combustion engine and transmits a starter torque or Rotation energy via a clutch and / or a transmission to the engine or at the crankshaft.

If the electric motor of the drive is used as a starter, then it is sufficient that the converter control initially activates only the main contactor so that the intended as a traction electric motor starter (i. H. the traction electric motor) receives the energy directly from the traction battery. In addition, to supply the electronics of the internal combustion engine (spark generator, control of the fuel supply, ignition control, etc.) the u. a. is needed to start the engine, the DC / DC converter can be activated. In this case, not all of the energy for starting the internal combustion engine is taken from the traction battery via the DC / DC converter in the corresponding cascade, but only the part which is needed to control the internal combustion engine (and further components of the 12 V vehicle electrical system) ,

The other part for generating the rotational energy for the starting process is fed directly from the traction battery. The inventive control thus includes not only the activation of the DC / DC converter, but also the AnSteuerung the electric motor so that this energy of the traction battery directly converts into mechanical rotational energy to start the engine. The converter control activates in this case first the main contactor, whereupon a start control of the electric motor, the internal combustion engine and the DC / DC converter is activated. The converter control is thus preferably connected directly to the main contactor or to a main contactor control. Alternatively, the starting operation may be performed by the drive's electric motor after or with the activation of the DC / DC converter to provide a starting control with 12V operating voltage, if desired.

The converter control may be connected directly to the main contactor via a main contactor control, or via a control line passing through the DC / DC converter. If the starting operation is performed by the electric motor fed directly from the traction battery (via

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

the main contactor), then the DC / DC converter can be designed for a lower load, which substantially corresponds to the load by the engine control, for example approx . 200W or <500 W. According to the invention relates to the supply of the starter by the traction battery starting the engine in normal operation, the supply of the control of the internal combustion engine by means of activated DC / DC converter. Another aspect of starting is then generating the rotational energy by the electric motor fed directly from the traction battery.

Furthermore, in addition to the electric motor and other components can be fed directly from the high-voltage traction battery, eg. a power steering or a (air) compressor. These components can be designed by the higher operating voltage for significantly lower currents; this also applies to associated switches or drive circuits. Preferably, such additional components are initially deactivated until the internal combustion engine has started and, for example, has reached a desired rotational speed. After the engine can contribute to maintaining the energy balance (i.e., after startup), these additional components can be reactivated or activated as needed.

In the above case, in which the starter is supplied directly from the traction battery, a circuit, as shown in Fig. 1, would result in the wiring of the starter, which is not connected to the 12-board electrical system, but on the traction battery or another point of the high-voltage network operated by the traction battery, eg. the input of the DC / DC converter. Preferably, in this case, a switching element would be provided between the high-voltage network and the starter, which is controlled by a high-voltage starter control or another controller (for example, by the converter control). The switching element and / or the associated control can in principle be supplied directly by the traction battery, or by the DC / DC converter, which is activated in this case before the starting process as described above.

In particular, the definition of starting in claim 1 relates to the supply of the engine control via the DC / DC converter and the supply of the starter via the DC / DC converter or directly via the traction battery, depending on whether the starter from the electrical system and thus from DC / DC converter is powered, or the starter (and optionally a starter control) is powered by the traction battery network.

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EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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Priority And Related Applications

Priority Applications (2)

Application	Priority date	Filing date	Title

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

DE102007052750.2		2007-11-06	
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Applications Claiming Priority (1)

Application	Filing date	Title
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Legal Events

Date	Code	Title	Description
2009-07-08	121	Ep: the epo has been informed by wipo that ep was designated in this application	**Ref document number:** 08804986 **Country of ref document:** EP **Kind code of ref document:** A2
2010-06-02	WWE	Wipo information: entry into national phase	**Ref document number:** 2008804986 **Country of ref document:** EP

Concepts

machine-extracted

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Name	Image	Sections	Count	Query match
combustion reaction		claims,abstract,description	34	0.000
activating		claims,description	3	0.000
ventilation		claims,description	3	0.000
electric heating		claims	1	0.000
electricity		claims	1	0.000
initiator		claims	1	0.000
method		abstract,description	10	0.000

Show all concepts from the description section

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(54) **Title**: USB OUTLET CHARGER

(57) **Abstract**: Disclosed is a Universal Serial Bus (USB) charging module for installation with a surface mounted power outlet. The charging module allows convenient and flexible installation in certain new and already installed power outlets to provide a convenient charging facility of devices with USB connection. Also disclosed is a housing for the charging module, a charging circuit and a method of installation.

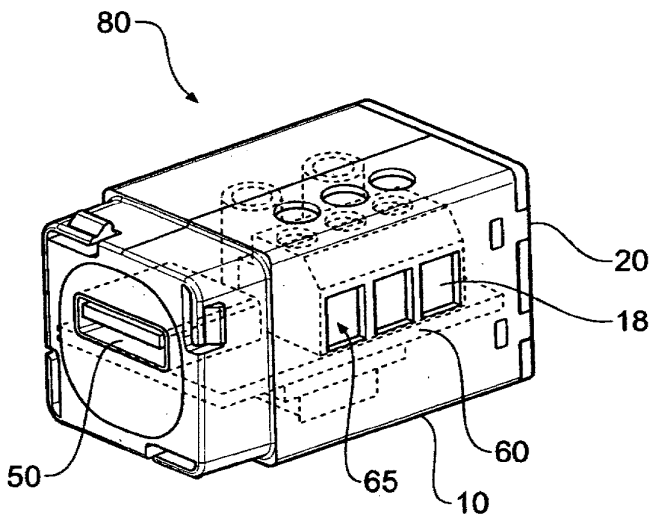


Figure 8

WO 2012/068635 A1

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

USB OUTLET CHARGER

FIELD OF THE INVENTION

The present invention relates to an electrical power outlet in a building such as a hotel, office or home. In a particular form, the invention relates to a power outlet providing an interface for charging Universal Serial Bus (USB) compatible devices.

PRIORITY

The present application claims priority from Australian Provisional Patent Application No. 2010905218 entitled "USB Outlet Charger" filed on 25 November 2010.

The entire contents of this document are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

Many electronic devices such as mobile phones, mp3 players and digital cameras are charged through USB ports in either a computer or a USB Alternating Current (AC) adaptor which may be plugged into a wall socket or power outlet. Charging devices through a USB port on a computer requires the computer to be switched on and also prevents other peripheral devices such as mice and memory devices from accessing the port while in use. By using a USB AC adaptor the electronic device may be charged at a wall socket or power outlet. One portion of the adaptor has AC prongs which engage into AC receptacles of the wall socket while another portion of the adaptor has a USB port to interface with a USB connector of an appliance or electronic device to be charged. The disadvantage with this arrangement is that the USB AC adaptor is a separate component that must be purchased and carried around and also that the AC prongs will only be suitable for a particular country or region. This leads to another drawback with using USB AC adaptors in foreign countries, namely that additional AC adaptors are necessary to engage with sockets found in different areas around the world.

There are also USB wall outlets wherein the USB charger is integral with the power outlet. Having the USB charger integral with the power outlet can lead to increased complexity during installation and costly repair and replacement of parts.

An object of the present invention is to ameliorate one or more of the above described difficulties or at least provide a useful alternative for charging USB compatible devices.

Other advantages of the present invention will become apparent from the following description, taken in connection with the accompanying drawings, wherein, by way of illustration and example, several aspects and embodiments of the present invention are disclosed.

EXHIBIT 1002
Page 2001 of 2306 Petitioner ADC (IPR2024-00671)

SUMMARY

In one aspect of the invention, there is proposed a Universal Serial Bus (USB) charging module housing adapted for securement to a surface mountable power outlet, the housing including:

an engaging portion for connecting the housing to a supporting portion of the power outlet;

access means to allow a USB charging circuit to be inserted into the housing; and

an aperture for allowing external access to a USB port.

In one form, the USB charging module housing further includes at least one aperture for receiving wires carrying mains power.

In one form, the access means to allow the USB charging circuit to be inserted into the housing is provided by an aperture in an external face of the housing.

In one form, the aperture is covered by a removable portion.

In one form, the removable portion includes at least one aperture for receiving wires carrying mains power.

In one form, the supporting portion of the power outlet is an integral portion of a grid or face plate.

In another form, the supporting portion of the power outlet is located in a mounting plate that is adapted to be connected to the rear of a grid or face plate.

In one form, the housing is connected to the supporting portion of the power outlet from the front of the grid or face plate.

In one form, the housing is connected to the supporting portion of the power outlet from the rear of the grid or face plate.

In one form, the engaging portion of the USB charging module housing includes a plurality of clips extending outwardly from one or more exterior faces of the housing, said clips for engagement with one or more surfaces of the supporting portion of the power outlet in a snap fit arrangement.

In one form, the clips have a tapered front face and a substantially vertical rear face.

EXHIBIT 1002
Page 2002 of 2306 Petitioner ADC (IPR2024-00671)

In one form, the USB charging module housing has an aperture located on the front face of the housing for allowing external access to a USB port.

In a further aspect of the invention there is proposed a USB charging module adapted for securement to a surface mountable power outlet, the charging module including:

a USB port;

a USB charging circuit that is capable of receiving a mains power input;

a housing, said housing including an engaging portion for connecting the housing to a supporting portion of the power outlet; access means to allow the USB charging circuit to be inserted into the housing and an aperture for allowing external access to the USB port.

In one form, the USB charging module includes a USB charging circuit with a printed circuit board (PCB).

In one form, the USB charging module includes a plurality of wires that are soldered directly to the PCB for connection to mains power either directly or via a switch.

In another form, the USB charging module includes a terminal block mounted on the PCB for connection to wires carrying mains power either directly or via a switch.

In other embodiments, there are provided screwed terminals for wire termination.

In a further aspect of the invention there is proposed a surface mountable power outlet for allowing a user to charge a USB compatible device, the power outlet including:

a supporting portion;

a USB charging module including a USB port; a USB charging circuit that is capable of receiving a mains power input; a housing, said housing including an engaging portion for connecting the housing to the supporting portion of the power outlet; access means to allow the USB charging circuit to be inserted into the housing and an aperture for allowing external access to the USB port;

a grid or face plate adapted to allow a user to access the USB port;

a connection between the USB charging module and mains power; and

mounting means for mounting the power outlet to a mounting surface.

In one form, the mounting surface is a wall or floor.

In one form, the power outlet further includes a cover plate.

EXHIBIT 1002
Page 2003 of 2306 Petitioner ADC (IPR2024-00671)

In one form, the mains power is between about 100-240V alternating current (AC).

In a further aspect of the invention there is proposed a method of installing a power outlet for allowing a user to charge a USB compatible device as herein described, comprising the steps of:

connecting the engaging portion of the USB charging module housing to the supporting portion of the power outlet;

connecting the mains power to the USB charging module; and

mounting the power outlet to the mounting surface.

In a further aspect of the invention there is proposed a method of installing a power outlet for allowing a user to charge a USB compatible device as herein described, comprising the steps of:

connecting the engaging portion of the USB charging module housing to the supporting portion of the power outlet;

connecting the mounting plate to the rear of a grid or face plate.

connecting the mains power to the USB charging module; and

mounting the power outlet to the mounting surface.

In one form, the power outlet is attached or mounted to the mounting surface by fastening the grid or face plate to the surface by screws.

It will be understood that the term "comprise" and any of its derivatives (e.g. comprises, comprising) as used in this specification is to be taken to be inclusive of features to which it refers, and is not meant to exclude the presence of any additional features unless otherwise stated or implied.

The reference to any prior art in this specification is not, and should not be taken as, an acknowledgment or any form of suggestion that such prior art forms part of the common general knowledge of the technical field.

DRAWINGS

Various aspects of the present invention will be described in detail with reference to the following drawings in which:

FIGURE 1 is a front perspective view of a USB charging module housing according to a first aspect of the present invention;

FIGURE 2 is a rear perspective view of the USB charging module housing of Figure 1;

FIGURE 3 is a detailed view of part of an engaging portion of the USB charging module housing as shown in Figure 1;

EXHIBIT 1002
Page 2004 of 2306 Petitioner ADC (IPR2024-00671)

FIGURE 4 is a view of a removable cover that fits into the rear opening of a USB charging module housing;

FIGURE 5 shows an embodiment of a supporting portion of a surface mountable power outlet adapted to engage with a USB charging module housing;

FIGURE 6 is a detailed view of the mating interface of the supporting portion shown in Figure 5;

FIGURE 7 is a perspective view of a USB charging module according to an embodiment of a second aspect of the present invention;

FIGURE 8 is a perspective view of a USB charging module according to another embodiment of the second aspect of the present invention;

FIGURE 9 is a side view of the USB charging module shown in Figure 8;

FIGURE 10 is an end or rear view of the USB charging module shown in Figure 7 (wires not shown);

FIGURE 11 is a view of a USB charging module engaged with a grid or face plate of a surface mountable power outlet according to an embodiment of the present invention;

FIGURE 12 is a view of a USB charging module engaged with a grid or face plate of a surface mountable power outlet according to another embodiment of the present invention;

FIGURE 13 is a surface mountable power outlet according to an embodiment of a third aspect of the present invention;

FIGURE 14 shows a surface mountable power outlet according to another embodiment of the third aspect of the present invention;

FIGURE 15 is a circuit schematic depicting an embodiment of the AC mains voltage step down and regulation component of the USB charging circuit;

FIGURE 16 is a circuit schematic of a power conditioning circuit with a DC-DC converter to regulate the current and voltage suitable for the USB charging module;

FIGURE 17 is a top view of a USB charging circuit adapted to fit inside the USB charging module housing of Figure 1;

FIGURE 18 is a perspective view of the USB charging circuit as shown in Figure 17;

FIGURES 19a-19c depict a sequential series of views of a method of installing a USB charging module to a surface mountable power outlet according to a fourth aspect of the present invention; and

FIGURE 20 shows a flow diagram illustrating a general method of installing a USB charging module into a surface mountable power outlet according to a fourth aspect of the present invention.

FIGURE 21 is a perspective view of an embodiment of a USB charging module suitable for front entry engagement with a power outlet.

FIGURE 22 is a section view through A-A of the engaging portion of the USB charging module housing of Figure 23;

FIGURE 23 is a front view of the USB charging module housing as depicted in Figure 21;

FIGURE 24 is a section view B-B of the supporting portion of the grid or face plate depicted in Figure 25;

EXHIBIT 1002
Page 2005 of 2306 Petitioner ADC (IPR2024-00671)

FIGURE 25 is a front view of a grid or face plate suitable for engagement with the USB charging module of Figure 21;

FIGURE 26 shows the USB charging module of Figure 21 to be connected from the front of the grid or face plate according to an embodiment of the present invention; and

FIGURE 27 shows the USB charging module of Figure 21 to be connected from the front of the grid or face plate according to another embodiment of the present invention.

In the following description, like reference characters designate like or corresponding parts throughout the several views of the drawings.

DESCRIPTION

Referring now to Figures 1-4, there is shown a USB charging module housing 10 according to a first aspect of the present invention. The housing 10 has an aperture 12 through a front face 11 that is large enough to provide access for a USB connector to plug into a USB port or socket 50 enclosed within the housing (see Figure 7). At the rear of the housing 10 (see Figure 2) is an opening or aperture 13 which enables access for inserting a USB charging circuit 60 (see Figure 7) into the housing 10. Although this embodiment shows the rear of the housing as being open to provide an access means for the USB charging circuit 60, it is possible that the opening 13 could be located on a different face and may constitute an entire face or a part thereof. Figure 4 shows a removable cover 20 that engages with the rear of the housing 10 to substantially seal the enclosure from dust and ingress. The removable cover 20 has angled clips 26 and 27 that engage into mating apertures 16 and 15 respectively of the housing 10 in a snap fit arrangement. The lip of the angled clips 27 are inserted directly into apertures 15 and then the cover 20 is closed by applying force proximate the clips 26 until they snap into apertures 16. The clips 26, 27 are flexible and resilient so that they may bend sufficiently to allow fitment into the apertures 15, 16 whereupon they return to their undeformed positions.

In one embodiment, a feature of the housing 10 is the clip interface comprising four clips 14 that are positioned around the four side faces of the housing 10. These clips form an engaging portion that connects the housing 10 to a supporting portion 30 (see Figure 5) of a surface mountable power outlet. The supporting portion 30 may be integral with a grid or face plate of the power outlet or located on a mounting plate that is adapted to be connected to the rear of a grid or face plate. Figure 3 shows a detailed view of a clip 14, in particular illustrating a type of clip with a tapered front face 14b and substantially vertical rear face 14a. These clips are designed to engage with the mating interface 34 of the supporting portion 30 which is most clearly illustrated in Figure 6. Figure 6 shows detail of a typical mating interface 34 which will connect to a USB charging module housing 10. As the housing 10 is inserted into the supporting portion 30, the tapered surface 14b of the clip 14 will engage a corresponding tapered surface 35 of the supporting portion 30. As more insertion force is applied, the

EXHIBIT 1002
Page 2006 of 2306 Petitioner ADC (IPR2024-00671)

clip 14 will deflect slightly as it passes the vertical surface 37 of the supporting portion 30. The substantially vertical rear face 14a of the clip 14 will eventually pass the lowest point of the vertical surface 37, upon which it reaches the recessed horizontal surface 36 of the supporting portion 30. The compression force acting on the clip 14 is then released and it deflects back to its undeformed position and the substantially vertical rear face 14a engages in surface to surface contact with the horizontal recessed surface 36 of the supporting portion 30 to thereby retain housing 10 to the supporting portion 30. In the embodiment shown in Figure 5, the supporting portion 30 has only two mating interfaces 34 requiring that only two of the four clips 14 be used to connect the housing 10 to the supporting portion 30. In practice, two or more of the clips 14 may be used to secure the housing, and the supporting portion 30 may also have two or more mating interface 34.

Referring now to Figure 7, there is shown a USB charging module 40 according to an embodiment of a second aspect of the present invention. Enclosed inside the housing 10 is a USB port 50 and a USB charging circuit 60. Wires 70, 71 to be connected to mains power are soldered directly onto a printed circuit board (PCB) 62 of the charging circuit 60 (see Figure 16). The wires 70, 71 exit the housing 10 through apertures 22 located through the removable cover 20 (see Figure 10). During installation these wires may be connected to mains power either directly or via a switch. In other embodiments, there may be simply provided screwed terminals for wire termination instead of a terminal block.

Referring now to Figures 8 and 9, there is shown a USB charging module 80 according to another embodiment of the second aspect of the present invention. Enclosed inside the housing 10 is USB port 50 and USB charging circuit 60 with a terminal block 65 to be connected to mains power. During installation, wires carrying mains power either directly or via a switch are connected to the terminal block 65 to power the USB charging circuit 60. The wires enter the housing 10 through apertures 18 located on one side of the housing 10.

