PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 17/112,920	Filing Date 12/04/2020	☐ 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 $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $480 =	
☐ 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	12/04/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 21	Minus	** 21	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0		x $480 =	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.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/PATRICIA F LEWIS/
*** 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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PTO/AIA/50 (10-17)
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REISSUE PATENT APPLICATION TRANSMITTAL

Address to:

Mail Stop Reissue
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Attorney Docket No.	240001.00005
First Named Inventor	Yun LEI
Original Patent Number	10,148,105
Original Patent Issue Date (Month/Day/Year)	December 4, 2018
Priority Mail Express® Label No.	VIA EFS-WEB

APPLICATION FOR REISSUE OF: (*Check applicable box*) ☑ Utility Patent ☐ Design Patent ☐ Plant Patent

APPLICATION ELEMENTS (37 CFR 1.173)

1. ☑ **Fee Transmittal Form** (PTO/SB/56)
2. ☑ **Applicant asserts small entity status.** See 37 CFR 1.27
3. ☐ **Applicant certifies micro entity status.** See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.
4. ☑ **Specification and Claims** in double column copy of patent format (*amended, if appropriate*)
5. ☑ **Drawing(s)** (*proposed amendments, if appropriate*)
6. ☑ **Reissue Oath/Declaration or Substitute Statement** (37 CFR 1.175) (PTO/AIA/05, 06, or 07)
7. ☑ **Application Data Sheet** **NOTE:** Benefit claims under 37 CFR 1.78 and foreign priority claims under 37 CFR 1.55 MUST be set forth in an Application Data Sheet (ADS).
8. ☑ **Original U.S. Patent currently assigned?** ☑ Yes ☐ No (*If Yes, check applicable box(es)*)
   - ☑ Written Consent of all Assignees (PTO/AIA/53)
   - ☑ 37 CFR 3.73(c) Statement (PTO/AIA/96)
9. ☐ **CD-ROM or CD-R** in duplicate, Computer Program (*Appendix*) or large table
   - ☐ Landscape Table on CD
10. **Nucleotide and/or Amino Acid Sequence Submission** (*if applicable, items a. – c. are required*)
    - a. ☐ Computer Readable Form (CRF)
    - b. ☐ Specification Sequence Listing on:
      - i. ☐ CD -ROM (2 copies) or CD-R (2 copies); **or**
      - ii. ☐ Paper
    - c. ☐ Statements verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

11. ☑ **Statement of status and support for all changes to the claims.** See 37 CFR 1.173(c).
12. ☐ **Power of Attorney**
13. ☐ **Information Disclosure Statement (IDS)** PTOSB/08 or PTO-1449
    - ☐ Copies of citations attached
14. ☐ **English translation of Reissue Oath/Declaration** (*if applicable*)
15. ☐ **Return Receipt Postcard** (MPEP § 503) (Should be specifically itemized)
16. ☑ **Preliminary Amendment** (37 CFR 1.173; MPEP § 1453)
17. ☐ **Other:** _____

☐ This is a continuation reissue or divisional reissue application (*i.e.*, a second or subsequent reissue application for the same issued patent). (*Check box if applicable.*)

18. CORRESPONDENCE ADDRESS

☑ The address associated with Customer Number: 153979 **OR** ☐ Correspondence address below

Name					
Address					
City		State		Zip Code	
Country		Telephone			
Email	haotan@archlakelaw.com				

Signature	/Hao Tan/	Date	December 4, 2020
Name (Print/Type)	Hao Tan	Registration No.	73,711

This collection of information is required by 37 CFR 1.173. 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: Mail Stop Reissue, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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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.

Doc Code: REIS.DECL

Document Description: Reissue Declaration Filed In Accordance With MPEP 1414

PTO/AIA/06 (09-20)

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REISSUE APPLICATION DECLARATION BY THE ASSIGNEE	Docket Number (optional) 240001.00005

I hereby declare that:

The residence and mailing address of the inventor or joint inventors are stated below.

Name of the Assignee:

Shenzhen Carku Technology Co., Ltd.

I am authorized to act on behalf of the assignee (if the assignee is a juristic entity).

The entire title to the patent identified below is vested in said assignee, or if there are multiple assignees/owners, all assignees/owners have executed a Reissue Application Declaration to account for the entire title of the patent identified below.

Inventor Yun LEI

Residence: City	State	Country
Shenzen, Guangdong		China

Mailing Address

Building A, Qixing Creative Square, Lianrun Rd., Gaofeng Community, Dalang Street, Longhua District

City	State	Zip	Country
Shenzhen, Guangdong			China

☐ Additional inventors are named on separately numbered sheets attached hereto.

Patent Number 10,148,105	Patent Issue Date December 4, 2018

I believe said inventor(s) to be the original inventor or original joint inventors of the subject matter which is described and claimed in said patent, for which a reissue patent is sought on the invention titled:

BATTERY CLAMP

the specification of which

☑ is attached hereto.

☐ was filed on _____ as reissue application number _____.

The above-identified application was made or authorized to be made by me.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

I believe the original patent to be wholly or partly inoperative or invalid, for the reasons described below.
(Check all boxes that apply.)

☐ by reason of a defective specification or drawing.

☑ by reason of the patentee claiming more or less than he had the right to claim in the patent.

☐ by reason of other errors.

This collection of information is required by 37 CFR 1.175. 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 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, 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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REISSUE APPLICATION DECLARATION BY THE ASSIGNEE

Docket Number (Optional)

At least one error upon which reissue is based is described below. If the reissue is a broadening reissue, a claim that the application seeks to broaden must be identified and the box below must be checked.

U.S. Pat. No. 10,148,105 is wholly or partially inoperative because the patentee claims less than he had a right to claim in the patent. Claim 1 and other claims of U.S. Pat. No. 10,148,105 are amended by broadening amendments to the limitations, and new 11-25 claims are added.

[Attach additional sheets, if needed.]

☑ The application for the original patent was filed under 37 CFR 1.46 by the assignee of the entire interest.

I hereby appoint:

☑ Practitioners associated with Customer Number: 153979

OR

☐ Practitioner(s) named below:

Name	Registration Number

as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith.

Correspondence Address: Direct all communications about the application to:

☑ The address associated with Customer Number: 153979

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

Signature	Yun LEI	Date (Optional)
Legal name of person signing	Yun LEI	
Address of Assignee	Building A, Qixing Creative Square, Lianrun Rd., Gaofeng Community, Dalang Street, Longhua District, Shenzhen,Guangdong,China 518109	

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.