In the USB charging module embodiments described above, the power input to the module is mains power (also known as household, supply or grid power) supplied between about 100-240V alternating current (AC). The USB charging circuit 60 regulates the voltage and steps it down to a usable 4.75-5.25V direct current (DC) which is typically required to charge many electronic devices.

Referring now to Figures 11-14, there are shown various embodiments of the USB charging module 40 or 80 connected to a grid or face plate of a surface mountable power outlet. Figure 11 shows USB charging module 40 engaged with a supporting portion 30 which is integral with a grid or face plate 100. In one example, the supporting portion 30 is integrally machined into the grid or face plate 100 during manufacture. In other embodiments, the supporting portion 30 is provided as a separate piece and is attached to the grid or faceplate during or before installation. The grid or face plate 100 can be

constructed from plastic, metal or any other suitable materials. Figure 11 shows a grid or face plate 100 with two apertures 102 (only one visible in this view) capable of receiving switches or other electrical connectors in addition to USB ports. Further, as the USB charging module is modular in design, it can always be easily interchanged for a switch or other desired user interface. The grid or face plate 100 shown in Figure 11 may be adapted in many ways such as providing for AC receptacles as commonly found in most household power outlets. The grid or face plate 100 is fastened to a wall by screws or other suitable fasteners through mounting lugs 101. These may be arranged in any suitable position on the grid or face plate 100 and may vary in quantity.

Figure 12 shows a USB charging module 80 engaged with a supporting portion 30 located in a mounting plate 200 that is adapted to be inserted into the rear of a grid or face plate 110. In this arrangement the supporting portion 30 is integrally machined into mounting plate 200. Such a mounting plate 200 (also known as a base or base plate) in standard power outlets, commonly includes electrical contacts for AC receptacles, switch mounting and terminals to connect mains power wiring. The mounting plate 200 is designed to be received by the rear of a grid or face plate 110. As shown in Figure 12, the mounting plate 200 is fastened to the grid or face plate 110 by screws at mounting positions 201. The grid or face plate 110 is mounted onto a wall by screws at mounting locations 111, 112.

Figure 13 more specifically shows a surface mountable power outlet 500 according to a third aspect of the present invention allowing a user to charge USB compatible devices. In this arrangement the USB charging module 40 or 80 is connected to a supporting portion 30 that may either by integral with the grid or face plate or located on a mounting plate adapted to be connected to the rear of the grid or face plate. In this embodiment the power outlet 500 has a pair of switches and AC receptacles in addition to the USB charging module 40 or 80. A power outlet 500 such as this allows a user to plug in normal AC type connectors with power switched on or off and advantageously also provides a user with access to a USB port 50 for charging electronic devices. If the USB charging module 40 or 80 is wired directly to mains without a switch then the charging module 40 or 80 is constantly connected to mains power so that when a user connects their device into the USB port; charging will begin automatically. If the USB charging module 40 or 80 is wired to mains via a switch, then power will not be drawn until the user engages the switch to an "ON" position. As shown in Figure 14 in another embodiment of a wall mounted power outlet 510, there is a USB charging module 40 or 80 provided additionally with LED status lights 55 that indicate whether the device connected to the port is charging or not. In both Figures 13 and 14 there is also shown a cover plate 90, 91 that is adapted to fit around the periphery of the power outlet. The cover plate 90, 91 usually snap fits around the grid or face plate and is provided primarily for aesthetics when the power outlet is mounted to a surface such a wall or floor.

EXHIBIT 1002
Page 2008 of 2306 Petitioner ADC (IPR2024-00671)

It will be appreciated by those skilled in the art that the surface mountable power outlet embodiments illustrated in this text are by no means limiting to how the invention may be performed. The geometric arrangement of switches, AC receptacles, USB ports or other network connection ports may be customised to suit a particular application. The supporting portion 30 also need not necessarily be limited to being an integral portion of a grid or face plate or located on a mounting plate adapted to be inserted into the rear of a grid or face plate. The supporting portion 30 could be mounted or machined into almost any structure, including a box or other structural housing. Further, the engaging portion of the USB charging module housing and supporting portion of the power outlet may be designed with alternative interfaces to the clip arrangement shown which achieves the principle aim of the invention in providing a modular USB housing which is adapted to be installed in a surface mountable power outlet thereby allowing a user to charge USB compatible devices.

Referring now to Figures 15-19, there is shown the USB charging circuit 60 that receives a 240V AC mains power input and provides a 5V DC output to the USB port 50, suitable for charging USB compatible electronic devices. The USB charging circuit 60 comprises the following stages. In the first stage, shown in Figure 15, the 240V AC mains input is first stepped down using a transformer 61 to reduce the high AC voltage to a low AC voltage (e.g. 15V, 1.2A). This stepped down AC voltage is then passed through a rectifier circuit 63 (e.g. bridge rectifier) that outputs a full wave varying rectified voltage shown as the output across load R_L. As shown in Figure 16, this varying voltage is then smoothed with a capacitor to produce a relatively smooth DC voltage with a small ripple. A voltage regulator (e.g. 7812 Integrated Circuit (IC)) is then used to output a regulated 12V DC output as will be understood by the person skilled in the art.

In the second stage, an embodiment of which is shown in Figure 16, a DC-DC converter (e.g. Texas Instruments TPS40210 current mode boost controller) is then used to regulate the output suitable for the USB charger. The TPS40210 implements a DC-DC single-ended primary inductance converter (SEPIC) with input and output current regulation, as well as output voltage regulation implemented by closed loop feedback control. The TPS40210 ensures that the output voltage of the USB charger is between about 4.75 and 5.25 V (nominally 5V DC) with an operating current of about 1A and also prevents overcharging. The voltage input in Figure 16 is the regulated 12V from the first stage, which is converted to a regulated 5V DC voltage output by the circuit shown. It should be understood that this is just one example of how a USB charging circuit may be implemented and any other suitable circuit arrangement may be used.

Referring specifically to Figures 17 and 18 there is shown an embodiment of the physical circuit layout of the USB charging circuit 60. A double layered PCB 62 is used which provides a compact

EXHIBIT 1002
Page 2009 of 2306 Petitioner ADC (IPR2024-00671)

and efficient way to house all of the components inside the housing 10. On one layer of the PCB 62 there is mounted the USB port 50, an optional terminal block 65 and the circuit components for the AC mains voltage step down and first stage regulation (including transformer, capacitors, 7812 IC voltage regulator and rectifier circuit). On the second layer of the PCB 62 there is provided the power conditioning circuitry for the USB charger output (including the TPS40210 and various other capacitors, inductors, resistors and diodes).

In other embodiments, there is provided 2 or 3 or more PCBs over which the circuit components are arranged, rather than (or as well as) a double layered arrangement.

Referring now to Figures 19a-19c there is shown a sequential series of views of a method of installing the USB charging module 80 to a surface mountable power outlet according to a fourth aspect of the present invention. In this embodiment, the mounting surface is a wall 90. In Figure 19a there is shown the step of connecting the engaging portion of the USB charging module housing 10 to a supporting portion 30 of the power outlet. Figure 19a shows the USB charging module 80 already having been engaged with the supporting portion 30. Figure 19b illustrates the next step of connecting the mains power to the USB charging circuit 60. The USB charging module 80 and grid or face plate assembly is held in close proximity to a wall opening where the power outlet is to be located. The wiring from the mains (typically active and neutral wires, with earth optional) is physically connected to the USB charging circuit 60. The particular embodiment illustrated in Figures 19a-19c shows a USB charging module 80 with a terminal block 65 for terminating the mains wires. The final step in the installation is to attach or mount the power outlet to the wall 90 as illustrated in Figure 19c. The grid or face plate is held flat against the wall 90 and screws or other suitable fastening means are inserted through mounting apertures in the grid or face plate and fastened securely to the wall 90. In another example, the USB charging module 40 may be connected using wires 70, 71 as previously described.

Figure 20 illustrates a flow diagram of a method of installing the USB charging module 40 or 80 to a surface mountable power outlet. In step 600, the installer begins with the USB charging module. In step 601, the engaging portion of the USB charging module housing 10 is connected to the supporting portion 30 of the power outlet. In step 602, a determination is made as to whether the supporting portion is located in a mounting plate that is not integral with the grid or faceplate. If the supporting portion 30 is integral with the grid or face plate, the mains power is connected to the USB charging circuit 60 and the power outlet is attached or mounted to the mounting surface (which may be a wall or floor or other appropriate surface) in step 604. If the supporting portion 30 is located in a mounting plate that is not integral with the grid or face plate, then there is an additional step 603 of connecting the mounting plate to the grid or face plate.

In step 605, the installer then connects the AC mains power to the USB and then in step the power outlet assembly is mounted or attached to the mounting surface such as the wall 90 or a floor. In step 606, the resulting product of the method is a surface mounted USB power or charging outlet.

Once installation is complete, the power outlet provides an interface to charge USB compatible devices. The USB charging module 40,80 receives a mains input power between about 100-240V AC and converts this to a regulated 5V DC output suitable for charging USB compatible electronic devices. The modular housing 10 enables the power outlet to have interchangeable interfaces to suit operational requirements. The USB charging module 40,80 may be removed from the power outlet and replaced with a switch or any other interface without having to replace the entire power outlet.

Referring now to Figures 21-27, there is shown a further embodiment whereby the USB charging module 40,80 is connected to the supporting portion 130 of a grid or face plate 120 of a surface mountable power outlet from the front thereby providing a 'front entry' insertion option. Whereas previously described the USB charging module 40,80 is connected into a supporting portion 30 in the rear of the grid or face plate, it is also desirable to be able to insert the module from the front of the grid or face plate. It will be appreciated that this connection may be facilitated in many ways, an example of which is shown in Figures 21-27. Figure 21 generally shows a USB charging module 40,80 which can be connected to mains power as previously described. In one form, the module may have a clip interface comprising clips 18 as shown in more detail in Figures 22-23. Figure 23 is a front view of a USB charging module housing 10 showing the location of two clips 18 suitable for front entry connection of the module. Figure 22 is a sectional view through A-A of Figure 23 providing detail of a possible clip arrangement. This clip arrangement allows the housing 10 to engage with a supporting portion 130 of a grid or face plate 120 as shown in Figure 25. Figure 24 shows as a sectional view through B-B of Figure 25 which generally shows the supporting portion 130 in more detail. The housing 10 of the USB charging module 40,80 is inserted through aperture 132 of the supporting portion 130. The clip arrangement facilitates a snap-fit connection between the clips 18 and the supporting portion 130. As the module is inserted into the grid or face plate, the resilient clips 18 bend slightly as force is applied such that the outer most surface 18b of the clips 18 can pass the inner most surface 133 of the supporting portion 130.Once engaged, surface 19 of the housing 10 mates with recessed surface 131 of the supporting portion 130 and surface 18a of the clips 18 is in contact with surface 134 of the supporting portion 130.

Figures 26-27 show exploded views of the USB charging module 40,80 and grid or face plate front entry installation. Figure 26 shows a grid or face plate 120 with two apertures 132 which enables more than one USB charging module 40,80 to be inserted. Figure 27 shows a grid or face plate 140 with a single aperture 132 for receiving a USB charging module 40,80 from the front. In addition, Figure 27

EXHIBIT 1002
Page 2011 of 2306 Petitioner ADC (IPR2024-00671)

shows a cover plate 145 that is attached or mounted to the grid or face plate after the USB charging module 40,80 has been connected and screws 146 for attaching or mounting the grid or face plate to a surface such as a wall or floor.

Although various illustrative embodiments of the present invention have been described in the foregoing detailed description, it will be understood that the invention is not limited to the embodiments disclosed, but is capable of numerous rearrangements, modifications and substitutions without departing from the scope of the invention as set forth and defined by the following claims.

EXHIBIT 1002
Page 2012 of 2306 Petitioner ADC (IPR2024-00671)

CLAIMS:

1. A Universal Serial Bus (USB) charging module housing adapted for securement to a surface mountable power outlet, the housing including:

an engaging portion for connecting the housing to a supporting portion of the power outlet;

access means to allow a USB charging circuit to be inserted into the housing; and

an aperture for allowing external access to a USB port.

2. The housing according to claim 1 further including at least one aperture for receiving wires carrying mains power.

3. The housing according to claim 1 wherein the access means is provided by an aperture in an external face of the housing.

4. The housing according to claim 3 wherein the aperture is covered by a removable portion.

5. The housing according to claim 4 wherein the removable portion includes at least one aperture for receiving wires carrying mains power.

6. The housing according to claim 1 wherein the supporting portion of the power outlet is an integral portion of a grid or face plate.

7. The housing according to claim 1 wherein the supporting portion of the power outlet is located in a mounting plate that is adapted to be connected to the rear of a grid or face plate.

8. The housing according to claim 1 wherein said housing is connected to the supporting portion of the power outlet from the front of the grid or face plate.

9. The housing according to claim 1 wherein said housing is connected to the supporting portion of the power outlet from the rear of the grid or face plate.

10. The housing according to any one of the preceding claims wherein the engaging portion includes:

a plurality of clips extending outwardly from one or more exterior faces of the housing, said clips for engagement with one or more surfaces of the supporting portion of the power outlet in a snap fit arrangement.

EXHIBIT 1002
Page 2013 of 2306 Petitioner ADC (IPR2024-00671)

11. The housing according to claim 10 wherein the clips have a tapered front face and a substantially vertical rear face.

12. The housing according to any one of the preceding claims wherein the aperture for allowing external access to a USB port is located on a front face of the housing.

13. A Universal Serial Bus (USB) charging module adapted for securement to a surface mountable power outlet, the charging module including:

a USB port;

a USB charging circuit that is capable of receiving a mains power input;

a housing, said housing including an engaging portion for connecting the housing to a supporting portion of the power outlet; access means to allow the USB charging circuit to be inserted into the housing and an aperture for allowing external access to the USB port.

14. The USB charging module according to claim 13 wherein the USB charging circuit includes a printed circuit board (PCB).

15. The USB charging module according to claim 14 wherein a plurality of wires are soldered directly to the PCB for connection to mains power either directly or via a switch.

16. The USB charging module according to claim 14 wherein a terminal block is mounted on the PCB for connection to wires carrying mains power either directly or via a switch.

17. The USB charging module according to claim 14 wherein there are provided screwed terminals for wire termination.

18. A surface mountable power outlet for allowing a user to charge a USB compatible device, the power outlet including:

a supporting portion;

a USB charging module including a USB port; a USB charging circuit that is capable of receiving a mains power input; a housing, said housing including an engaging portion for connecting the housing to the supporting portion of the power outlet; access means to allow the USB charging circuit to be inserted into the housing and an aperture for allowing external access to the USB port;

a grid or face plate adapted to allow a user to access the USB port;

a connection between the USB charging module and mains power; and

mounting means for mounting the power outlet to a mounting surface.

19. The power outlet according to claim 18 wherein the supporting portion is an integral portion of the grid or face plate.

20. The power outlet according to claim 18 wherein the supporting portion is located in a mounting plate that is adapted to be connected to the rear of the grid or face plate.

21. The power outlet according to claim 18 wherein the USB charging module housing is connected to the supporting portion from the front of the grid or face plate.

22. The power outlet according to claim 18 wherein the USB charging module housing is connected to the supporting portion from the rear of the grid or face plate.

23. The power outlet according to claim 18 wherein the mounting surface is a wall or floor.

24. The power outlet according to claim 18 further including a cover plate.

25. The power outlet according to claim 18 wherein the mains power is between about 100-240V alternating current (AC).

26. A method of installing a power outlet for allowing a user to charge a USB compatible device, the power outlet according to claim 18, comprising the steps of:

connecting the engaging portion of the USB charging module housing to the supporting portion of the power outlet;

connecting the mains power to the USB charging module; and

mounting the power outlet to the mounting surface.

27. A method of installing a power outlet allowing a user to charge USB compatible devices, the power outlet according to claim 20, comprising the steps of:

connecting the engaging portion of the USB charging module housing to the supporting portion of the power outlet;

connecting the mounting plate to the rear of a grid or face plate;

connecting the mains power to the USB charging module; and

mounting the power outlet to the mounting surface.

EXHIBIT 1002
Page 2015 of 2306 Petitioner ADC (IPR2024-00671)

28. The method of installing a power outlet according to any one of claims 26 or 27 wherein the power outlet is mounted to the mounting surface by fastening the grid or face plate to the surface by screws.