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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).
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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.

PTO/AIA/81 (09-12)
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REISSUE APPLICATION: CONSENT OF ASSIGNEE; STATEMENT OF NON-ASSIGNMENT

Docket Number (Optional)
240001.00005

This is part of the application for a reissue patent based on the original patent identified below.

Name of Patentee(s)
Shenzhen Carku Technology Co., LTD

Patent Number	Date Patent Issued
10,148,105	December 4, 2018

Title of Invention
Battery Clamp

1. [X] Filed herein is a statement under 37 CFR 3.73(c). (Form PTO/AIA/96)

2. [ ] Ownership of the patent is in the inventor(s), and no assignment of the patent is in effect.

One of boxes 1 or 2 above must be checked. If multiple assignees, complete this form for each assignee. If box 2 is checked, skip the next entry and go directly to "Name of Assignee."

The written consent of all assignees and inventors owning an undivided interest in the original patent is included in this application for reissue.

The assignee(s) owning an undivided interest in said original patent is/are Shenzhen Carku Technology Co., LTD. and the assignee(s) consents to the accompanying application for reissue.

Name of assignee/inventor (if not assigned)
Shenzhen Carku Technology Co., LTD

Signature	Date
Yun LEI	December 3, 2020

Typed or printed name and title of person signing for assignee (if assigned)
Yun LEI
Legal Representatives President

This collection of information is required by 37 CFR 3.172. 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 6 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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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.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: SHENZHEN CARKU TECHNOLOGY CO., LTD.

Application No./Patent No.: 10,148,105 Filed/Issue Date: December 4, 2018

Titled: BATTERY CLAMP

SHENZHEN CARKU TECHNOLOGY CO., LTD., 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 039514, Frame 0221, 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:

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Hao Tan	December 4, 2020
Signature	Date
/Hao Tan/	73,711
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switched off as well. If the 10th pin of P_VSN of the control chip U2 detects a high level, the wire clamps are proved to be normally connected. Accordingly, the power supply from the external power supply **200** to the external device will be sustained.

In one embodiment of the present invention, the master-control circuit unit **128** further comprises an indicator light circuit unit, which is connected to the master-control chip unit **1281**. The indicator light circuit unit comprises two LED with different colors for indicating normal or abnormal conditions of the control device.

In one embodiment of the present invention, the master-control circuit unit **128** further comprises a buzzing circuit unit, which is connected to the master-control chip unit **1281**. The buzzing circuit unit mainly comprises a loudspeaker for alerting a user about abnormal conditions.

To sum up, a communication connection between the battery clamp **100** and the external power supply **200** can be built for obtaining status information of the external power supply **200**. The status information comprises temperature of battery units, or a voltage difference of any two of battery units of the external power supply. Meanwhile, the battery clamp **100** has functions of electric current or voltage detection and anti-inverse detection etc. Therefore, the battery clamp **100** can effectively solve the problems of a lithium battery in the external power supply **200** e.g. battery bulge or explosion resulted from improper uses.

Although the aforesaid embodiments are preferred in the present invention, none of them shall be regarded as a limitation. Any modifications, improvements, or equivalents within spirit or scope of the preset invention fall into the protection scope of the present invention.

What is claimed is:

1. A battery clamp for delivering an instantaneous starting current from an external power supply to an external device, the battery clamp comprising:

a control device, comprising:

a housing;

a master-control board mounted within the housing; and

connectors disposed at one side of the housing, and being electrically connected to the master-control board, comprising:

at least a first and second electrode connectors, which are connected to an external power supply for receiving power, and

at least one communication connector connected to the external power supply for receiving status information of the external power supply, and sending the status information to the master-control board;

a first and second wire clamps, each having an end configured to receive power from the external power supply via the control device, and another end connected to the external device for supplying power to the external device;

wherein the control device is configured to control power supply from the external power supply to the external device based on the status information.

2. The battery clamp of claim **1**, wherein the control device is configured to allow the power supply from the external power supply to the external device when the status information is normal, wherein the status information comprises at least one of the following: temperature, voltage of a battery unit of the external power supply.

3. The battery clamp of claim **1**, wherein the master-control board comprises:

a first and second voltage input ports electrically connected to the first and second electrode connectors respectively;

a communication port electrically connected to the communication connector;

a first and second voltage output ports electrically connected to the first and second wire clamps for supplying power to the external device via the first and second wire clamps;

a switch control unit for controlling connection between the first voltage input port and the first voltage output port; and

a master-control circuit unit connected to the communication port for obtaining the status information of the external power supply;

wherein the master-control circuit unit is configured to control the switch control unit based on the status information of the external power supply, thereby controlling connection on/off between the first voltage input port and the first voltage output port.

4. The battery clamp of claim **3**, wherein the master-control circuit unit further comprises:

an electric current detection unit for detecting electric current from the external power supply to the external device;

a voltage detection unit for detecting voltage of the external power supply and the external device; and

wherein the master-control circuit unit is configured to compare the electric current value and the voltage value with a predefined electric current range and a predefined voltage range respectively, thereby controlling the switch control unit.

5. The battery clamp of claim **4**, wherein the voltage detection unit comprises:

a first voltage detection unit for detecting voltage value of the external power supply; and

a second voltage detection unit for detecting voltage value of the external device.

6. The battery clamp of claim **4**, wherein the master-control circuit unit further comprises:

an indicator light circuit unit connected to the master-control chip unit for indicating operating status of the control device.

7. The battery clamp of claim **4**, wherein the master-control circuit unit further comprises:

a buzzing circuit unit connected to the master-control chip unit for alerting users about abnormal condition.

8. The battery clamp of claim **1**, wherein the communication connector is disposed between the first and second electrode connectors.

9. The battery clamp of claim **1**, wherein the housing comprises an upper piece and a lower piece, which are removably connected together, and the master-control board is mounted on the lower piece.

10. The battery clamp of claim **9**, wherein one side of the upper piece is provided with openings for indicator lights and buttons.

* * * * *

BATTERY CLAMP

CROSS REFERENCE TO PRIORITY

This application claims priority to Chinese Patent Application No. 201620692248.3 filed Jun. 30, 2016. This application also claims priority to Chinese Patent Application No. 201610506106.8 filed Jun. 30, 2016. This application further claims priority to Chinese Patent Application No. 201610506137.3 filed Jun. 30, 2016. The disclosure of these applications are incorporated by reference herein in its entirety.

TECHNICAL FIELD

The present invention relates to the technical field of electronic battery and charging control and, in particular, to a battery clamp.

BACKGROUND

Nowadays the technology of applying a high power lithium battery to an emergency power supply is gradually developing. A high power lithium battery has many advantages, such as a long service life, less pollution, small size and good portability etc. However, a lithium battery may have some defects in real-life applications. For example, when being used for starting a vehicle, the starting electric current of a lithium battery could be very large (up to 1000 A). In addition, improper uses, e.g., high temperature and over-charging or over-discharging, will result in battery bulge of an emergency power supply, or even an explosion, which may cause personal injury and property loss. Although certain smart battery clamps can accommodate a large electric current during the starting of a vehicle, they cannot adjust operating modes of a battery clamp based on the actual operating condition of a starting power supply.

Therefore, its desired to provide a novel battery clamp. The aforesaid problems can be solved by establishing a communication connection between the novel battery clamp and a starting power supply.

SUMMARY

The purpose of the present invention is to provide a battery clamp, which aims to solve the aforementioned problems of a lithium battery in an external power supply e.g. battery bulge or explosion resulted from improper uses.

In order to solve the aforesaid problems, the present invention provides a battery clamp, comprising: a control device, comprising: a housing; a master-control board mounted within the housing; and connectors disposed at one side of the housing, and being electrically connected to the master-control board, comprising: at least a first and second electrode connectors, which are connected to an external power supply for receiving power, and at least one communication connector connected to the external power supply for receiving status information of the external power supply, and sending the status information to the master-control board; a first and second wire clamps, one ends of the first and second wire clamps are configured to receive power from the external power supply via the control device, and the other ends of the first and second wire clamps are connected to an external device for supplying power to the external device; wherein the control device is configured to control power supply from the external power supply to the external device based on the status information.

Preferably, the control device is configured to allow the power supply from the external power supply to the external device when the status information is normal, wherein the status information comprises at least one of the following: temperature, voltage of a battery unit of the external power supply.

Preferably, the master-control board comprises: a first and second voltage input ports electrically connected to the first and second electrode connectors respectively; a communication port electrically connected to the communication connector; a first and second voltage output ports electrically connected to the first and second wire clamps for supplying power to the external device via the first and second wire clamps; a switch control unit for controlling connection between the first voltage input port and the first voltage output port; and a master-control circuit unit connected to the communication port for obtaining the status information of the external power supply; wherein the master-control circuit unit is configured to control the switch control unit based on the status information of the external power supply, thereby controlling connection on/off between the first voltage input port and the first voltage output port.

Preferably, the master-control circuit unit further comprises: an electric current detection unit for detecting electric current from the external power supply to the external device; a voltage detection unit for detecting voltage of the external power supply and the external device; and wherein the master-control circuit unit is configured to compare the electric current value and the voltage value with a predefined electric current range and a predefined voltage range respectively, thereby controlling the switch control unit.

Preferably, the voltage detection unit comprises: a first voltage detection unit for detecting voltage value of the external power supply; and a second voltage detection unit for detecting voltage value of the external device

Preferably, the master-control circuit unit further comprises: an indicator light circuit unit connected to the master-control chip unit for indicating operating status of the control device.

Preferably, the master-control circuit unit further comprises: a buzzing circuit unit connected to the master-control chip unit for alerting users about abnormal condition.

Preferably, the communication connector is disposed between the first and second electrode connectors.

Preferably, the housing comprises an upper piece and a lower piece, which are removably connected together, and the master-control board is mounted on the lower piece.

Preferably, one side of the upper piece is provided with openings for indicator lights and buttons.

The battery clamp is configured to build a communication connection between the communication connector and an external power supply, by which status information of the external power supply can be transmitted. Based on the status information, detected electric current and voltage value, the power supply from an external power supply to an external device can be controlled, thereby effectively solving the problems of a lithium battery in an external power supply e.g. battery bulge or explosion resulted from improper uses.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to clearly understand the technical solution in the embodiments of the present invention, drawings that used for the embodiments or prior art will be briefly introduced below. Obviously, the drawings described below are merely some embodiments of the present invention. For a person

skilled in the art, other drawings can be obtained according to these drawings below without any inventive effort.

FIG. **1** is a diagram illustrating a battery clamp in connection with an external power supply and an external device according to one embodiment of the present invention.

FIG. **2** is a structure diagram of a battery clamp according to one embodiment of the present invention.

FIG. **3** is a structure diagram illustrating a control device of a battery clamp according to one embodiment of the present invention.

FIG. **4** is a diagram illustrating a circuit module of a master-control board according to one embodiment of the present invention.

FIG. **5** is a circuit diagram illustrating voltage input ports, voltage output ports and a communication ports of a master-control board according to one embodiment of the present invention.

FIG. **6** is a diagram illustrating a module of a master-control circuit unit according to one embodiment of the present invention.

FIG. **7** is a circuit diagram illustrating a power control unit of a master-control circuit unit according to one embodiment of the present invention.

FIG. **8** is a circuit diagram illustrating a master-control chip unit of a master-control circuit unit according to one embodiment of the present invention.

FIG. **9** is a circuit diagram illustrating an electric current detection unit of a master-control circuit unit according to one embodiment of the present invention.

FIG. **10** is a circuit diagram illustrating a first voltage detection unit of voltage detection units of a master-control circuit unit according to one embodiment of the present invention.

FIG. **11** is a circuit diagram illustrating a second voltage detection unit of voltage detection units of a master-control circuit unit according to one embodiment of the present invention.

FIG. **12** is a circuit diagram illustrating a first connection unit of a switch control unit according to one embodiment of the present invention.

FIG. **13** is a circuit diagram illustrating a second connection unit of a switch control unit according to one embodiment of the present invention.

FIG. **14** is a circuit diagram illustrating an anti-inverse detection unit according to one embodiment of the present invention.

DETAILED DESCRIPTION

The present invention is further described below along with the drawings and embodiments, in order to clearly understand the purpose, technical solution and advantage thereof.

FIG. **1** is a diagram illustrating a battery clamp **100** in connection with an external power supply **200** and an external device **300** according to one embodiment of the present invention.