EXHIBIT 1002
Page 2016 of 2306 Petitioner ADC (IPR2024-00671)

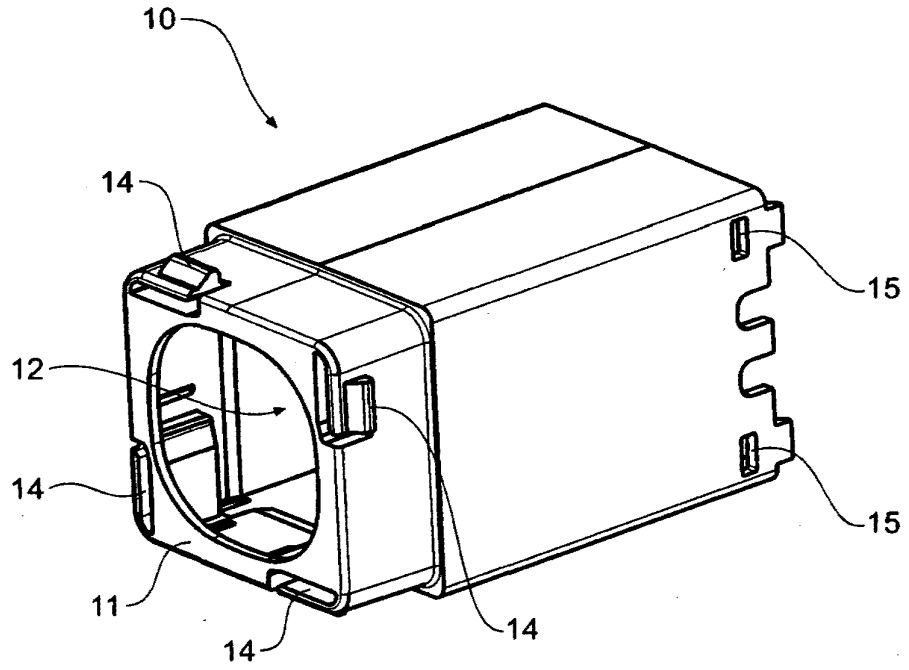


Figure 1

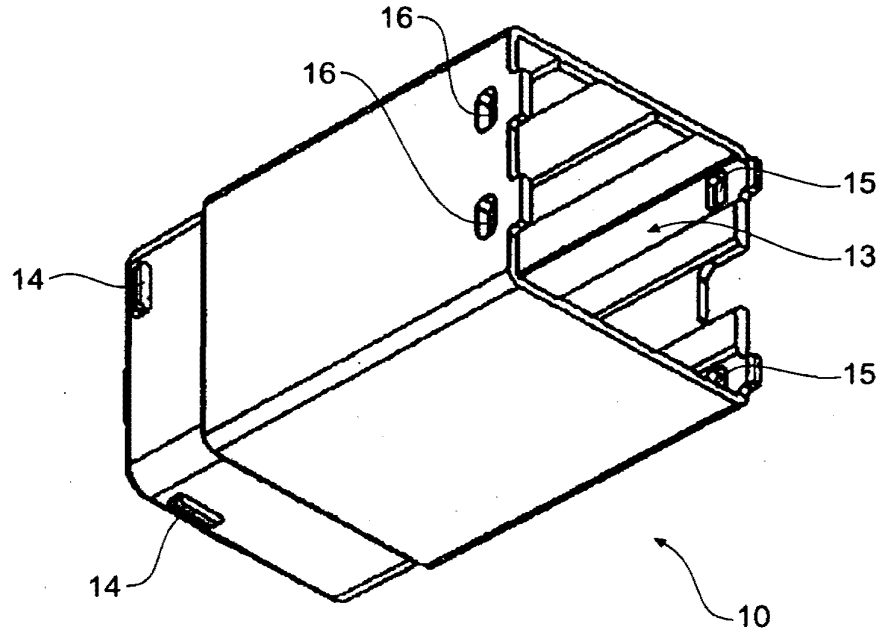


Figure 2

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

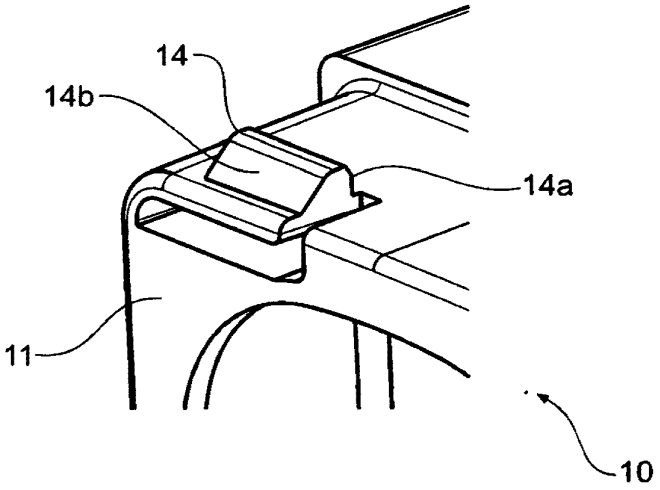


Figure 3

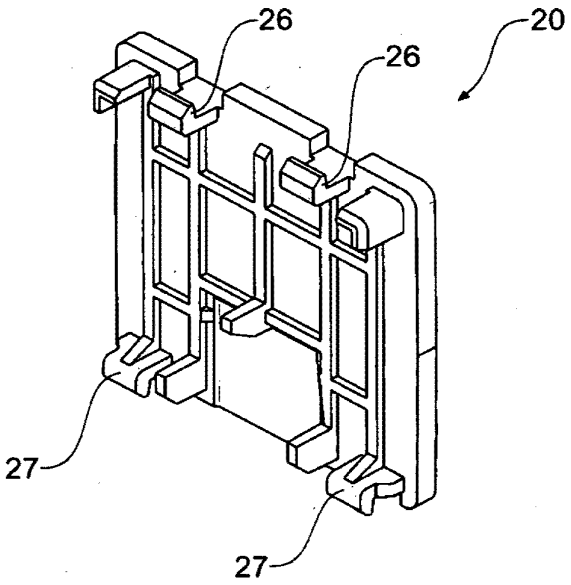


Figure 4

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

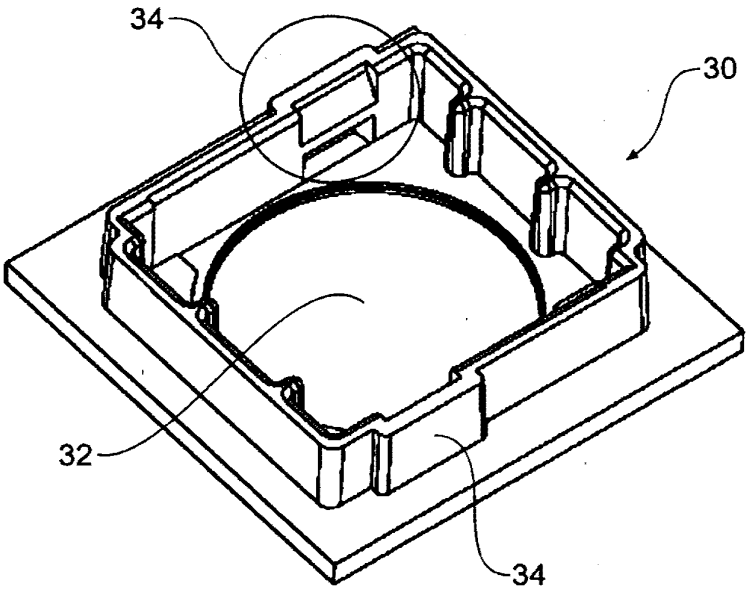


Figure 5

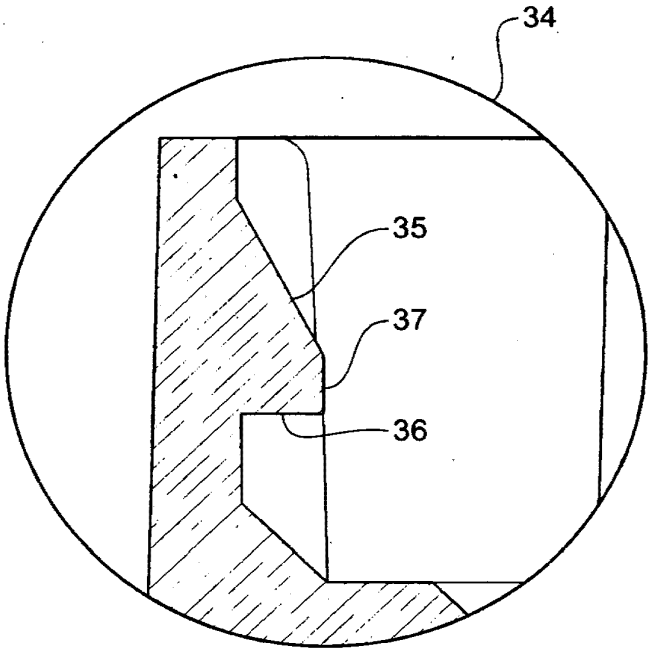


Figure 6

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

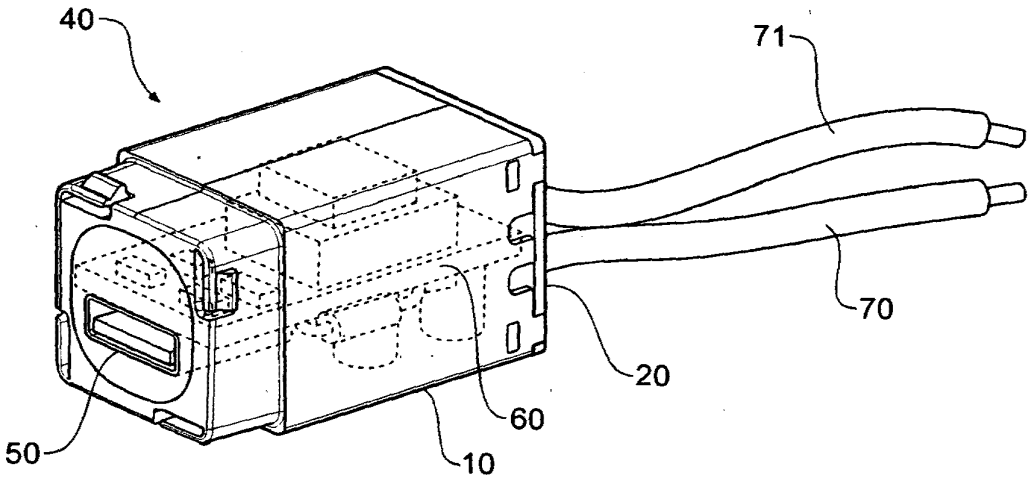


Figure 7

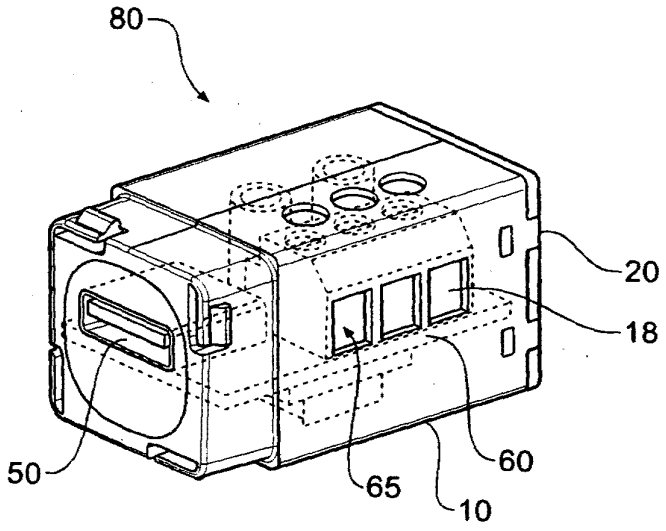


Figure 8

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

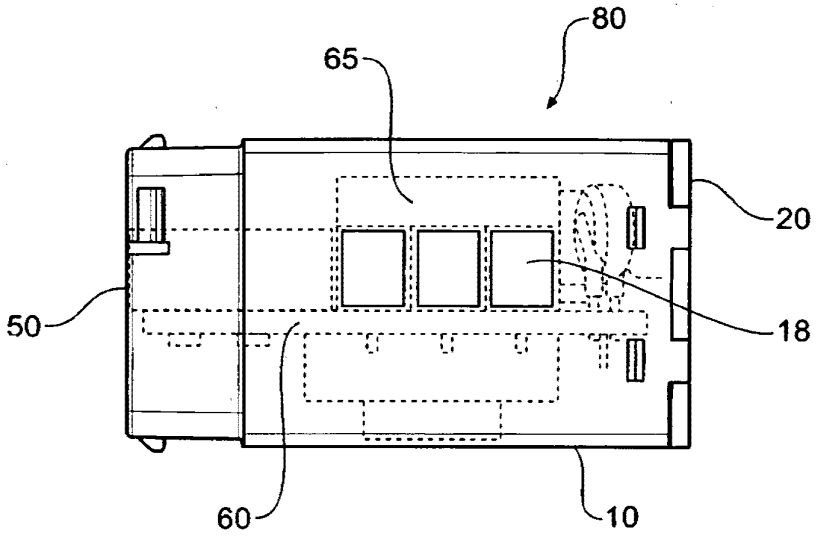


Figure 9

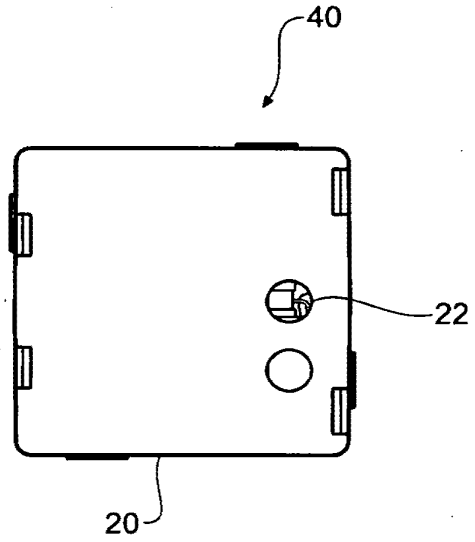


Figure 10

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

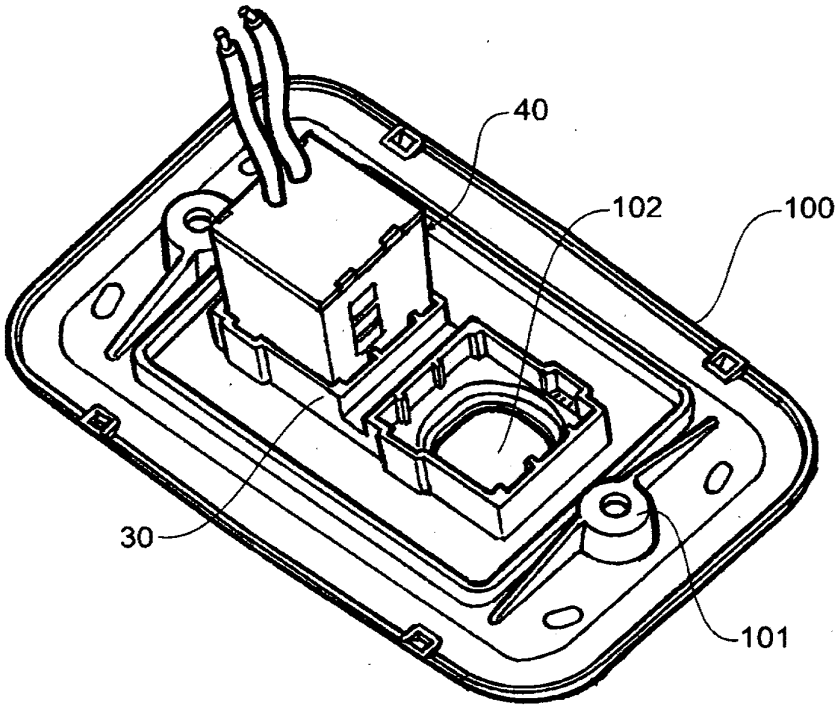


Figure 11

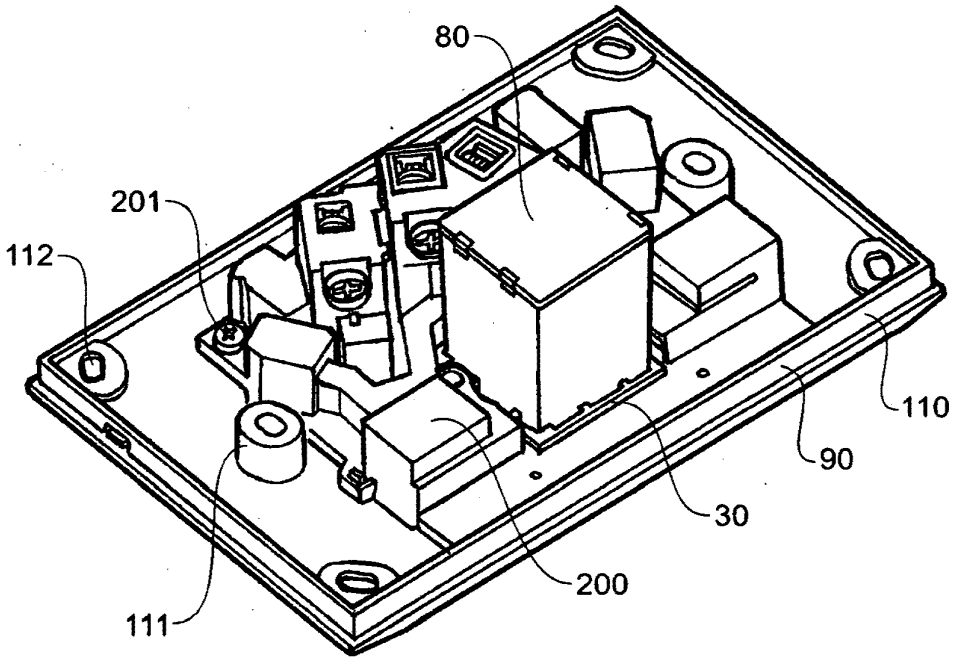


Figure 12

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

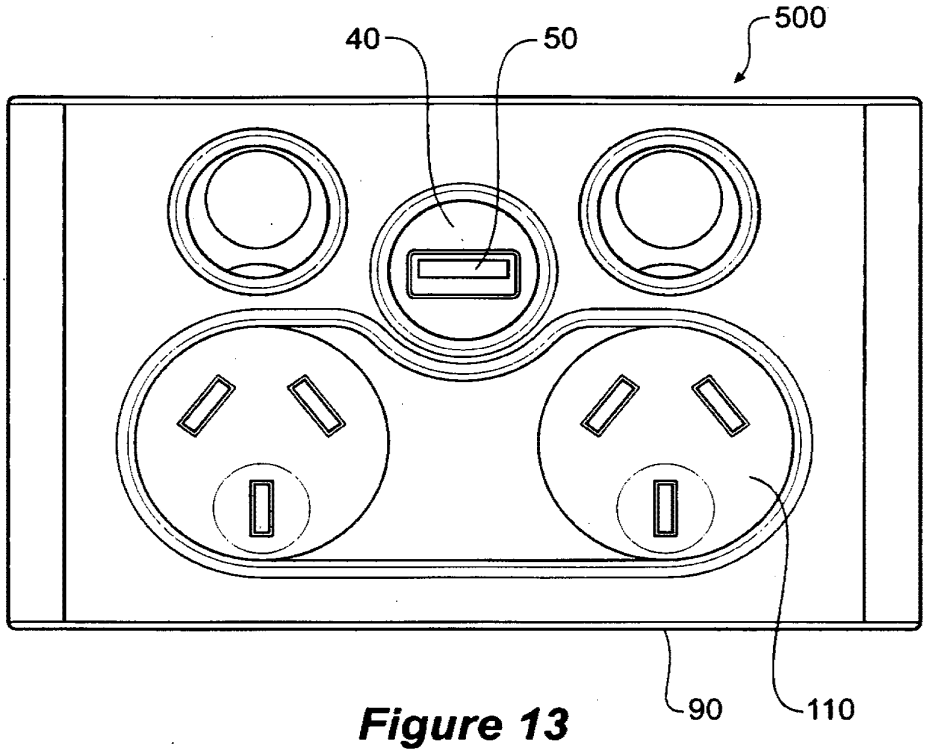


Figure 13

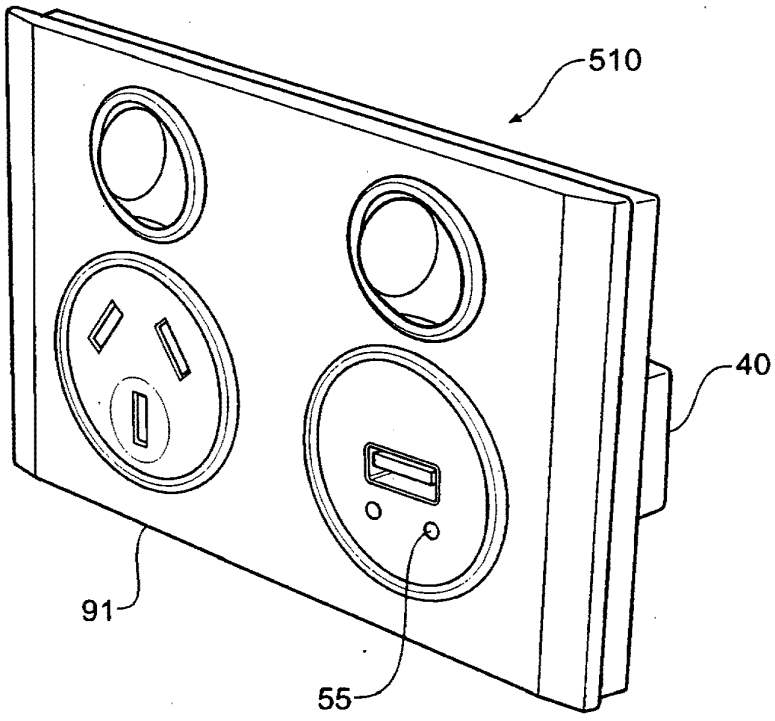


Figure 14

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

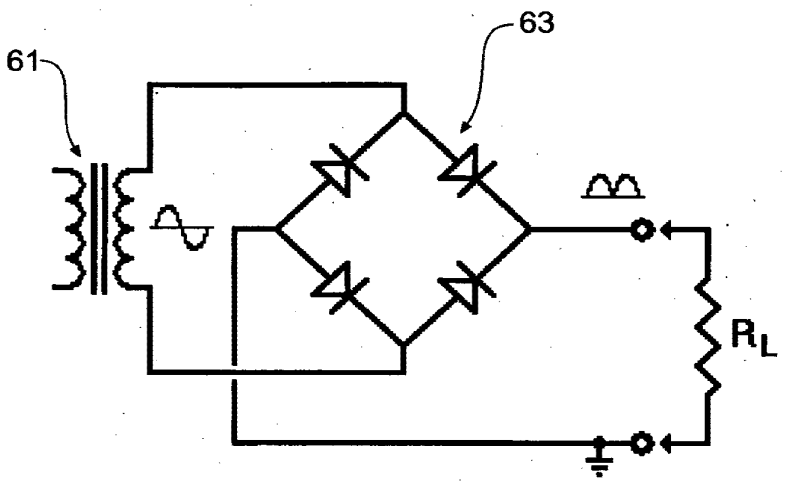


Figure 15

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

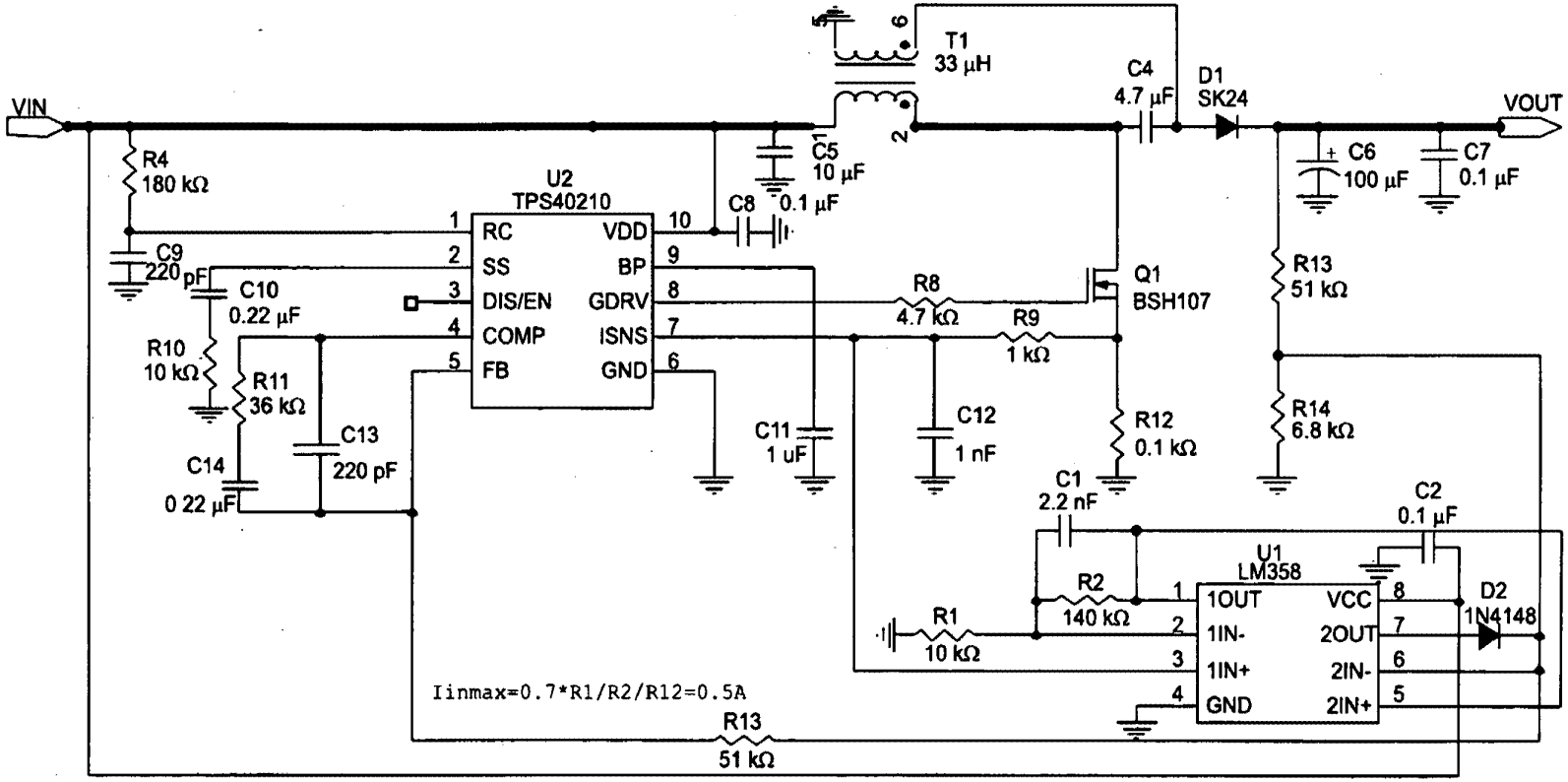


Figure 16

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

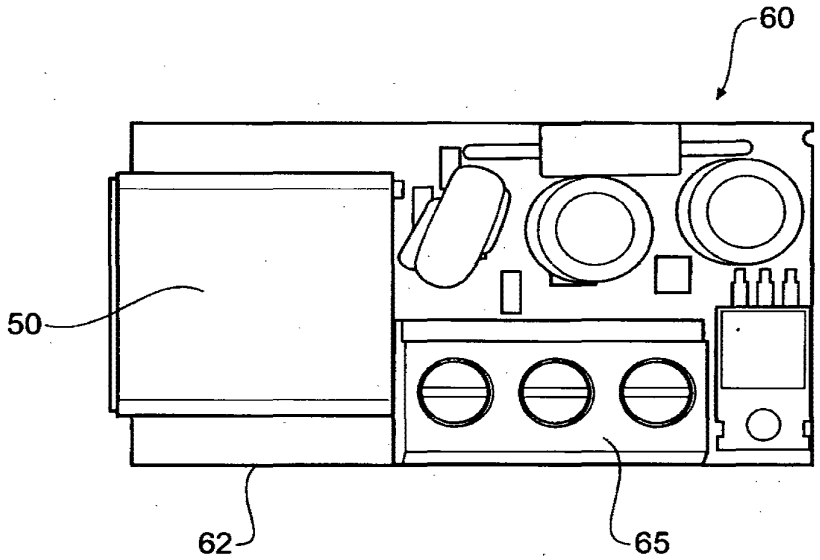


Figure 17

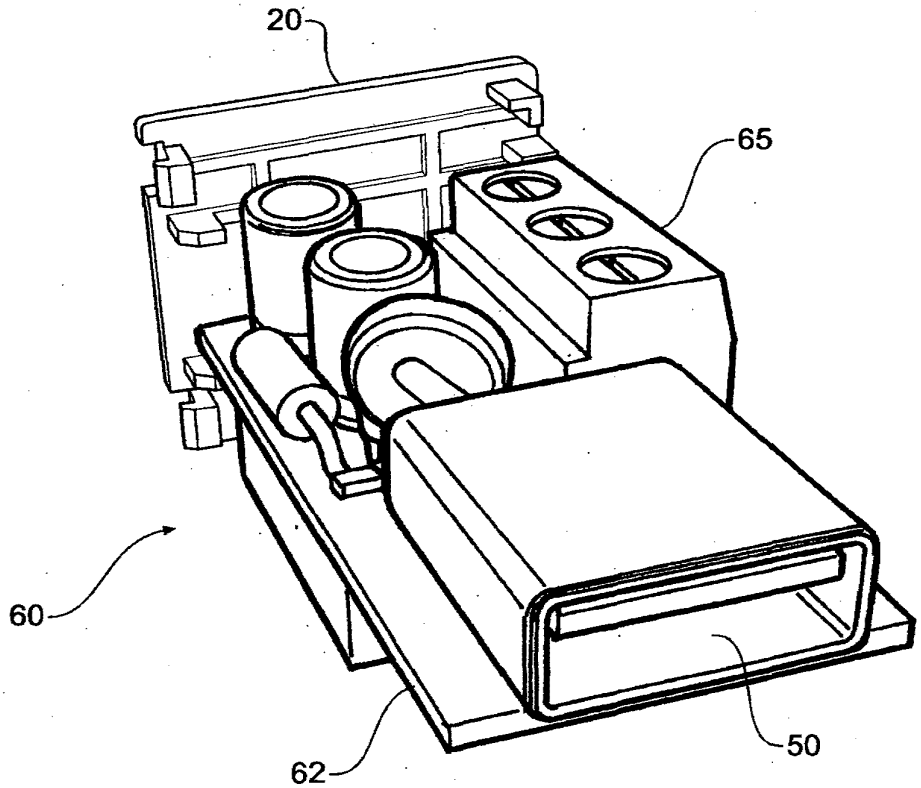


Figure 18

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

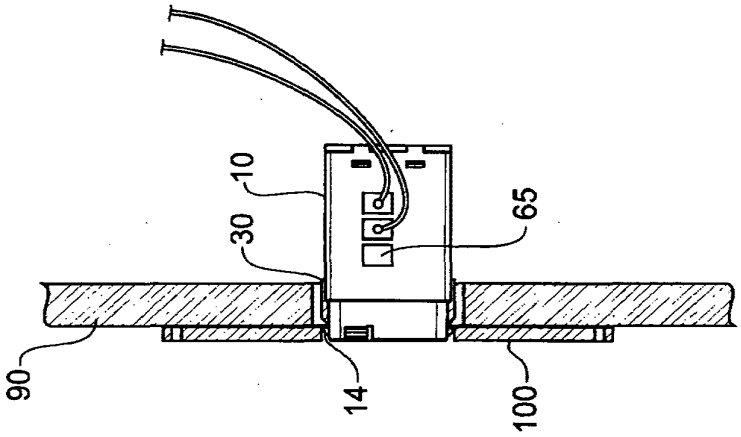


Figure 19c

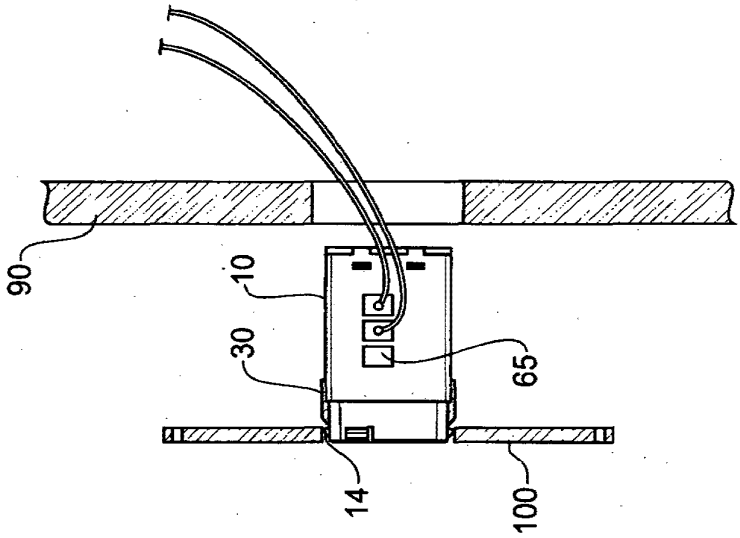


Figure 19b

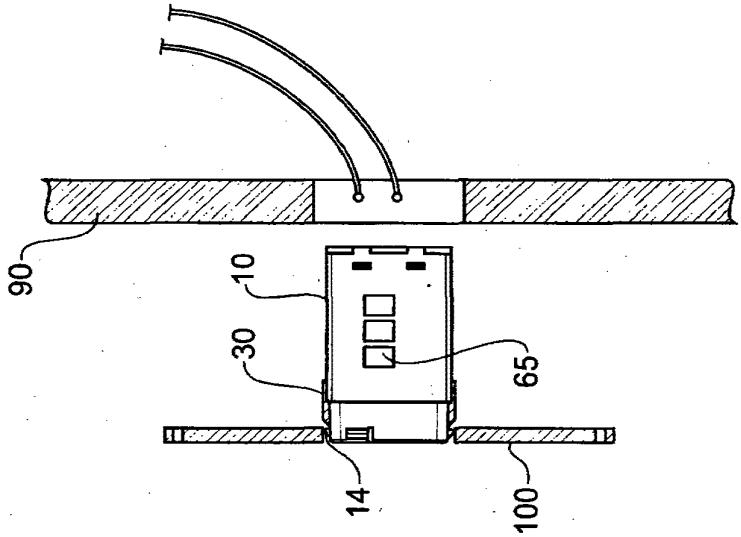


Figure 19a

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

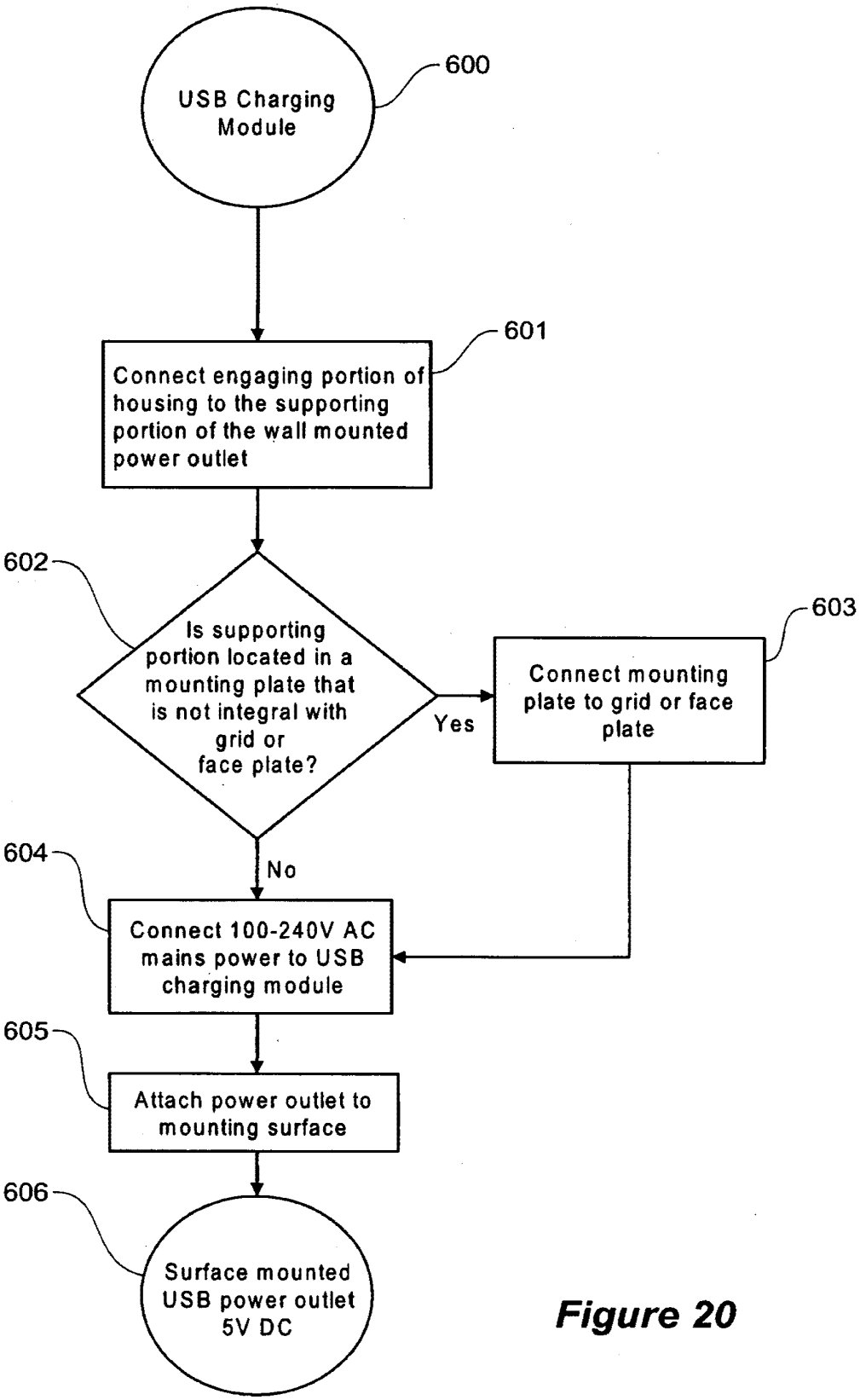


Figure 20

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

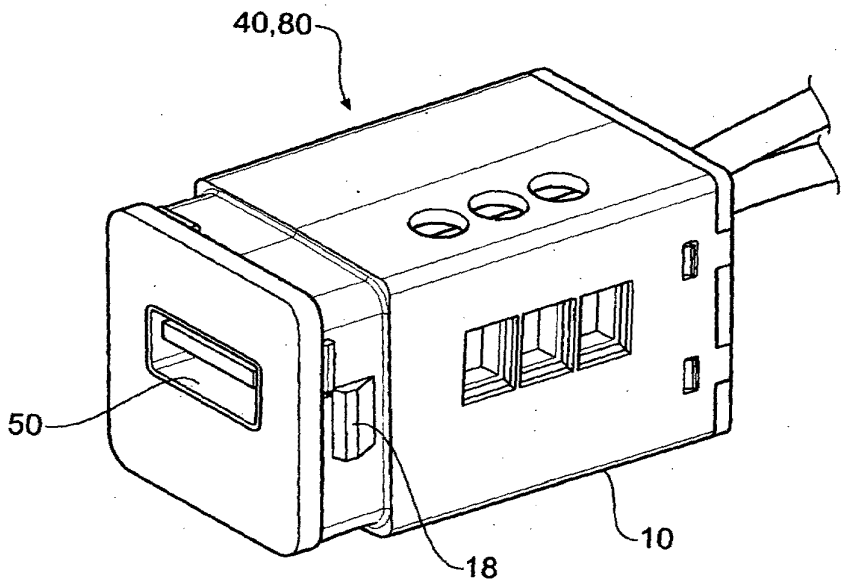


Figure 21

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

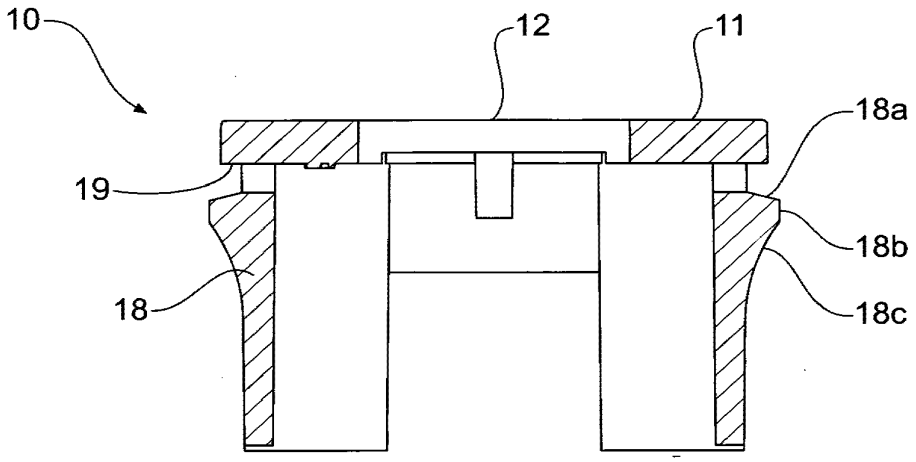


Figure 22

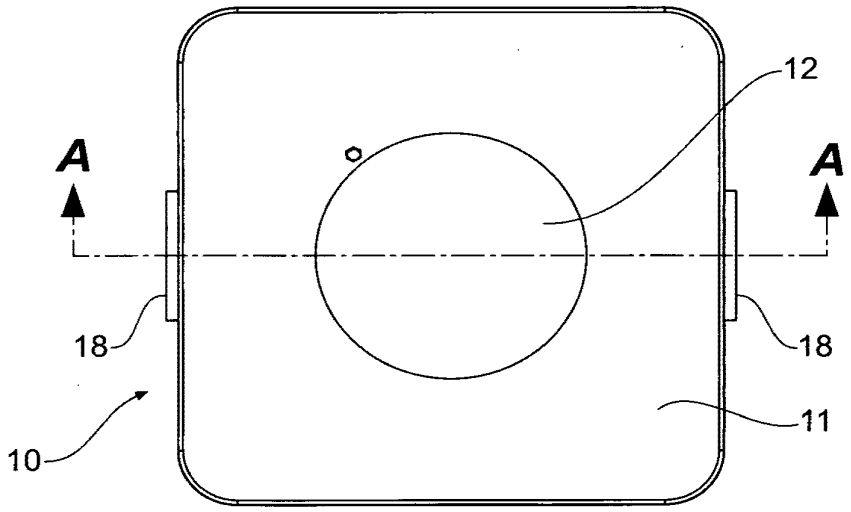


Figure 23

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

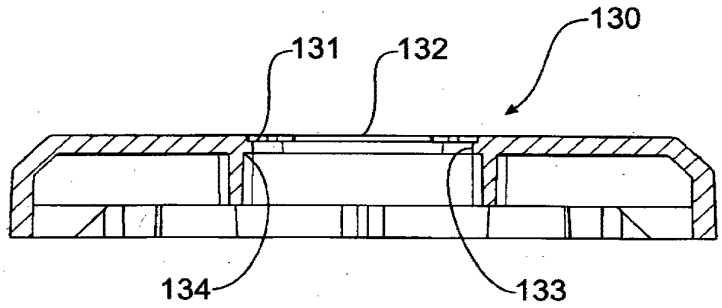


Figure 24

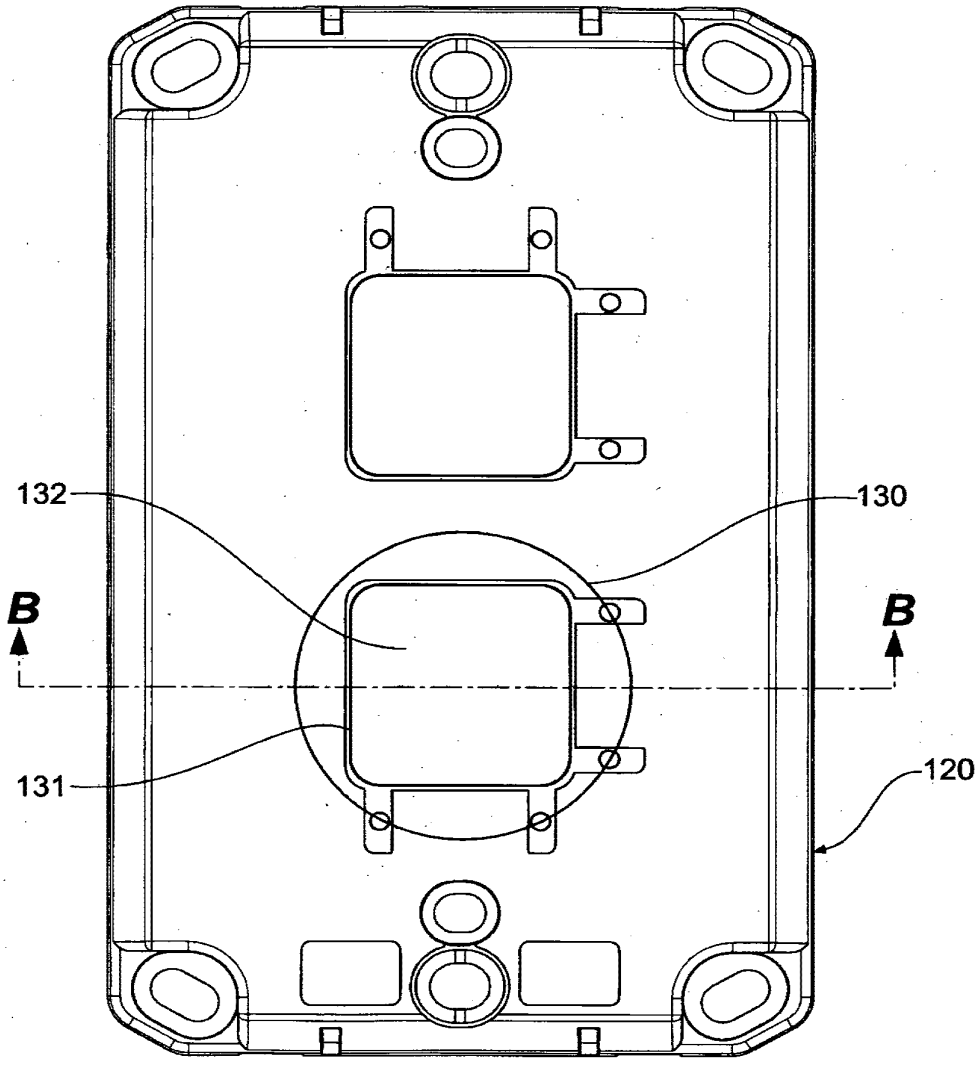


Figure 25

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

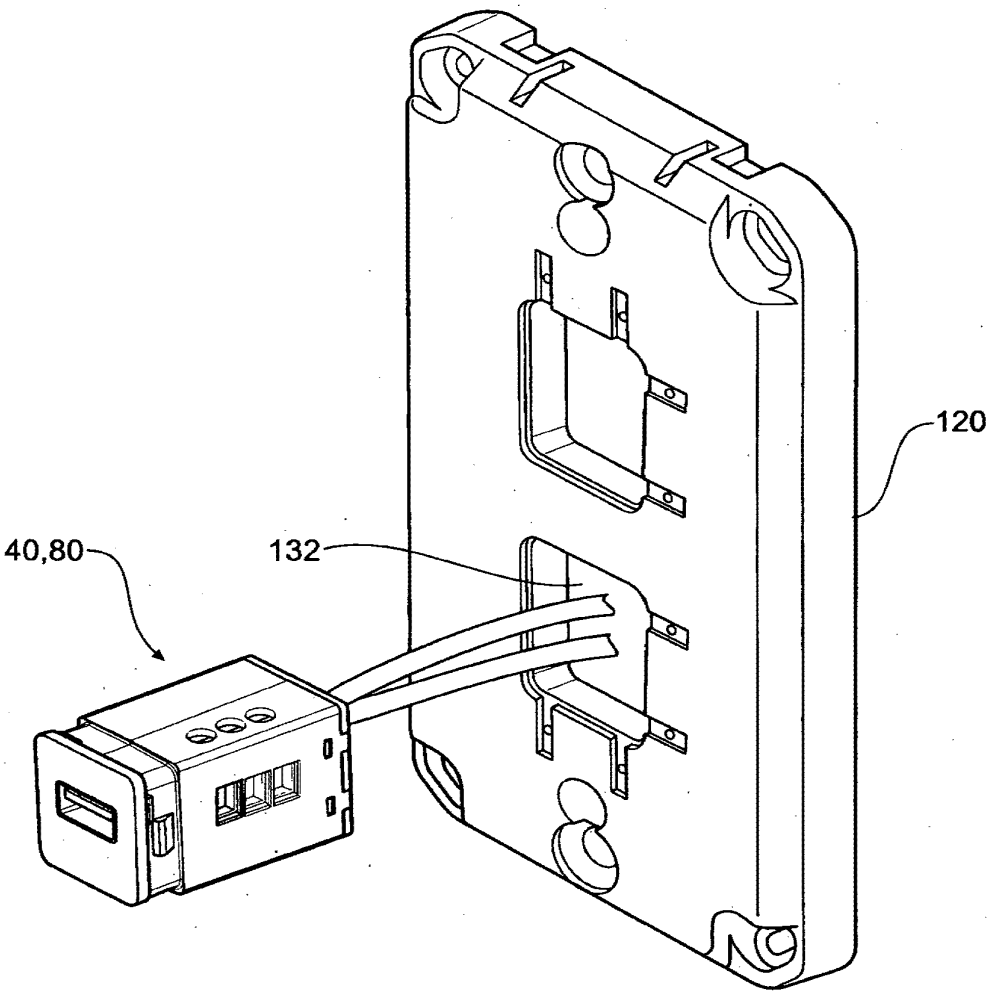


Figure 26

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

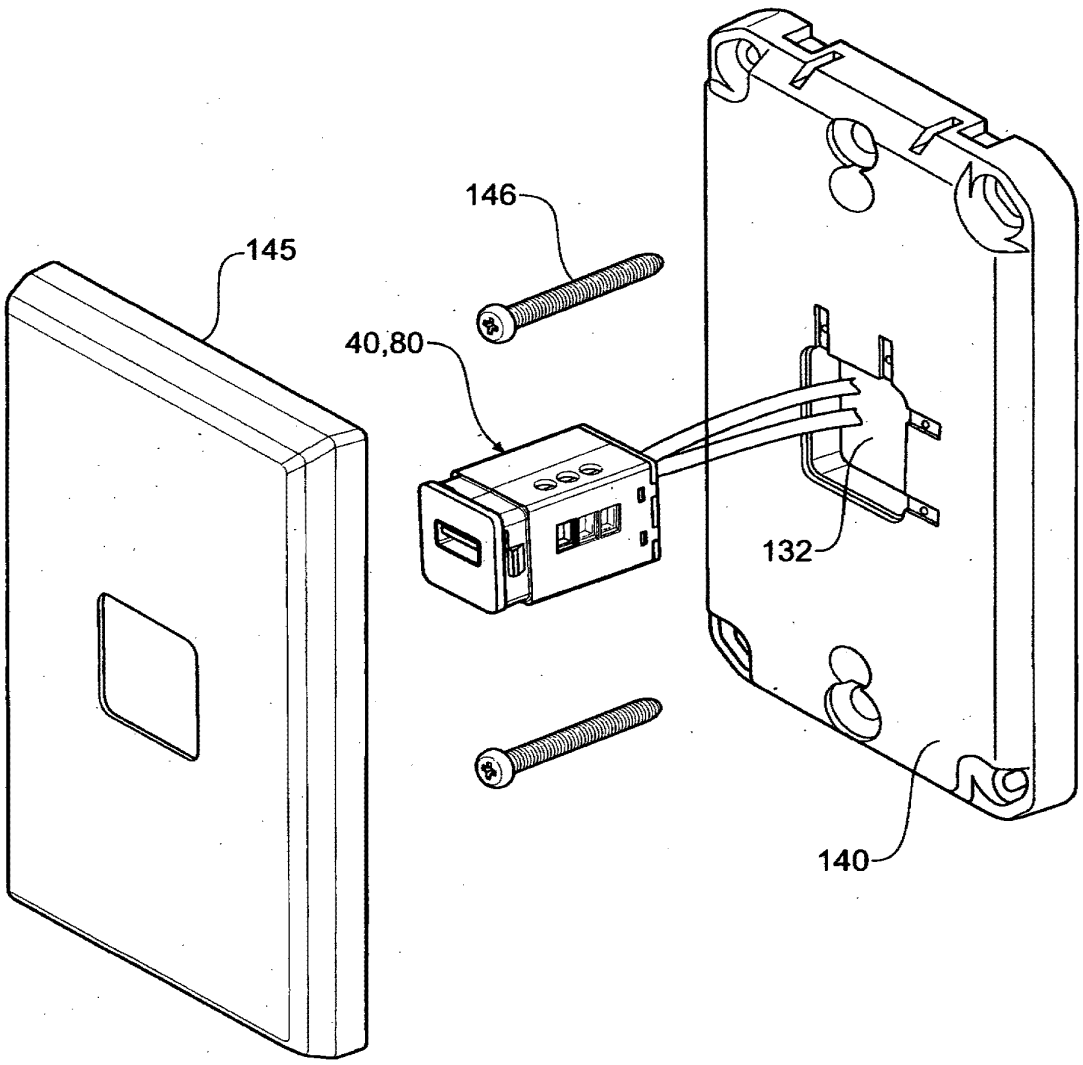


Figure 27

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2011/001532

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

H01R 13/648 (2006.01) ***H02J 7/00*** (2006.01)
H01R 31/06 (2006.01) ***H05K 5/04*** (2006.01)