As shown in FIG. **1**, the connection between the battery clamp **100** and the external power supply **200** comprises a power connection, by which the battery clamp **100** can obtain power supply from the external power supply **200**. Generally, the power connection is implemented by a pluggable interface.

The connection between the battery clamp **100** and the external power supply **200** also comprises a communication connection, by which the battery clamp **100** can obtain status information of the external power supply **200**. The communication connection can be wired connections, such as via a serial interface, or can be wireless connections, such as via Bluetooth, NFC, Wi-Fi etc.

As shown in FIG. **1**, the battery clamp **100** is configured to use a power connection for supplying power to the external device **300**.

FIG. **2** is a structure diagram of the battery clamp **100** according to one embodiment of the present invention.

As shown in FIG. **2**, the battery clamp **100** comprises a control device **1** and wire clamps **2**. One side of the control device **1** is provided with connectors **10**, and the other side is provided with wires **20**. The control device **1** and the wire clamps **2** are connected via the wires **20**. The wire clamps **2** comprises a first and second wire clamps **21**, **22** representing an positive and negative electrodes respectively.

The wire clamps **2** are connected to the external device **300** for supplying power to it. For example, when the external power supply **200** is an emergency starting power supply and the external device **300** is a vehicle, the emergency starting power supply **200** is connected to the vehicle **300** via the battery clamp **100** for starting the vehicle **300**.

FIG. **3** is a structure diagram illustrating a control device of the battery clamp **100** according to one embodiment of the present invention.

As shown in FIG. **3**, the control device **1** comprises: a housing **11**, a master-control board **12** and connectors **10**. The housing **11** comprises an upper piece **111** and a lower piece **112** which are removably connected together.

The master-control board **12** is mounted within the housing **11**. Specifically, the master-control board **12** is mounted on the lower piece **112**.

The connectors **10** are disposed at one side of the housing **11**, and are electrically connected to the master-control board **12**.

The connectors **10** comprise a positive electrode connector **101**, a negative electrode connector **102** and a communication connector **103**. According to one embodiment of the present invention, the communication connector **103** is disposed between the positive electrode connector **101** and the negative electrode connector **102**.

The positive and negative electrode connectors **101**, **102** are connected to the external power supply **200** for receiving power supply.

A communication connection between the battery clamp **100** and the external power supply is built via the communication connector **103**. The battery clamp **100** can obtain status information of the external power supply **200** via the communication connector **103**, thereby monitoring and managing the external power supply **200** to prevent bulge or explosion of the external power supply **200**.

According to one embodiment of the present invention, the control device **1** is configured to allow the power supply from the external power supply **200** to the external device **300** when the status information is normal.

According to one embodiment of the present invention, the status information of the external power supply **200** comprises at least one of the following: temperature, voltage of a battery unit of the external power supply **200**.

According to one embodiment of the present invention, the master-control board **12** of the control device **1** comprises voltage input ports BATs, voltage output ports CARs, a communication port COM, a switch control unit K1, and a master-control circuit unit **128**.

FIG. **4** is a diagram illustrating a circuit module of the master-control board **12** according to one embodiment of the present invention.

As shown in FIG. **4**, the master-control board **12** comprises: voltage input ports BATs (including a positive voltage input port BAT+ and a negative voltage input port BAT−), voltage output ports CARs (including a positive voltage output port CAR+ and a negative voltage output port CAR−), a communication port COM, a switch control unit K1 and a master-control circuit unit **128**.

As discussed above, the positive and negative electrode connectors **101**, **102** are connected to the external power supply **200** for receiving power supply. The positive voltage input port BAT+ and the negative voltage input port BAT− are electrically connected to the electrode connectors **101**, **102** respectively, i.e. the voltage input ports BATs are electrically connected to the external power supply **200**, for receiving power supply from the external power supply **200**.

As discussed above, the control device **1** is connected to the wire clamps **2** via the wires **20**, and the wire clamps **20** are connected to the external device **300** for supplying power via the wire clamps **20**. The positive voltage output port CAR+ and the negative voltage output port CAR− are electrically connected to the first and second wire clamps **21**, **22** respectively, i.e. the voltage output ports CARs are electrically connected to the external device **300**, for supplying power to the external device **300**.

The positive voltage input port BAT+ is connected to the positive voltage output port CAR+ via the switch control unit K1. The switch control unit K1 is configured to control connection on/off between the positive voltage input port BAT+ and the positive voltage output port CAR+.

The switch control unit K1 is connected to and controlled by the master-control circuit unit **128**.

The master-control circuit unit **128** is connected to the communication port COM for receiving status information of the external power supply **200**.

The master-control circuit unit **128** is also connected to the positive voltage input port BAT+ or the positive voltage output port CAR+ for detecting voltage values of them, i.e. detecting voltage values of the external power supply **200** or the external device **300**.

The master-control circuit unit **128** is also connected to two grounding ports GND and PGND for detecting an electric current value from the external power supply **200** to the external device **300**.

Based on the status information, the master-control circuit unit **128** can control the switching on/off of the switch control unit K1, thereby controlling the power supply from the external power supply **200** to the external device **300**.

Similarly, based on the voltage values or electric current values detected by the master-control circuit unit **128**, the master-control circuit unit **128** can control the switching on/off of the switch control unit K1, thereby controlling the power supply from the external power supply **200** to the external device **300**.

FIG. **5** is a circuit diagram illustrating voltage input ports BATs, voltage output ports CARs, a communication port COM and a switch control unit K1 of the master-control board **12** of the battery clamp **100**.

As shown in FIG. **5**, the voltage input ports BATs of the master-control board **12** comprises a positive voltage input port BAT+ and a negative voltage input port BAT−. The voltage output ports CARs of the master-control board **12** comprises a positive voltage output port CAR+ and a negative voltage output port CAR−.

The voltage input ports BATs are electrically connected to the electrode connectors. Specifically, the positive voltage input port BAT+ is electrically connected to the positive electrode connector **101** for receiving a positive output voltage from the external power supply **200**; the negative voltage input port BAT− is electrically connected to the negative electrode connector **102** for receiving a negative output voltage from the external power supply **200**.

The voltage output ports CARs are electrically connected to the wire clamps **20**. Specifically, the positive voltage output port CAR+ is electrically connected to the first wire clamp **21** and the negative voltage output port CAR− is electrically connected to the second wire clamp **22** for supplying power to the external device **300**.