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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)
EPODOC, WPI: USB, housing, socket, wall mounted, engage, aperture and like words.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 201213213 Y (WENZHI WU) 25 March 2009 Abstract, fig.1-8	1-28

☐ 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
15 February 2012	22 February 2012
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. +61 2 6283 7999	Authorized officer **ARPIT DIXIT** AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : +61 2 6283 2879

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

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/AU2011/001532**

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Member
CN 201213213	NONE

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

LIST OF REFERENCES CITED BY APPLICANT (Use several sheets if necessary)	ATTY. DOCKET NO. 14710-137-999 (000055-US-02-02)	APPLICATION NO. 16/820,040
	FIRST NAMED INVENTOR Jonathan Lewis NOOK	
	FILING DATE March 16, 2020	ART UNIT 2859

U.S. PATENT DOCUMENTS

*Examiner Initials		Document Number	Date yyyy-mm-dd	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	A01	7893558	2011-02-22	Lee	
	A02	10087904	2018-10-02	Butler et al.	
	A03	2015/0306967	2015-10-29	Cohen	

FOREIGN PATENT DOCUMENTS

*Examiner Initials		Foreign Patent Document Country Code, Number, Kind Code (if known)	Date yyyy-mm-dd	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T	Additional Information
	B01	WO 2009/059852 A2	2009-05-14	Bosch GmbH			Machine translation
	B02	WO 2012/068635 A1	2012-05-31	Clipsal Australia Pty Ltd.			

NON PATENT LITERATURE DOCUMENTS

*Examiner Initials		Include name of the author (in CAPITAL LETTERS), (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T	Additional Information
	C01	USB Battery Charging 1.2 Compliance Plan, Rev. 1.0		
	C02	Carku Epower-20B catalog information		
	C03	USB Battery Charging Specification Version 1.2 (EX1009)		

EXAMINER	DATE CONSIDERED
*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

NAI-1534128438v1

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

Electronic Acknowledgement Receipt

EFS ID:	46933533
Application Number:	16820040
International Application Number:	
Confirmation Number:	1056
Title of Invention:	PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION
First Named Inventor/Applicant Name:	Jonathan Lewis NOOK
Customer Number:	20583
Filer:	Joseph McGowan Sauer/Erin Rosenfelder
Filer Authorized By:	Joseph McGowan Sauer
Attorney Docket Number:	054985-000055-US-02-02
Receipt Date:	01-NOV-2022
Filing Date:	16-MAR-2020
Time Stamp:	11:08:35
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$130
RAM confirmation Number	E2022A1B08582845
Deposit Account	503013
Authorized User	Erin Rosenfelder

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		14710-137_Response081022.pdf	213183 dda1f558e898ec918abdb442030d5a8f80aa8791	yes	14

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Request for Reconsideration-After Non-Final Rejection	1	1
	Claims	2	10
	Applicant Arguments/Remarks Made in an Amendment	11	14

Warnings:

Information:

2		14710-137_IDS_ListRefs_110122.pdf	173752 d111dafe30504f1c1b63b04217629306d59a2c60	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	2
	Information Disclosure Statement (IDS) Form (SB08)	3	3

Warnings:

Information:

3	Foreign Reference	WO_2009_059852A2.pdf	2208261 496053f63c3070fd03b9efe880acd07837596eb3	no	30

Warnings:

Information:

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

4	Foreign Reference	WO_2012_068635A1.pdf	2083465 bb75ac5a22048cbcf50c88f74e9be90e18cb0d32	no	36
Warnings:					
Information:					
5	Non Patent Literature	USB_BatteryChargingSpec1_2_ex1009.PDF	25494630 5cb82378142539a44c208c60779478c658fb533e	no	71
Warnings:					
Information:					
6	Non Patent Literature	Carku_E-Power-20B_.PDF	474572 492f1e3f9029dc7ea9520c0dcdb28c5a9b511976	no	2
Warnings:					
Information:					
7	Non Patent Literature	USB_BatteryCharging_1_2_part2.pdf	20900044 cc9f97944ab534d287d73aa459fb40b0a8d2044f	no	84
Warnings:					
Information:					
8	Non Patent Literature	USB_BatteryCharging_1_2_part1.pdf	11724018 8e30f74a610bab23a23cb936749916c9a0311de0	no	82
Warnings:					
Information:					
9	Fee Worksheet (SB06)	fee-info.pdf	38279 43c6deb7de2ec436296a5a77167357f895008588	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	63310204	

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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 a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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

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

New International Application Filed with the USPTO as a Receiving Office

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

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	Jonathan Lewis Nook	Confirmation No.:	1056
Serial No.:	16/820,040	Art Unit:	2859
Filed:	March 16, 2020	Examiner:	Diao, M Baye
For:	PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION	Atty. Docket No.:	14710-137-999 (55-US-02-02)

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In accordance with the duty of disclosure imposed by 37 C.F.R. § 1.56, Attorneys for Applicant hereby direct the Examiner's attention to the references listed on the attached form entitled "List of References Cited by Applicant."