In addition, FIG. **5** further illustrates the communication port COM and the switch control unit K1 of the master-control board **12**.

The communication port COM is electrically connected to the communication connector **103**.

The positive voltage input port BAT+ is connecter to the positive voltage output port CAR+ by the switch control unit K1.

The switch control unit K1 is also connected to the master-control circuit unit **128** via two input ports N_EN and C_EN, and is controlled by the master-control circuit unit **128**. The master-control circuit unit **128** is connected to the switch control unit K1 for controlling the switching on/off of the switch control unit K1 based on status information of an external power supply.

When the switch control unit K1 is off, the positive voltage input port BAT+ is disconnected from the positive voltage output port CAR+, which means the power supply provided by the external power supply **200** is also disconnected from the external device **300**. When the switch control unit K1 is on, the positive voltage input port BAT+ connects with the positive voltage output port CAR+, which means the power supply from the external power supply **200** is provided to the external device **300**.

In another embodiment of the present invention, the master-control circuit unit **128** further comprises an electric current detection unit **1283**, voltage detection units **1282** and a master-control chip unit **1281**. The master-control circuit unit **128** is connected to the communication port COM for obtaining status information of the external power supply **200**.

The master-control circuit unit **128** further comprises a power control unit for supplying the obtained external power to the electric current detection unit **1283**, the voltage detection units **1282** and the master-control chip unit **1281**.

FIG. **6** is a diagram illustrating a module of a master-control circuit unit **128** according to one embodiment of the present invention.

As shown in FIG. **6**, the master-control circuit unit **128** comprises a master-control chip unit **1281**, an electric current detection unit **1283** and voltage detection units. The voltage detection units further comprises a first voltage detection unit **12821** and a second voltage detection unit **12822**.

Input ports of the first and second voltage detection unit **12821** and **12822** are connected to the positive voltage input port BAT+ and the positive voltage output port CAR+ respectively, thereby detecting voltages of the positive voltage input port BAT+ and positive voltage output port CAR+, i.e. detecting voltages of the external power supply **200** and the external device **300**. Output ends of the first and second voltage detection unit **12821** and **12822** are connected to the master-control chip unit **1281** for delivering the detected voltage values to the master-control chip unit **1281**.

Input ports of the electric current detection unit **1283** are connected to two grounding ports GND and PGND for detecting an electric current value from the external power

supply **200** to the external device **300**. An output port of the electric current detection unit **1283** is connected to the master-control chip unit **1281** for delivering the detected electric current value to the master-control chip unit **1281**.

The master-control chip unit **1281** is connected to the switch control unit K1, and is configured to control the switching on/off of the switch control unit k1 based on the detected electric current or voltage value, thereby controlling the power supply from the external power supply **200** to the external device **300**.

FIGS. **7-11** are example circuit diagrams illustrating a power control unit, a master-control chip unit **1281**, an electric current detection unit **1283**, and voltage detection units **1282** respectively.

FIG. **7** is a circuit diagram illustrating a power control unit according to one embodiment of the present invention.

As shown in FIG. **7**, the circuit of the power control unit comprises a power control chip U1, a plurality of capacitors, and two diodes.

The power control unit is respectively connected to the positive voltage input port BAT+ and the positive voltage output port CAR+ by the two diodes.

The power control unit is provided with a voltage output port VCC5. The voltage output port VCC5 is connected to VCC5 ports of the electric current detection unit **1283**, the voltage detection units **1282**, the master-control chip unit **1281** and an anti-inverse detection unit etc. for providing a drive voltage.

FIG. **8** is a circuit diagram illustrating a master-control chip unit **1281** according to one embodiment of the present invention.

As shown in FIG. **8**, the master-control chip unit **1281** comprises a control chip U2.

The 11th pin of the control chip U2 is connected to a communication port COM for communicating between the battery clamp **100** and the external power supply **200**.

The control chip U2 is also provided with a programming port ICPCK. The programming port ICPCK, which is also powered by the voltage output port VCC5 of the power control unit, is used for programming relevant control program on the control chip U2, thereby storing instruction and data on the chip in advance.

FIG. **9** is a circuit diagram illustrating an electric current detection unit **1283** according to one embodiment of the present invention.

As shown in FIG. **9**, the electric current detection unit **1283** comprises an amplifier U4A, and relevant capacitors and resistors

The electric current detection unit **1283** is powered by the voltage output port VCC5 of the power control unit. Input ports thereof are connected to two grounding ports GND and PGND for detecting an electric current value of the voltage input ports BATs or the voltage output ports CARs, i.e. the electric current value from the external power supply **200** to the external device **300**.

The electric current detection unit **1283** is also connected to the master-control chip unit **1281**. Specifically, an output port CHA IN ISN of the electric current detection unit **1283** is connected to the 16th pin of CHA IN ISN of the control chip U2 for delivering a detected electric current value to the control chip U2.

According to one embodiment of the present invention, after obtaining a detected electric current value from the external power supply **200** to the external device **300**, the master-control chip unit **1281** is configured to compare the detected electric current value with a predefined electric current range, i.e. a protection threshold of starting electric current, which is stored in the master-control chip unit **1281** in advance. If the detected electric current value exceeds the predefined electric current range, the master-control chip unit **1281** will switch off the switch control unit K1 by means of a pre-stored control program. Correspondingly, the power supply from the external power supply **200** to the external device **300** will be switched off as well. On the contrary, if the detected electric current value does not exceed the predefined electric current range, the power supply from the external power supply **200** to the external device **300** would be sustained.

TABLE 1

Parameters with regard to different types of external power supply

Type of battery module	Operating voltage	Low voltage alert threshold	Protection threshold of starting electric current
3C lithium cobalt oxide	8.1-12.6 v	Voltage of one battery unit is below 2.7 v	550 A
4F lithium iron phosphate	8-14.6 v	Voltage of one battery unit is below 2.0 v	600 A
4C lithium cobalt oxide	10.8-16.8 v	Voltage of one battery unit is below 2.7 v	600 A

For example, as shown in Table 1, when the external power supply **200** is 3C lithium cobalt oxide, the predefined electric current range can be 0-550 A. If an electric current value from the external power supply **200** to the external device **300**, which is obtained by the master-control chip unit **1281**, exceeds 550 A, the master-control chip unit **1281** will switch off the switch control unit K1. Correspondingly, the power supply from the external power supply **200** to the external device **300** will be switched off as well. On the contrary, if the detected electric current value is below 550 A, the power supply from the external power supply **200** to the external device **300** would be sustained. Same rules would be applicable when types of the external power supply **200** are 4F lithium iron phosphate and 4C lithium cobalt oxide.

In one embodiment of the present invention, the status information, predefined current range and predefined voltage range are stored in the control chip U2 in advance.

In another embodiment of the present invention, the voltage detection units **1282** are connected to the master-control chip unit **1281**. The voltage detection units **1282** are configured to detect voltage of the positive voltage input port BAT+ or the positive voltage output port CAR+, i.e. voltage of the external power supply **200** or the external device **300**, and to send a detected voltage value to the master-control chip unit **1281**.

In another embodiment of the present invention, the voltage detection units **1282** comprises a first and second voltage detection units.

FIGS. **10** and **11** are circuit diagrams illustrating a first and second voltage detection units respectively.

As shown in FIG. **10**, the first voltage detection unit comprises a diode as well as relevant capacitors and resistors. A power port VCC5 of the first voltage detection unit is connected to the voltage output port VCC5 of the power control unit via the diode. An input port BAT+ of the first voltage detection unit is connected to the positive voltage input port BAT+. An output port VIN_SN of the first voltage detection unit is connected to the 19th pin of VIN_SN of the control chip U2 for detecting voltage value of the positive

voltage input port BAT+, and then delivers the detected voltage value to the control chip U2.

As shown in FIG. **11**, the second voltage detection unit comprises two diodes as well as relevant capacitors and resistors. A power port VCC5 of the second voltage detection unit is connected to the voltage output port VCC5 of the power control unit via the diodes. An output port CAR+ of the second voltage detection unit is connected to the positive voltage output port CAR+. An output port VOUT_SN of the second voltage detection unit is connected to the 17th pin of VOUT_SN of the control chip U2 for detecting voltage value of the positive voltage output port CAR+, and then delivers the detected voltage value to the control chip U2.

According to one embodiment of the present invention, after obtaining a voltage value of the positive voltage input port BAT+ or the positive voltage output port CAR+, the master-control chip unit **1281** is configured to compare the detected voltage value with a predefined voltage range, i.e. range of operating voltage, which is stored in the master-control chip unit **1281** in advance. If the detected voltage value is beyond the predefined voltage range, the master-control chip unit **1281** will switch off the switch control unit K1 by means of a pre-stored control program. Correspondingly, the power supply from the external power supply **200** to the external device **300** will be switched off as well. On the contrary, if the detected voltage value is not beyond the predefined voltage range, the power supply from the external power supply **200** to the external device **300** would be sustained.

For example, as shown in Table 1, when the external power supply **200** is 3C lithium cobalt oxide, the predefined voltage range can be 8.1-12.6V. If a voltage value of the positive voltage input port BAT+ or the positive voltage output port CAR+ obtained by the master-control chip unit **1281** is 13V, which is beyond the predefined voltage range, the master-control chip unit **1281** will switch off the switch control unit K1. Correspondingly, the power supply from the external power supply **200** to the external device **300** will be switched off as well. On the contrary, if a voltage value of the positive voltage input port BAT+ or the positive voltage output port CAR+ is 12V, which is within the predefined voltage range, the power supply from the external power supply **200** to the external device **300** would be sustained. Same rules would be applicable when types of the external power supply **200** are 4F lithium iron phosphate and 4C lithium cobalt oxide.

In one embodiment of the present invention, the switch control unit K1 further comprises a first and second connection units.

FIGS. **12** and **13** are circuit diagrams illustrating a first and second connection units of the switch control unit K1 according to one embodiment of the present invention. The switch control unit K1 is connected to the control chip U2 by the first and second connection units.

As shown in FIGS. **12** and **13**, the 9th pin of RELAY_EN1 and the 14th pin of RELAY_EN2 of the control chip U2 are connected to the two input ports N_EN and C_EN of the switch control unit K1 respectively. The control chip U2 is configured to control switching on/off of the switch control unit K1 by the two pins.

According to one embodiment of the present invention, after obtaining status information of the external power supply, the control chip U2 of the master-control chip unit **1281** can obtain temperature of a battery unit. Then the control chip U2 is configured to compare the detected temperature with a predefined temperature threshold, which is stored in the master-control chip unit **1281** in advance. If a temperature value of a battery unit exceeds the predefined temperature threshold, the control chip U2 will switch off the switch control unit K1 by means of a pre-stored control program. Accordingly, the power supply from the external power supply **200** to the external device **300** will be switched off as well. On the contrary, if a temperature value of a battery unit does not exceed the predefined temperature threshold, the power supply from the external power supply **200** to the external device **300** would be sustained.

According to another embodiment of the present invention, after obtaining status information of the external power supply, the control chip U2 of the master-control chip unit **1281** can obtain a voltage difference of any two of battery units. Then the control chip U2 is configured to compare the voltages difference between any two of battery units with a predefined voltage difference, which is stored in the master-control chip unit **1281** in advance. If a voltage difference of any two of battery units exceeds the predefined voltage difference of any two of battery units, the control chip U2 will switch off the switch control unit K1 by means of a pre-stored control program. Correspondingly, the power supply from the external power supply **200** to the external device **300** will be switched off as well. On the contrary, if a voltage difference of any two of battery units does not exceed the predefined voltage difference of any two of battery units, the power supply from the external power supply **200** to the external device **300** would be sustained.

In one embodiment of the present invention, the switch control unit K1 comprises a relay switch.

In one embodiment of the present invention, the master-control circuit unit **128** further comprises an anti-inverse detection unit.

FIG. **14** is a circuit diagram illustrating an anti-inverse detection unit according to one embodiment of the present invention. The anti-inverse detection unit is connected to the master-control chip unit **1281** and the positive voltage output port CAR+ for detecting whether a user has inversely connected the first and second wire clamps **21** and **22**.

As shown in FIG. **14**, the anti-inverse detection unit comprises a photocoupling chip U3 as well as relevant capacitors and resistors. An output port VCC5 of the anti-inverse detection unit is connected to the output port VCC5 of the power control unit for supplying power to the anti-inverse detection unit. A detecting port of the anti-inverse detection unit is connected to the positive voltage output port CAR+ for detecting whether a user has inversely connected the first and second wire clamps **21** and **22**. An output port P_VSN of the anti-inverse detection unit is connected to the 10th pin of P_VSN of the control chip U2 for delivering a level signal to the control chip U2.