References A01-A03 are U.S. patent documents; therefore, copies of these references are not submitted herewith, pursuant to 37 C.F.R. § 1.98(a)(2)(ii). Copies of References B01-B02 and C01-C03 are submitted herewith. Applicant respectfully requests that the Examiner review the listed references and that the references be made of record in the file history of the application.

As provided for by 37 C.F.R. § 1.97(g) and (h), no inference should be made that the information and references cited are prior art merely because they are in this statement and no representation is being made that a search has been conducted or that this statement encompasses all the possible relevant information.

This Information Disclosure Statement is filed under 37 C.F.R. §1.97(c) after the period specified in 37 C.F.R §1.97(b), but before the mailing date of any of a final action under 37 C.F.R. §1.113, a notice of allowance under 37 C.F.R. §1.311, or an action that otherwise closes prosecution in the application.

It is estimated that a fee of $130.00, as set forth in 37 C.F.R. §1.17(p) in accordance with 37 C.F.R. §1.97(c), is required; please charge the required fee to Jones Day deposit account no. 50-3013 (referencing 101476-999137).

Respectfully submitted,

Date: November 1, 2022

/Joseph M. Sauer/ 47,919

Joseph M. Sauer (Reg. No.)
JONES DAY
901 Lakeside Avenue
Cleveland, Ohio 44114
(216) 586-7506

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

INVENTOR: Jonathan Lewis Nook

CONFIRMATION NO.: 1056

APPLICATION NO.: 16/820,040

GROUP ART UNIT: 2859

FILING DATE: March 16, 2020

EXAMINER: Diao, M Baye

TITLE:
PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION

DOCKET NO.: 054985-000055-US-02-02

AMENDMENT IN REPLY TO OFFICE ACTION OF AUGUST 10, 2022

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sirs:

This is in response to the Non-final Office Action mailed August 10, 2022.

Reconsideration and allowance of Applicant's claim is requested in view of the amendments and remarks provided herein.

Amendments to the claims are provided on the listing of the claims which begins on page **2**.

Remarks begin on page **11** of this paper.

REMARKS

Claims 24-80 are pending with claims 24 and 80 being independent claims. Claims 24, 29, 41, 44, and 80 are amended herein. Support for the amendments can be found throughout the specification, including at least at paragraphs [0014] and [0025] and in Fig. 4 of the published application, as well as in the original claims. No new matter is added. Reconsideration is respectfully requested.

Examiner Interview

Examiner is thanked for the courtesies extended in an interview with Applicant's representative, Joseph Sauer, on September 15, 2022. During the interview, the validity of U.S. Patent No. 10,087,904 to Butler ("Butler") as a prior art reference for the present application was discussed. Butler was used as a basis for the Section 103 rejections of each pending claim. No agreement was reached regarding its validity as prior art.

Claim Objections

Claim 24 is objected to for reciting "the jump starter device" in line 5 and for failing to underline the limitation "the positive and negative battery connectors." Claim 24 is amended herein to recite "the jump *starting* device" and to underline the appropriate limitation.

Claim 41 is objected to for failing to underline "37" in the preamble of the claim when its dependency was modified. Claim 41 is amended herein to include the appropriate mark-up indications.

Claim 29 is objected to for reciting "wherein the DC-DC converter is configured to convert 5VDC from *at* the USB connector. . . ." Claim 29 is amended herein to remove the mention of "at" in this language.

Claim 80 is objected to for antecedent basis for reciting "the jump starter device." Claim 80 is amended herein to recite "the jump *starting* device."

Applicant submits that the aforementioned amendments are sufficient to overcome the claim objections and thus respectfully requests withdrawal of the objections.

Claim Rejections Under 35 U.S.C. § 103

Claims 24-28, 31-32, 36-58, 60, 63-68, 71, and 74-80 are rejected under 35 U.S.C. § 103 for allegedly being unpatentable over U.S. Published Application No. 2009/0174362 to Richardson et al. (hereafter, "Richardson") in view of U.S. Patent No. 10,087,904 to Butler et al.

(hereafter, "Butler"). Claim 35 is rejected under 35 U.S.C. § 103 as allegedly being unpatentable over Richardson in view of Butler and further in view of U.S. Published Application No. 2011/0175461 to Tinaphong (hereafter, "Tinaphong"). Claims 69-70 are rejected under 35 U.S.C. § 103 as allegedly being unpatentable over Richardson in view of Butler and U.S. Patent No. 8,076,900 to Brown (hereafter, "Brown") and in further view of U.S. Published Application No. 2011/0068734 to Waldron (hereafter, "Waldron"). Claims 29, 30, 72, and 73 are rejected under 35 U.S.C. § 103 as allegedly being unpatentable over Richardson in view of Butler and in further view of U.S. Patent No. 9,506,446 to Xinfang (hereafter, "Xinfang"). Claims 33-34 are rejected under 35 U.S.C. § 103 as allegedly being unpatentable over Richardson in view of Butler and further in view of U.S. Patent No. 9,601,801 to Nakamoto (hereafter, "Nakamoto"). Claims 59 and 61 are rejected under 35 U.S.C. § 103 as allegedly being unpatentable over Richardson in view of Butler and in further view of U.S. Published Application No. 2004/0130298 to Krieger (hereafter, "Krieger"). Claim 62 is rejected under 35 U.S.C. § 103 as allegedly being unpatentable over Richardson in view of Butler and in further view of U.S. Patent No. 5,867,007 to Kim (hereafter, "Kim").

As indicated in the above recitation of the Section 103 rejections, Butler is relied on by the Office as a basis of rejecting each claim. However, Butler does not qualify as prior art to the present application. 35 U.S.C. § 102(a) defines the prior art that may preclude the grant of a patent on a claimed invention. MPEP § 2152. 35 U.S.C. § 102(a) provides that:

> [a] *person shall be entitled to a patent unless—*
>
> > (1) the claimed invention was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public *before the effective filing date of the claimed invention*; or
> >
> > (2) the claimed invention was described in a patent issued under section 151, or in an application for patent published or deemed published under section 122(b), in which *the patent or application, as the case may be, names another inventor and was effectively filed before the effective filing date of the claimed invention.*
>
> (Emphasis added.)

35 U.S.C. § 100(i) defines "effective filing date" for patents and patent applications:

(1) The term "effective filing date" for a claimed invention in a patent or application for patent means—

(A) if subparagraph (B) does not apply, *the actual filing date of the patent or the application for the patent* containing a claim to the invention; *or*

(B) *the filing date of the earliest application for which the patent or application is entitled, as to such invention, to a right of priority* under section 119, 365(a), 365(b), 386(a), or 386(b) or to the benefit of an earlier filing date under section 120, 121, 365(c), or 386(c).

(Emphasis added.)

The earliest possible effective filing date of Butler is August 14, 2014. This is the filing date of Provisional Application No. 62/037,379, to which the parent application of Butler claims priority. However, the present application is a continuation of application No. 15/691,884, filed on August 31, 2017, now Patent No. 10,604,024, which is a continuation of application No. 14/619,655, filed on February 11, 2015, now Patent No. 9,770,992, which is a division of application No. 14/325,938, filed on July 8, 2014, now Patent No. 9,007,015, which is a continuation of application No. PCT/US2014/045434, filed on July 3, 2014. The effective filing date of the present application is therefore July 3, 2014—the filing date of PCT Application PCT/US2014/045434. Thus, the effective filing date of the present application predates the effective filing date of Butler and Butler is not a valid prior art reference. For at least the reason that Butler was improperly relied on by the Office to reject each claim under 35 U.S.C. § 103, Applicant respectfully traverses each Section 103 rejection.

CONCLUSION

Applicant respectfully submits that a full and complete response has been made to the outstanding Office Action, and, as such, there being no other objections or rejections, this application is in condition for allowance and a notice of the same is earnestly solicited.

In the event this paper is not being timely filed, the Applicant respectfully petitions for an appropriate extension of time. Any fees for such an extension together with any additional fees associated with the processing of this Response and any other documents filed concurrently with this Response may be charged to Counsel's Deposit Account 50-5013, under 37 CFR 1.16 and 1.17.

If the Office has any questions, or believes for any reason that personal communication will expedite prosecution of this application, the Office is hereby invited to telephone the undersigned at the number provided below.

Respectfully submitted,

Date: November 1, 2022

/Joseph M. Sauer/

Joseph M. Sauer (Reg. No. 47,919)
JONES DAY
901 Lakeside Avenue
Cleveland, Ohio 44114
(216) 586-7506

LISTING OF THE CLAIMS:

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

1-23. (Cancelled)

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

a power supply;

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

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

a power switch or switch circuit connected in circuit with the power supply and the positive and negative battery connectors, the power switch or switch circuit configured to switch power on from the power supply to boost or charge the depleted or discharged battery when connected between the positive and negative battery connectors;

a USB input connector; and

a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit comprising a DC-DC converter configured to upconvert voltage from the USB input connector to the power supply.

25. (Previously Presented) The device according to claim 24, wherein the power switch or switch circuit is controlled to turn on power to the depleted or discharged battery only when the jump starting device is connected with correct polarity to the depleted or discharged battery.

26. (Previously Presented) The device according to claim 24, wherein the power supply is an internal power supply.

27. (Previously Presented) The device according to claim 24, wherein the USB charging circuit and power supply are located within the jump starting device.

28. (Previously Presented) The device according to claim 27, wherein the DC-DC converter is one or more DC-DC converters.

29. (Currently amended) The device according to claim 24, wherein the DC-DC converter is configured to convert about 5VDC from [[at]] the USB input connector to at least 11.1 VDC for the power supply when an active USB power source is connected to the USB input connector.

30. (Previously Presented) The device according to claim 29, wherein the USB charger power source is a USB charger, and the USB charging circuit is configured to convert power from the USB charger to charge voltage and current for supplying power or charging the power supply.

31. (Previously presented) The device according to claim 24, wherein the DC-DC converter is configured to be turned on and off via a circuit by an output from a microcontroller.

32. (Previously Presented) The device according to claim 31, wherein the power supply is a rechargeable battery, and wherein the microcontroller software can turn charge off if the rechargeable battery voltage is measured to be too high by an A/D input.

33. (Previously Presented) The device according to claim 32, wherein the rechargeable battery is a rechargeable lithium battery, and further comprising a rechargeable lithium battery charge controller configured to provide charge balance to internal lithium battery cells of the rechargeable lithium battery.

34. (Previously Presented) The device according to claim 33, wherein the rechargeable lithium battery charge controller is also configured to provide safety redundancy for eliminating over discharge of the rechargeable lithium battery.

35. (Previously Presented) The device according to claim 24, wherein the USB input connector is a micro-USB connector.

36. (Previously Presented) The device according to claim 24, further comprising a USB output connector for providing a power output from the power supply to a USB-chargeable device.

37. (Previously Presented) The device according to claim 36, wherein the USB output connector is electrically connected to a USB output circuit, the USB output circuit connecting the power supply to the USB output connector.

38. (Previously Presented) The device according to claim 36, wherein the USB output connector at least partially defines a USB output port.

39. (Previously Presented) The device according to claim 37, wherein the USB output connector and the USB output circuit define a USB output port.

40. (Previously Presented) The device according to claim 39, wherein the USB output port is configured to provide a portable charger for charging smartphones, tablets, music players, and other rechargeable electronic devices.

41. (Currently Amended) The device according to claim 37 [[39]], further comprising a microcontroller with a control circuit, the control circuit for the microcontroller allows the USB output circuit to be turned on and off by software control to prevent the power supply getting too low in capacity.

42. (Previously Presented) The device according to claim 39, wherein the USB output port is accessible from outside of the jump charge device using the USB output connector.

43. (Previously Presented) The device according to claim 42, wherein the USB connector includes a voltage divider configured to enable charge to certain smartphones that require the voltage divider.

44. (Currently Amended) The device according to claim 24, wherein the power supply is a rechargeable battery disposed within the jump starting ~~starter~~ device.

45. (Previously Presented) The device according to claim 24, wherein the power switch or switch circuit comprises at least one power switch or switch circuit configured to turn power on from the power supply to the depleted or discharged battery when connected to the positive and negative battery connectors.

46. (Previously Presented) The device according to claim 45, wherein the power switch or switch circuit comprises one or more sensors configured to detect whether the positive and negative battery connectors are properly connected to the depleted or discharged battery prior to switching on the power switch or switch circuit.

47. (Previously Presented) The device according to claim 46, wherein the power switch or switch circuit is configured to detect presence of the depleted or discharged battery when connected between the positive and negative battery connectors.

48. (Previously Presented) The device according to claim 46, wherein the power switch or switch circuit is configured to detect polarity of the depleted or discharged battery when connected between the positive and negative battery connectors.

49. (Previously Presented) The device according to claim 46, wherein the power switch or switch circuit is configured to detect presence of the depleted or discharged battery when connected between the positive and negative battery connectors, and configured to detect polarity of the depleted or discharged battery when connected between the positive and negative battery connectors,

wherein the power switch or switch circuit switches on the power supply to connect the power supply to the depleted or discharged battery only when the depleted or discharged battery is present when connected between the positive and negative battery connectors and the depleted or discharged battery is connected with correct polarity between the positive and negative battery terminals.

50. (Previously presented) The device according to claim 45, wherein the power switch or switch circuit comprises a microcontroller configured for providing an output controlling the power switch or switch circuit.

51. (Previously presented) The device according to claim 50, 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.

52. (Previously presented) The device according to claim 51, 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 connectors, and another sensor configured to detect polarity of the depleted or discharged battery when connected between the positive and negative battery connectors.

53. (Previously presented) The device according to claim 52, wherein the one or more sensors is one or more sensing circuits.

54. (Previously Presented) The device according to claim 50, wherein the microcontroller switches the power switch or switch circuit on 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 connected with correct polarity to the positive and negative battery connectors.

55. (Previously presented) The device according to claim 50, wherein the microcontroller is a programmable microcontroller configured to allow updates in functionality and system parameters.

56. (Previously presented) The device according to claim 55, wherein the programmable microcontroller comprises a memory.

57. (Previously presented) The device according to claim 24, wherein the positive battery connector comprises a positive battery cable, and the negative battery connector comprises a negative battery cable.

58. (Previously presented) The device according to claim 57, wherein the positive battery cable comprises a positive battery clamp and the negative battery cable comprises a negative battery clamp.

59. (Previously Presented) The device according to claim 24, wherein said power switch or switch circuit comprises a plurality of FETs in parallel.

60. (Previously Presented) The device according to claim 51, wherein the one or more sensors is a presence sensor configured for detecting presence of the depleted or discharged battery when connected between the positive and negative battery connectors, and a reverse polarity sensor configured to detect polarity of a connection of the positive and negative battery connectors of the jump starting device with the depleted or discharge battery.

61. (Previously Presented) The device according to claim 60, wherein the presence sensor and the reverse polarity sensor comprise optically coupled isolator phototransistors.

62. (Previously presented) The device according to claim 24, further comprising a plurality of power diodes coupled between the positive and negative battery connectors and the power supply to prevent back-charging of the power supply from an electrical system connected to the depleted or discharged battery.

63. (Previously presented) The device according to claim 24, further comprising an output port providing positive and negative polarity outputs to the positive and negative battery connectors.

64. (Previously presented) The device according to claim 50, further comprising a temperature sensor configured to detect temperature of the power supply and to provide a temperature signal to the microcontroller.

65. (Previously presented) The device according to claim 50, further comprising a voltage measurement circuit configured to measure output voltage of the power supply and to provide a voltage measurement signal to the microcontroller.

66. (Previously presented) The device according to claim 24, 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 device.

67. (Previously presented) The device according to claim 60, further comprising a manual override switch configured to activate a manual override mode to enable a user to connect jump start power to the positive and negative battery connectors when the one sensor configured for detecting presence of the depleted or discharged battery is unable to detect presence of the depleted or discharged battery.

68. (Previously presented) The device according to claim 67, wherein the microcontroller 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.

69. (Previously Presented) The device according to claim 24, wherein the positive and negative battery connectors are defined by a jumper cable device including a plug configured to plug into an output port of the jump starting device, a pair of cables integrated with the plug at one respective end of the pair of cables and being configured to be connected to positive and negative battery terminals of the depleted or discharged battery at an opposite end of the pair of cables.

70. (Previously presented) The device according to claim 69, wherein the output port and the plug are dimensioned so that the plug will fit into the output port only in one specific orientation.

71. (Previously Presented) The device according to claim 24, wherein the power switch or switch circuit is configured to switch power on only when the jump starting device is properly connected to the depleted or discharged battery.

72. (Previously Presented) The device according to claim 29, wherein the USB charging source is a USB charger.

73. (Previously Presented) The device according to claim 72, wherein the USB charger is a standard USB charger.

74. (Previously Presented) The device according to claim 24, wherein the power supply is a rechargeable lithium battery pack.

75. (Previously Presented) The device according to claim 7 4, wherein the rechargeable lithium battery pack is an internal power supply.

76. (Previously Presented) The device according to claim 7 4, wherein the USB charge circuit is configured to convert power from a USB charger power source, to charge voltage and current suitable for charging the rechargeable lithium battery pack.

77. (Previously Presented) The device according to claim 74, further comprising a rechargeable lithium battery pack voltage measurement circuit configured to monitor the rechargeable lithium battery pack to prevent voltage potential from rising too high during a charging operation and from dropping too low during a discharge operation.

78. (Previously Presented) The device according to claim 74, further comprising a fuel gauge LEDS for indicating a charge level of the rechargeable lithium battery pack.

79. (Previously Presented) The device according to claim 24, wherein the power switch or switch circuit is a smart switch, or comprises a smart switch.