When the first wire clamp **21** is normally connected to the external device **300**, the detecting port of the anti-inverse detection unit is a positive voltage. Correspondingly, a luminous diode in the photocoupling chip U3 is not conductive, and the output port P_VSN of the anti-inverse detection unit will output a high level. When the first wire clamp **21** is inversely connected to the external device **300**, the detecting port of the anti-inverse detection unit is a negative voltage. Correspondingly, the luminous diode in the photocoupling chip U3 will be conductive and luminous, and the output port P_VSN of the anti-inverse detection unit will output a low level.

If the 10th pin of P_VSN of the control chip U2 detects a low level, the wire clamps are proved to be inversely connected. Accordingly, the control chip U2 will switch off the switch control unit K1, and the power supply from the external power supply **200** to the external device will be

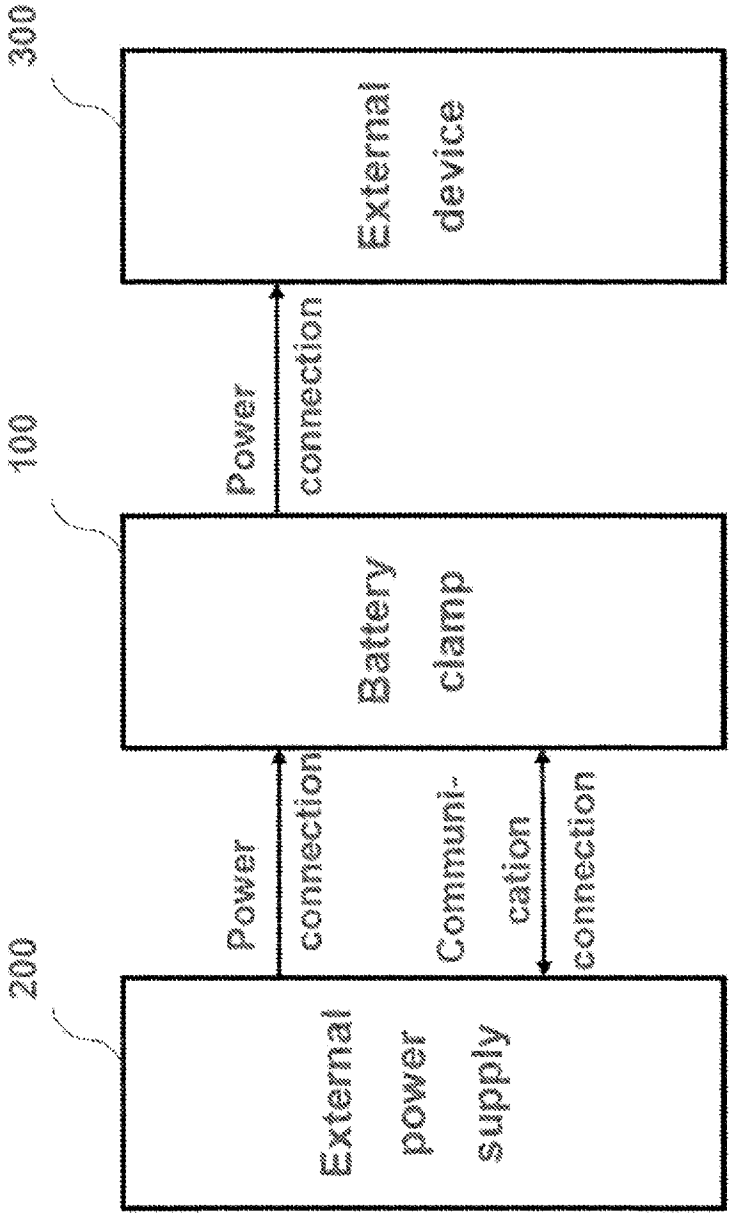
300
External device
Power connection
100
Battery clamp
Power connection
Communi-cation connection
200
External power supply