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

a power supply;

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

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

a power switch or switch circuit in circuit with the power supply and the positive and negative battery connectors, the power switch or switch circuit configured to switch power on from the power supply to boost or charge the depleted or discharged battery when connected between the positive and negative battery connectors;

a USB input connector;

a USB charge circuit electrically connecting the USB input connector to the power supply, the USB charge circuit configured to up-convert voltage from a USB charger power source connected to the USB input connector to the power supply using a DC-DC converter;

a USB output connector; and

a USB output circuit electrically connecting the power supply to the USB output connector.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/820,040	Filing Date 03/16/2020	☐ 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	11/01/2022	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 57	Minus	** 57	= 0		x $50 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0		x $240 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(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.	SPE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/KARA E CRESTWELL/
*** 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.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

EXHIBIT 1002
Petitioner ADC (IPR2024-00671)

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	68	("20020041174"|"20040066168"|"20040130298"|"20050040788"|"20050110467"|"20050252573"|"20070285049"|"20100301800"|"20110068734"|"20120091944"|"20	(US-PGPUB; USPAT)	OR	ON	ON	2019/11/20 07:47 PM

		130154543"|"20130314041"|"20140159509"|"20150306964"|"20160001666"|"20180111491"|"20180215274"|"20180269703"|"20180342891"|"20180345803"|"20190308518"|"3933140"|"4041445"|"4885524"|"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"|"7301303"|"7749031"|"7872361"|"8076900"|"8199024"|"8376775"|"8493021"|"9007015"|"9506446"|"9770992"|"D625265"|"D649116"|"D689020"|"D726109"|"D726114"|"D726121"|"D735665"|"D746774").PN.				
L175	1	"10328808".pn.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:01 PM
L176	1	"9770992".pn.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:03 PM
L177	9696	(isolat$3 (batter$3 adj presence)) adj sens$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:25 PM
L178	279	reverse adj polarity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:25 PM
L179	11	L177 and L178	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:25 PM
L180	7	L174 and L179	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:38 PM
L182	1	"10604024".pn.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/07/01 07:06 PM
L183	3558	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:42 PM
L184	24862	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:43 PM
L185	166340	output adj port	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:43 PM
L186	0	vehicle adj batter$3 adj isolat$3 adj sens$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:44 PM
L187	1674253	(isolat$3 (batter$3 adj	(US-PGPUB; USPAT;	OR	ON	ON	2014/10/23

		presence) adj sens$3)	EPO)				12:47 PM
L188	6642	(isolat$3 (batter$3 adj presence)) adj sens$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:48 PM
L189	0	reverse adj popularity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:49 PM
L190	186	reverse adj polarity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:49 PM
L191	0	(microcontroller microcomputer microprocessor processor controller) and L183 and L184 and L185 and L188 and L190	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L192	2960317	(microcontroller microcomputer microprocessor processor controller)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L193	0	L183 and L184 and L185 and L188 and L190	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L194	0	L183 and L184 and L185 and L188	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L195	0	L183 and L184 and L185 and L190	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L196	15	L183 and L184 and L185 and L1830	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:51 PM
L197	3	L188 and L190	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:52 PM
L198	195	320/105.ccls. and (@ad<="20140708")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:55 PM
L199	1845	320/110-112.ccls. and (@ad<="20140708")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:55 PM
L200	0	(L198 L199) and (L196 L197)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 12:56 PM
L201	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	2014/10/23 12:57 PM
L202	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
L203	0	((integrated combo combination assembly)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:48 PM

		adj jumper) with ((plug connector) same (other another) adj end$2)					
L204	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
L205	222	((integrated combo combination assembly) adj jumper) and ((plug connector))	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:49 PM
L206	1674253	(isolat$3 (batter$3 adj presence) adj sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:49 PM
L207	6642	(isolat$3 (batter$3 adj presence)) adj sens$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:49 PM
L208	186	reverse adj polarity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:49 PM
L209	3	L206 and L207 and L208	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:49 PM
L210	3558	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:50 PM
L211	24862	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:50 PM
L212	48	L210 and L211	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:50 PM
L213	0	L205 L206 L207 L208	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2014/10/23 03:50 PM
L214	0	L205 L206 L207	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2014/10/23 03:50 PM
L215	0	L205 L212	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2014/10/23 03:51 PM
L216	0	L205 L212	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2014/10/23 03:51 PM
L217	1	L208 L212	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2014/10/23 03:51 PM
L218	8	L206 L212	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2014/10/23 03:51 PM
L219	12	L209 L217 L218	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:52 PM
L220	195	320/105.ccls. and (@ad<="20140708")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:52 PM
L221	1845	320/110-112.ccls. and (@ad<="20140708")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:52 PM
L222	1	(L220 L221) and (L219 L212)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:52 PM
L223	8	(L218) and (L219)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:56 PM
L224	8	(L218) and (L219)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:56 PM

L225	8	(L218) and (L212)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:56 PM
L226	8	L224 L225	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 03:56 PM
L227	0	L205 and L212	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 04:03 PM
L228	0	L205 and L211 and L208	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 04:04 PM
L229	0	L205 and L208	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 04:04 PM
L230	1	L212 and L208	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 04:04 PM
L231	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-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-	(USPAT)	OR	ON	ON	2014/10/23 05:39 PM

		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.					
L232	3558	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 05:41 PM
L233	24862	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 05:41 PM
L234	48	L232 and L233	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 05:41 PM
L235	1	L234 and L231	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 05:41 PM

L236	84	(jump adj (start$3 cable)) with (alligator$2 clamp$2)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:17 PM
L237	0	L236 with ((integrated embedded) adj plug)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:21 PM
L238	0	L236 and ((integrated embedded) adj plug)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:21 PM
L239	0	L236 and ((integrated embedded) adj (plug connect$3 socket$2))	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:23 PM
L240	83	L236 and (plug connect$3 socket$2)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:28 PM
L241	36	L236 and (plug)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:28 PM
L242	3558	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:29 PM
L243	24862	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:29 PM
L244	48	L242 and L243	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:29 PM
L245	0	L241 and L244	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/23 11:29 PM
L246	225	(reverse reversed) adj polarity adj (sens$3 detect$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:19 PM
L247	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
L248	95	battery adj (presence connection) adj (sens$3 detect$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:21 PM
L249	2960317	(microcontroller microcomputer microprocessor processor controller)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:22 PM
L250	0	L246 and L248 and L249	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:22 PM
L251	3558	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:22 PM
L252	0	L246 and L248 and L251	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:22 PM
L253	0	L246 and L248	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:23 PM
L254	10	(US-20130314041-$ or US-20120091944-$ or US-20070285049-$ or US-20050252573-$ or US-20050040788-	(US-PGPUB; USPAT)	OR	ON	ON	2014/10/24 11:49 PM

		$).did. or (US-6130519-$ or US-8172603-$ or US-6262559-$ or US-5083076-$ or US-4885524-$).did.					
L255	22	("5635817"|"8493021"|"7872361"|"20040130298"|"20100301800"|"5921809"|"6140796"|"6632103"|"7301303"|"5793185"|"6262492"|"5635818"|"8376775"|"20140159509"|"5111130"|"5189359"|"6756764"|"5795182"|"6212054"|"8199024"|"20020041174"|"20130154543").PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:50 PM
L256	0	L254 and L255	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/10/24 11:50 PM
L257	4	("20050110467"|"6362599"|"6803743"|"7148580").PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/11/12 05:02 PM
L258	2	WO-2013137873-$.did.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2014/12/03 12:05 PM
L259	134	advantages near4 (lithium-ion) adj batter$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:03 PM
L260	196	320/105.ccls. and (@ad<="20140703")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L261	0	L259 and L260	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L262	3573	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L263	25112	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L264	167713	output adj port	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L265	2991441	(microcontroller microcomputer microprocessor processor controller)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L266	15	L262 and L263 and L264 and L265	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L267	0	L259 and L266	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:04 PM
L268	188	reverse adj polarity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:05 PM
L269	0	L259 and L268	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:05 PM
L270	224	((integrated combo	(US-PGPUB; USPAT;	OR	ON	ON	2014/12/03

		combination assembly) adj jumper) and ((plug connector))	EPO)				01:05 PM
L271	0	L259 and L270	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:05 PM
L272	25112	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:05 PM
L273	0	L259 and L272	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:05 PM
L274	1687265	(isolat$3 (batter$3 adj presence) adj sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:06 PM
L275	53	L259 and L274	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:06 PM
L276	0	L275 and L272	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:07 PM
L277	84	(jump adj (start$3 cable)) with (alligator$2 clamp$2)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:07 PM
L278	0	L275 and L277	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:07 PM
L279	150	(US-5793185-$ 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-5796255-$ or US-6036574-$ or US-6111393-$ or US-6130519-$ or US-6232728-$ or US-	(USPAT)	OR	ON	ON	2014/12/03 01:08 PM

		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.					

L280	0	L275 and L279	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:08 PM
L281	1856	320/110-112.ccls. and (@ad<="20140703")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:08 PM
L282	0	L275 and L281	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:08 PM
L283	1	"20130241488"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2014/12/03 01:39 PM
L284	1	"20050110467"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 11:35 AM
L285	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
L286	3612	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:07 PM
L287	25490	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:07 PM
L288	169705	output adj port	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:07 PM
L289	17	L286 and L287 and L288	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:07 PM
L290	4	L285 and L287 and L288	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:08 PM
L291	1	"6130519".pn.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 02:32 PM
L292	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
L293	25490	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 10:34 PM
L294	169705	output adj port	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 10:34 PM
L295	4	L303 and L304 and L305	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 10:34 PM
L296	4	L306 and (@ad<="20140703")	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2015/01/29 10:34 PM
L297	1	"9007015".PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/23 12:22 PM
L298	2	"9506446".PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/23 08:53 PM
L299	2	"20040130298"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/23 09:12 PM
L300	1	"20050110467"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 03:49 PM
L301	154	("5793185" "5752754" "4562893" "4793175" "4972135" "5886501"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 06:18 PM

		"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" "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.					
L302	4480	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 06:18 PM
L303	35042	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 06:18 PM
L304	62	L313 and L314	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 06:18 PM
L305	1	L312 AND L315	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2018/04/24 06:18 PM
L306	73	((batter$3 adj presence)) adj (sens$3 detect$4)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 07:16 PM
L307	259	reverse adj polarity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 07:16 PM
L308	0	L317 and L318	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 07:16 PM
L309	35	(positive negative) near vehicle near connect$2	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 07:18 PM
L310	73	((batter$3 adj presence)) adj (sens$3 detect$4)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:13 PM
L311	35	(positive negative) near vehicle near connect$2	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:13 PM
L312	0	L321 and L322	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:13 PM
L313	302	((integrated combo combination assembly) adj jumper) and ((plug connector))	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:24 PM
L314	0	L321 and L324	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:24 PM
L315	37280	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:25 PM
L316	7	L321 and L326	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:25 PM
L317	4703	jump adj start$3	(US-PGPUB; USPAT;	OR	ON	ON	2019/01/05

			EPO)				09:26 PM
L318	37280	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:26 PM
L319	67	L328 and L329	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:26 PM
L320	0	L327 and L330	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:26 PM
L321	130	battery adj (presence connection) adj (sens$3 detect$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:29 PM
L322	7	L327 and L332	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 09:29 PM
L323	2	"20040130298"	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/01/05 11:34 PM
L324	14677	(B60L53/14 or H02J7/0047 or H02J7/0054 or H02J7/0029 or H02J7/0034 or H02J2007/0062 or H02J2007/005 or H02J2001/006).cpc.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/07/25 02:58 PM
L325	1	"9007015".PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 11:00 AM
L326	1	"9770992".PN.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 12:07 PM
L327	150	(US-6014016-$ 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-	(USPAT)	OR	ON	ON	2019/10/07 01:22 PM

		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-$).did.					
L328	150	(US-6014016-$ 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- 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-	(USPAT)	OR	ON	ON	2019/10/07 01:22 PM

		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.					
L329	4959	jump adj start$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:28 PM
L330	39692	(internal adj power adj (supply source)) (internal adj PS)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:28 PM
L331	70	L343 and L344	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:28 PM
L332	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	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:31 PM

		H02J2007/004 or H02J2007/0037).cpc.					
L333	331	(reverse reversed) adj polarity adj (sens$3 detect$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:32 PM
L334	135	battery adj (presence connection) adj (sens$3 detect$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:32 PM
L335	0	L347 and L348	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:32 PM
L336	0	L345 and (L347 L348) and L342	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:34 PM
L337	10	L345 and (L347 L348) and L346	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:34 PM
L338	4639064	(microcontroller microcomputer microprocessor processor controller)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:35 PM
L339	10	L351 and L352	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/10/07 01:35 PM
L340	38	((("THE") near3 ("NOCO") near3 ("COMPANY"))).AS,AANM.	(USPAT)	OR	ON	ON	2019/10/07 01:48 PM
L341	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
L342	68	("20020041174"|"20040066168"|"20040130298"|"20050040788"|"20050110467"|"20050252573"|"20070285049"|"20100301800"|"20110068734"|"20120091944"|"20130154543"|"20130314041"|"20140159509"|"20150306964"|"20160001666"|"20180111491"|"20180215274"|"20180269703"|"20180342891"|"20180345803"|"20190308518"|"3933140"|"4041445"|"4885524"|"4931731"|"5083076"|"5111130"|"5189359"|"5486434"|"5635817"|"5635818"|"5793185"|"5795182"|"5921809"|"5965998"|"6054779"|"6130519"|"6140796"|"6147471"|"62	(US-PGPUB; USPAT)	OR	ON	ON	2019/11/20 07:47 PM

		12054"|"6262492"|"6262559"|"6362599"|"6386907"|"6426606"|"6632103"|"6648701"|"6756764"|"6803743"|"6822425"|"7301303"|"7749031"|"7872361"|"8076900"|"8199024"|"8376775"|"8493021"|"9007015"|"9506446"|"9770992"|"D625265"|"D649116"|"D689020"|"D726109"|"D726114"|"D726121"|"D735665"|"D746774").PN.					
L343	1	"10328808".pn.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:01 PM
L344	1	"9770992".pn.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:03 PM
L345	9696	(isolat$3 (batter$3 adj presence)) adj sens$3	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:25 PM
L346	279	reverse adj polarity adj (detect$3 sens$3)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:25 PM
L347	11	L359 and L360	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:25 PM
L348	7	L356 and L361	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2019/11/20 08:38 PM
L349	1	"10604024".pn.	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2020/07/01 07:06 PM
L365	2	"10604024".pn.	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/08/26 11:15 PM
L366	19947	(USB (universal NEAR serial NEAR bus)) NEAR ((charg$3 NEAR input NEAR port) (input charg$3) NEAR port)	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/08/26 11:33 PM
L367	30	L233 L232 L366	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2021/08/26 11:35 PM
L368	33	L346 L366 L333 L330	(US-PGPUB; USPAT; USOCR; FIT (CN, EP, FR, JP, KR, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2021/08/26 11:42 PM
L369	199	(jump boost) NEAR start$3 NEAR (device apparatus instrument module)	(US-PGPUB; USPAT; EPO)	OR	ON	ON	2021/08/26 11:44 PM
L370	25	L369 L366	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2021/08/26 11:45 PM

L371	921407	"705"	(US-PGPUB; USPAT; EPO)	AND	ON	ON	2021/08/26 11:52 PM
L372	2	("2019/0081472").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	AND	ON	ON	2021/08/27 12:19 AM
L373	15	("2479705" | "4895530" | "5367243" | "6215273" | "6222342" | "6623315" | "20020195995" | "20030141842" | "20080185996" | "20150054460" | "20150377808" | "20160049819" | "20160329731" | "20190081472").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	AND	ON	ON	2021/08/27 12:20 AM
L374	555	(Lithium NEAR battery) WITH (cell NEAR (balanc$3 equaliz$5))	(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	2021/08/30 06:48 PM
L375	1219412	mini	(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	2021/08/30 07:34 PM
L376	26965543	10	(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,	OR	ON	ON	2021/08/30 11:27 PM

			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)				
L377	2	"20090174362".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	2021/08/30 11:38 PM
L378	5	"5867007".pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/08/31 11:34 AM
L379	2	"20090174362".pn.period	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2021/08/31 03:23 PM

			IBM_TDB)				
L380	2	"8076900".pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/08/31 03:41 PM
L381	4	"20110068734".pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/08/31 03:45 PM
L382	684307	(B60L53/14 OR H02J7/342 OR H02J7/0047 OR H02J7/0034 OR H02J7/0029 OR H02J1/122 OR H02J7/00 OR H02J7/0048 OR H02J7/00302 OR H02J7/00309 OR H02J7/00306 OR Y02T90/14 OR Y02T10/7072 OR Y02T10/70 OR H02J2310/46).cpc. 320/105.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/08/31 05:56 PM
L383	2	L382 L369 L374 L346 L366	(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,	AND	ON	ON	2021/08/31 05:58 PM

			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)				
L384	135	((("NOOK") near3 ("Jonathan")) OR (("NOOK") near3 ("William")) OR (("STANFIELD") near3 ("James")) OR (("UNDERHILL") near3 ("Derek"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	AND	ON	ON	2021/08/31 05:59 PM
L385	135	((("NOOK") near3 ("Jonathan")) OR (("NOOK") near3 ("William")) OR (("STANFIELD") near3 ("James")) OR (("UNDERHILL") near3 ("Derek"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	AND	ON	ON	2021/08/31 06:00 PM
L386	0	L338 L346 L369 L313	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	AND	ON	ON	2021/08/31 06:01 PM
L387	117	("10328808" OR "10604024" OR "20010025618" OR "20020041174" OR "20030141845" OR "20040066168" OR "20040130298" OR "20040150373" OR "20040239290" OR "20050040788" OR "20050110467" OR "20050116688" OR "20050252573" OR "20060176011" OR "20060220610" OR "20060244412" OR "20070278990" OR "20070285049" OR "20080143290" OR "20100301800" OR "20110068734" OR "20110175461" OR "20120025766" OR "20120091944" OR "20120319487" OR "20130154543" OR "20130162029" OR "20130241488" OR "20130314041" OR "20140084844" OR	(US-PGPUB; USPAT)	OR	ON	ON	2021/08/31 06:04 PM

		"20140159509" OR "20140210399" OR "20140368155" OR "20150054336" OR "20150137740" OR "20150306964" OR "20150340907" OR "20160001666" OR "20180111491" OR "20180215274" OR "20180269703" OR "20180342891" OR "20180345803" OR "20190308518" OR "3590357" OR "3638108" OR "3933140" OR "4041445" OR "4885524" OR "4910628" OR "4931731" OR "5083076" OR "5111130" OR "5189359" OR "5194799" OR "5281904" OR "5319298" OR "5486434" OR "5635817" OR "5635818" OR "5650974" OR "5793185" OR "5795182" OR "5820407" OR "5921809" OR "5953681" OR "5965998" OR "6054779" OR "6130519" OR "6140796" OR "6147471" OR "6212054" OR "6262492" OR "6262559" OR "6344733" OR "6362599" OR "6386907" OR "6424158" OR "6426606" OR "6632103" OR "6648701" OR "6650086" OR "6679212" OR "6756764" OR "6759833" OR "6803743" OR "6822425" OR "7148580" OR					

		"7301303" OR "7345450" OR "7749031" OR "7872361" OR "7893657" OR "8076900" OR "8172603" OR "8199024" OR "8362745" OR "8376775" OR "8493021" OR "9007015" OR "9041244" OR "9153978" OR "9243601" OR "9506446" OR "9525297" OR "9770992" OR "9809183" OR "9954391" OR "D597029" OR "D625265" OR "D649116" OR "D689020" OR "D726109" OR "D726114" OR "D726121" OR "D735665" OR "D746774").pn.					
L388	0	L387 L374 L369 L366	(US-PGPUB; USPAT)	AND	ON	ON	2021/08/31 06:04 PM
L389	34	(USB (universal NEAR serial NEAR bus)) NEAR charg$3 NEAR (circuit$2) WITH (USB (universal NEAR serial NEAR bus)) NEAR input	(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	2022/03/08 12:43 PM
L390	0	L329 AND L389	(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	2022/03/08 12:43 PM

			NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L391	0	(L313 L319) AND L389	(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	2022/03/08 12:44 PM
L392	0	(L313 L319 L369) AND L389	(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	2022/03/08 12:45 PM
L393	1	"62294067".pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/03/08 03:48 PM
L394	1	"62294067".fmid.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY,	OR	ON	ON	2022/03/08 03:49 PM

			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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L395	2	"20080157732".pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/03/08 05:52 PM
L396	2	"20120187897".pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/03/08 05:53 PM
L397	5	JP-3182855-$.DID.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH,	OR	ON	ON	2022/03/08 06:41 PM

			TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L398	3	"9048666".pn.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/03/08 07:31 PM
L399	114	(jump?start$3 near3 (vehicle automobile car truck)) WITH (discharged depleted drained emptyu dead) NEAR battery	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/03/08 07:35 PM
L400	115	(jump?start$3 near3 (vehicle automobile car truck)) WITH (discharged depleted drained empty dead) NEAR battery	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, 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, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/03/08 07:36 PM
L401	0	"201300154550".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA,	OR	ON	ON	2022/06/09 02:37 PM

			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)				
L402	9	"2013154550".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	2022/06/09 02:37 PM
L403	187	(jump near2 start$3 WITH boost$3 upconvert$3).clm. AND (USB NEAR (circuit$2 port))	(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	2022/07/30 01:46 PM
L404	1290	(usb NEAR (input connector port)) AND (USB near2 charg$3 NEAR circuit$2)	(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;	OR	ON	ON	2022/07/30 01:47 PM

			JPO; DERWENT; IBM_TDB)				
L405	3	L403 AND L404 AND L400	(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	2022/07/30 01:48 PM
L406	12	L382 AND L403	(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	2022/07/30 01:50 PM
L407	43	((US-8172603-B1 OR US-5083076-A OR US-6262559-B1 OR US-6130519-A OR US-4885524-A OR US-5965998-A OR US-5650974-A OR US-9041244-B2 OR US-5953681-A OR US-10981452-B2 OR US-6215273-B1 OR US-9748541-B2 OR US-9601800-B2 OR US-9048666-B2 OR US-10218172-B2 OR US-9748778-B2 OR US-7893558-B2 OR US-7893655-B2 OR US-7017055-B1 OR US-11112844-B2 OR US-10087904-B2).did. AND USPT.dbnm.) OR ((US-20130314041-A1 OR	(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	2022/08/03 01:52 PM

		US-20120091944-A1 OR US-20070285049-A1 OR US-20050252573-A1 OR US-20050040788-A1 OR US-20130241488-A1 OR US-20120319487-A1 OR US-20150137740-A1 OR US-20110175461-A1 OR US-20190081472-A1 OR US-20160181587-A1 OR US-20100052620-A1 OR US-20160111914-A1 OR US-20090026837-A1 OR US-20180341309-A1 OR US-20130154550-A1 OR US-20180369599-A1).did. AND PGPB.dbnm.) OR ((PH-12013500793-B1 OR AU-2011334615-B2 OR DE-102007052750-A1 OR WO-2009059852-A2).did. AND FTDB.dbnm.) OR ((US-20150015184-A1).did. AND DWPI.dbnm.)					
L408	3	((WO-2009059852-A2 OR DE-102007052750-A1).did. AND FTDB.dbnm.) OR ((US-10087904-B2).did. AND USPT.dbnm.)	(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); USPAT)	OR	ON	ON	2022/08/03 01:53 PM
L409	134	("10084173" OR "10128483" OR "10328806" OR "10461545" OR "20010003827" OR "20020007500" OR "20020007699" OR "20020121877" OR "20020155752" OR "20030096158" OR "20040106038" OR "20040124810" OR "20050082833" OR	(US-PGPUB; USPAT)	OR	ON	ON	2022/08/04 05:54 PM

		"20050162124" OR "20050213867" OR "20060071631" OR "20070132427" OR "20070132537" OR "20070178777" OR "20070182363" OR "20080131764" OR "20080150473" OR "20080157732" OR "20090039712" OR "20090108814" OR "20090174362" OR "20090218988" OR "20090236859" OR "20090253312" OR "20100001682" OR "20100013302" OR "20100055546" OR "20100129723" OR "20100164439" OR "20100173182" OR "20100181959" OR "20100244766" OR "20100283623" OR "20110117408" OR "20110127947" OR "20110140651" OR "20110250473" OR "20110268996" OR "20110279089" OR "20110308856" OR "20120013189" 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 "20130241498" OR "20130295444" OR "20140045001" OR "20140077755" OR "20140113463" OR "20140127550" OR "20140139175" OR "20150012174" OR "20150037662" OR "20150087182" OR "20150222060" OR "20150236329" OR "20150366538" OR					

		"20150380697" OR "20160141728" OR "20160155996" OR "20170084899" OR "20170309872" OR "3085187" OR "3105183" OR "3267452" OR "4142771" OR "4740740" OR "4972135" OR "4990723" OR "5496658" OR "5589757" OR "5637978" OR "5707257" OR "5716735" OR "5831350" OR "6002235" OR "6037778" OR "6057667" OR "6144110" OR "6160381" OR "6222342" OR "6249106" OR "6271605" OR "6300742" OR "6384573" OR "6679708" OR "6774607" OR "6799993" OR "6856764" OR "6919704" OR "7015674" OR "7095339" OR "7339347" OR "7508171" OR "7514900" OR "7579811" OR "7656118" OR "7675261" OR "7679317" OR "7791319" OR "7847520" OR "7868582" OR "8030900" OR "8125181" OR "8221915" OR "8686688" OR "8736227" OR "8786247" OR "8994327" OR "9007023" OR "9070938" OR "9197079" OR "9263717" OR "9263907" OR "9287725" OR					

		"9537136" OR "9608294" OR "9718419" OR "9871392" OR "9874611").pn.					
L410	3	("10087904" OR "20150306967" OR "7893558").pn.	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/10 11:20 AM
L411	13	("10087904" OR "20150306967" OR "7893558").pn.USB	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/10 11:28 AM
L412	0	(portable OR handheld) NEAR (car vehicle truck plane boat motorcycle autonomous vehicle robot forklift truck) ADJ ((jump ADJ start$3) jumpstart$2) ADJ (apparatus device unit module) WITH (safety ADJ protect$3) WITH (USB (universal ADJ serial ADJ bus)) ADJ (input ADJ connect$2 AND charg$3 ADJ circuit$2)	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/10 11:38 AM
L413	0	(portable OR handheld) NEAR (car vehicle truck plane boat motorcycle autonomous vehicle robot forklift truck) ADJ ((jump ADJ start$3) jumpstart$2) ADJ (apparatus device unit module) SAME (safety ADJ protect$3) SAME (USB (universal ADJ serial ADJ bus)) ADJ (input ADJ connect$2 AND charg$3 ADJ circuit$2)	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/10 11:39 AM
L414	0	(portable OR handheld) NEAR (car vehicle truck plane boat motorcycle autonomous vehicle robot forklift truck) ADJ ((jump ADJ start$3) jumpstart$2) ADJ (apparatus device unit module) AND (safety ADJ protect$3) AND (USB (universal ADJ serial ADJ bus)) ADJ (input ADJ connect$2 AND charg$3 ADJ circuit$2)	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/10 11:39 AM

L415	0	(portable OR handheld) NEAR (car vehicle truck plane boat motorcycle autonomous vehicle robot forklift truck) ADJ ((jump ADJ start$3) jumpstart$2) ADJ (apparatus device unit module) AND (safety ADJ protect$3) AND (USB (universal ADJ serial ADJ bus)) ADJ (input ADJ connect$2) AND (USB ADJ charg$3 ADJ circuit$2)	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/10 11:40 AM
L416	0	(portable OR handheld) NEAR (car vehicle truck plane boat motorcycle autonomous vehicle robot forklift truck) ADJ ((jump ADJ start$3) jumpstart$2) ADJ (apparatus device unit module) AND (safety ADJ protect$3) AND (USB (universal ADJ serial ADJ bus)) ADJ (input ADJ connect$2) AND (USB ADJ charg$3 ADJ circuit$2)	(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	2022/11/10 11:40 AM
L417	0	(portable OR handheld) NEAR (car vehicle truck plane boat motorcycle autonomous vehicle robot forklift truck) ADJ ((jump ADJ start$3) jumpstart$2) ADJ (apparatus device unit module) AND (safety (reverse ADJ polarity) ADJ protect$3) AND (USB (universal ADJ serial ADJ bus)) ADJ ((input ADJ connect$2) port) AND (USB ADJ charg$3 ADJ circuit$2)	(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	2022/11/10 11:42 AM
L418	0	(jumpstart$3 AND device AND boost$3 AND charg$3 AND deplet$2 AND discharg$2 AND battery AND power AND supply AND connect$3 AND power AND switch AND USB AND input AND charge AND circuit AND	(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	2022/11/10 11:44 AM

		USB AND connect$2).clm.	NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L419	0	(jumpstart$3 AND device AND boost$3 AND charg$3 AND deplet$2 AND discharg$2 AND battery AND power AND supply AND connect$3 AND power AND switch AND USB AND input AND charge AND circuit AND (USB ADJ connect$2)).clm.	(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	2022/11/10 11:45 AM
L420	0	(jumpstart$3 AND device AND boost$3 AND charg$3 AND deplet$2 AND discharg$2 AND battery AND power AND supply AND power AND switch$3 AND USB AND input AND charge AND circuit$2 AND (USB ADJ connect$2)).clm.	(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	2022/11/10 11:46 AM
L421	45	(Artificial Intelligence) Similar to: 16/820,040 with 0 CPC Selections and 0 Text Selections Text: (US-20200215926-A1 OR US-11447023-B2 OR US-20200317068-A1 OR US-11458851-B2 OR US-20160001666-A1 OR US-20190308518-A1 OR US-9007015-B1 OR US-10604024-B2 OR US-20180111491-A1 OR US-20210031640-A1 OR US-20180345803-A1 OR	(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))	OR	ON	ON	2022/11/10 12:28 PM

		US-20180215274-A1 OR US-10328808-B2 OR US-9770992-B2 OR US-20200259340-A1 OR GB-2582520-A OR US-7479763-B2 OR WO-2019190588-A1 OR US-20090174362-A1 OR US-20040251876-A1 OR US-11001212-B2 OR US-20200290535-A1 OR US-20030184264-A1 OR CN-207530573-U OR US-20210155096-A1 OR WO-2019101108-A1 OR JP-2020516219-A OR CN-207217796-U OR WO-9730502-A1 OR WO-2022055644-A1 OR US-20220085631-A1 OR GB-2579150-A OR US-5668461-A OR AU-2018403192-A1 OR CA-3085762-A1 OR US-9506446-B2 OR GB-2580257-A OR US-20150054336-A1 OR US-11254213-B2 OR US-20210075235-A1 OR US-20090218988-A1 OR GB-2605117-A OR AU-2018336956-B2 OR US-8493021-B2 OR EP-3707368-A1 OR CA-3072515-C OR JP-2020534772-A OR AU-2018336821-B2 OR DE-102019000352-A1 OR EP-0930199-A3).did.					
L422	47	(Artificial Intelligence) Similar to: 16/820,040 with 11 CPC Selections and 1 Text Selection Text: (US-20200215926-A1 OR US-11447023-B2 OR US-20200317068-A1 OR US-11458851-B2 OR US-10604024-B2 OR US-20190308518-A1 OR US-20160001666-A1	(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))	OR	ON	ON	2022/11/10 12:30 PM

		OR US-9007015-B1 OR US-20180111491-A1 OR US-20210031640-A1 OR US-20180345803-A1 OR US-20180215274-A1 OR US-10328808-B2 OR US-9770992-B2 OR GB-2582520-A OR US-7479763-B2 OR AU-2018403192-A1 OR CA-3085762-A1 OR US-20200259340-A1 OR GB-2605117-A OR US-20040251876-A1 OR US-11001212-B2 OR US-20200290535-A1 OR US-20090174362-A1 OR US-20030184264-A1 OR US-20210075235-A1 OR US-4349774-A OR GB-2579150-A OR CN-207530573-U OR EP-3707368-A1 OR WO-2019101108-A1 OR US-11254213-B2 OR AU-2022202497-A1 OR WO-9730502-A1 OR JP-2020516219-A OR US-5668461-A OR US-11394213-B2 OR GB-2580257-A OR CN-207217796-U OR WO-2022055644-A1 OR US-20220085631-A1 OR KR-101397709-B1 OR AU-2018336956-B2 OR US-10686323-B2 OR AU-2018403192-B2 OR KR-20130130190-A OR US-5965998-A OR US-9506446-B2 OR US-20180062410-A1 OR JP-2020534772-A).did.					

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	(US-PGPUB; USPAT)	OR	OFF	OFF	2015/01/29 04:50 PM

		and switch and microcontrol$3 and input and signal$2).clm.					
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 polarity and switch$3 and microcontrol$3 and input and signal$2).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2015/01/29 04:52 PM
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	(US-PGPUB; USPAT)	OR	OFF	OFF	2015/01/29 04:52 PM

		signal$1).clm.					
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
N181	5	(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	2019/11/20 09:46 PM
N182	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
N183	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
N184	0	(vehicle and internal and power and supply	(US-PGPUB; USPAT)	OR	OFF	OFF	2015/01/29 04:50 PM

		and output$2 and isolation and sensor and reverse and polarity and sensor and switch and microcontrol$3 and input and signal$2).clm.					
N185	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
N186	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
N187	0	(vehicle 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 04:52 PM
N188	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
N189	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
N190	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
N191	0	(power and supply and output$2 and isolation and sensor and revers$3 and polarity and switch$3 and microcontrol$3 and	(US-PGPUB; USPAT)	OR	OFF	OFF	2015/01/29 04:53 PM

		signal$1).clm.					
N192	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
N193	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
N194	4	N225 and N226	(US-PGPUB; USPAT)	OR	OFF	OFF	2019/07/25 05:24 PM
N195	5	(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	2019/11/20 09:46 PM
N363	270	(power AND supply AND switch$3 AND battery AND connect$3 AND USB AND input AND charg$3 AND circuit$2).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2022/03/08 08:01 PM
N364	18	(power AND supply AND switch$3 AND battery AND connect$3 AND USB AND input AND charg$3 AND circuit$2 AND DC$1DC AND convert$2).clm.	(US-PGPUB; USPAT)	OR	OFF	OFF	2022/03/08 08:02 PM
N365	11	(USB NEAR circuit$2) WITH (DC/DC boost up) NEAR converter	(US-PGPUB; USPAT)	OR	OFF	OFF	2022/03/08 10:09 PM
N366	1	"20200215926".pn.	(US-PGPUB; USPAT)	OR	OFF	OFF	2022/03/09 12:36 PM
N367	0	(portable OR handheld) NEAR (car vehicle truck plane boat motorcycle autonomous vehicle robot forklift truck) ADJ ((jump ADJ start$3) jumpstart$2) ADJ (apparatus device unit module) AND (safety (reverse ADJ polarity) ADJ protect$3) AND (USB (universal ADJ serial ADJ bus)) ADJ (input ADJ connect$2) AND (USB ADJ charg$3 ADJ circuit$2)	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/10 11:41 AM

N368	0	(portable OR handheld) NEAR (car vehicle truck plane boat motorcycle autonomous vehicle robot forklift truck) ADJ ((jump ADJ start$3) jumpstart$2) ADJ (apparatus device unit module) AND (safety (reverse ADJ polarity) ADJ protect$3) AND (USB (universal ADJ serial ADJ bus)) ADJ ((input ADJ connect$2) port) AND (USB ADJ charg$3 ADJ circuit$2)	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/10 11:42 AM
N369	0	(jumpstart$3 AND device AND boost$3 AND charg$3 AND deplet$2 AND discharg$2 AND battery AND power AND supply AND power AND switch$3 AND USB AND input AND charge AND circuit$2 AND (USB ADJ connect$2)).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/10 11:46 AM
N370	0	(jumpstart$3 AND device AND boost$3 AND charg$3 AND deplet$2 AND discharg$2 AND battery AND power AND supply AND power AND switch$3 AND USB AND input AND charg$3 AND circuit$2 AND (USB ADJ connect$2)).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/10 11:47 AM
N371	0	(jumpstart$3 AND device AND boost$3 AND discharg$3 AND deplet$2 AND discharg$2 AND battery AND power AND supply AND power AND switch$3 AND USB AND input AND charg$3 AND circuit$2 AND (USB ADJ connect$2)).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/10 11:48 AM
N372	0	(jumpstart$3 AND device AND deplet$2 AND discharg$2 AND battery AND power AND supply AND power	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/10 11:49 AM

		AND switch$3 AND USB AND input AND charg$3 AND circuit$2 AND (USB ADJ connect$2)).clm.					
N373	0	(jumpstart$3 AND device AND deplet$2 AND discharg$2 AND battery AND power AND supply AND switch$3 AND USB AND input AND charg$3 AND circuit$2 AND (USB ADJ connect$2)).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/10 11:49 AM
N374	0	(jumpstart$3 AND device AND deplet$2 AND discharg$2 AND battery AND power AND supply AND switch$3 AND USB AND input AND charg$3 AND circuit$2 AND connect$2).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/10 11:50 AM
N375	0	(jumpstart$3 AND device AND deplet$2 AND discharg$2 AND battery AND power AND supply AND switch$3 AND USB AND input AND charg$3 AND circuit$2 AND connect$2).clm.	(US-PGPUB; USPAT)	OR	OFF	ON	2022/11/10 11:51 AM
N376	4	(jump AND start$3 AND device AND deplet$2 AND discharg$2 AND battery AND power AND supply AND switch$3 AND USB AND input AND charg$3 AND circuit$2 AND connect$2).clm.	(US-PGPUB; USPAT)	OR	OFF	ON	2022/11/10 11:51 AM
N377	34	(Artificial Intelligence) More like doc: US-20200215926-A1 Text: (US-20200317068-A1 OR AU-2020201223-B2 OR AU-2020201223-C1 OR AU-2021258059-B2 OR AU-2022200612-A1 OR US-10604024-B2 OR AU-2020201224-A1 OR AU-2022201338-A1 OR AU-2022204065-A1 OR US-9007015-B1 OR	(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;	OR	ON	ON	2022/11/10 12:24 PM