Fig. 1

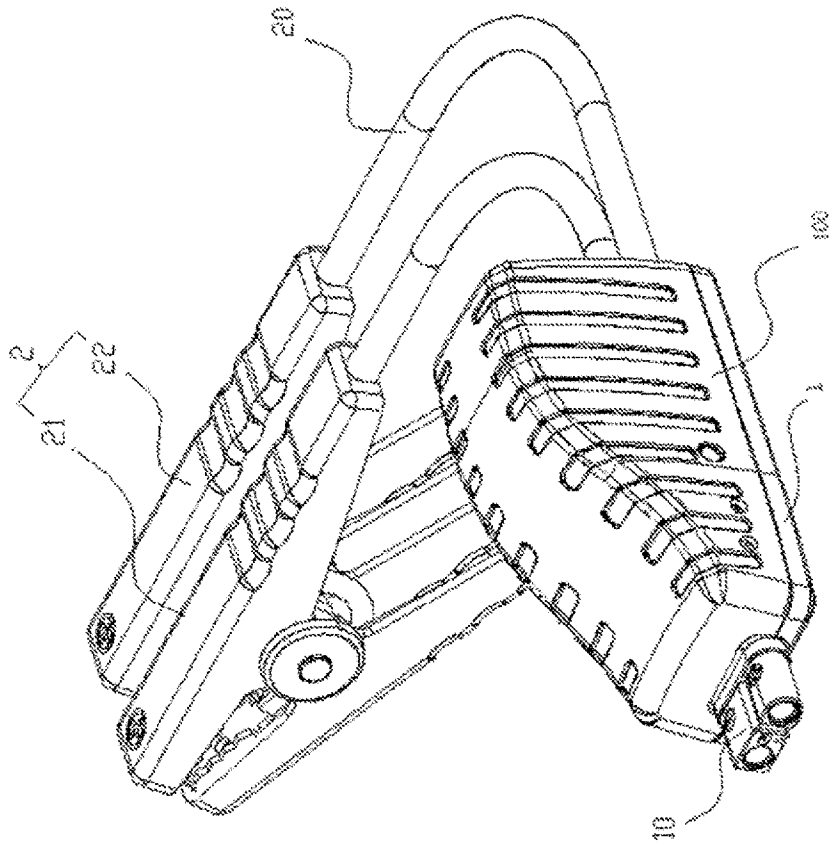

Fig. 2

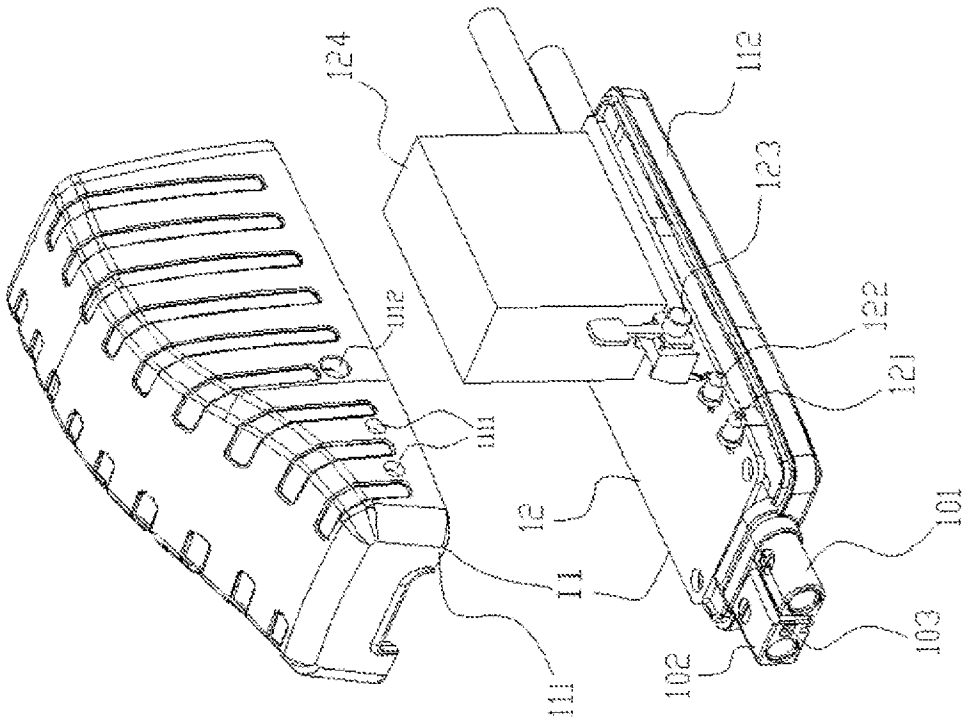

Fig. 3

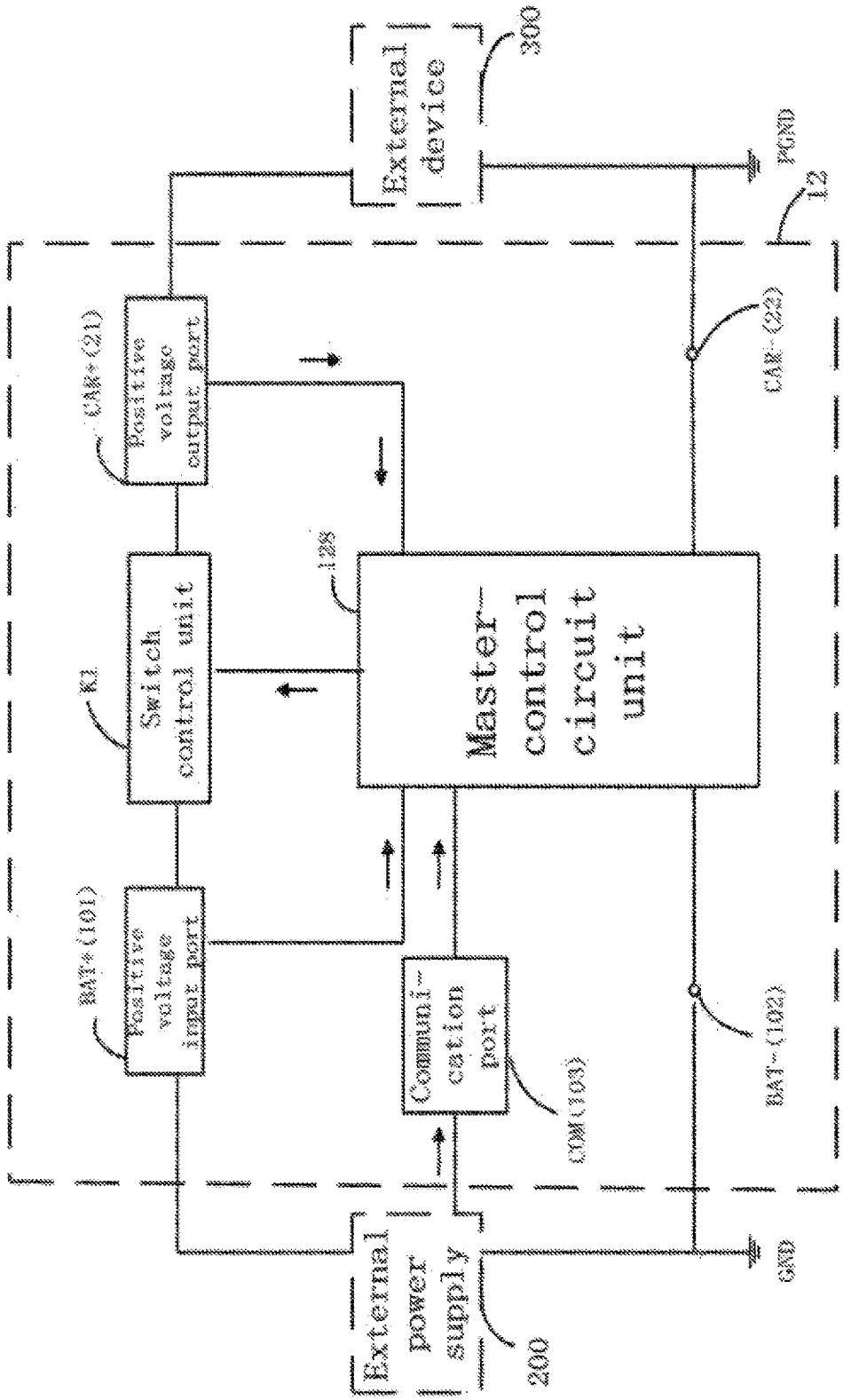
External device
300
POWD
12
CAR- (22)
CAR+ (21)
Positive voltage output port
128
K1
Switch control unit
Master control circuit unit
BAT+ (101)
Positive voltage input port
Communication port
COM (103)
BAT- (102)
External power supply
200
GND

Fig. 4

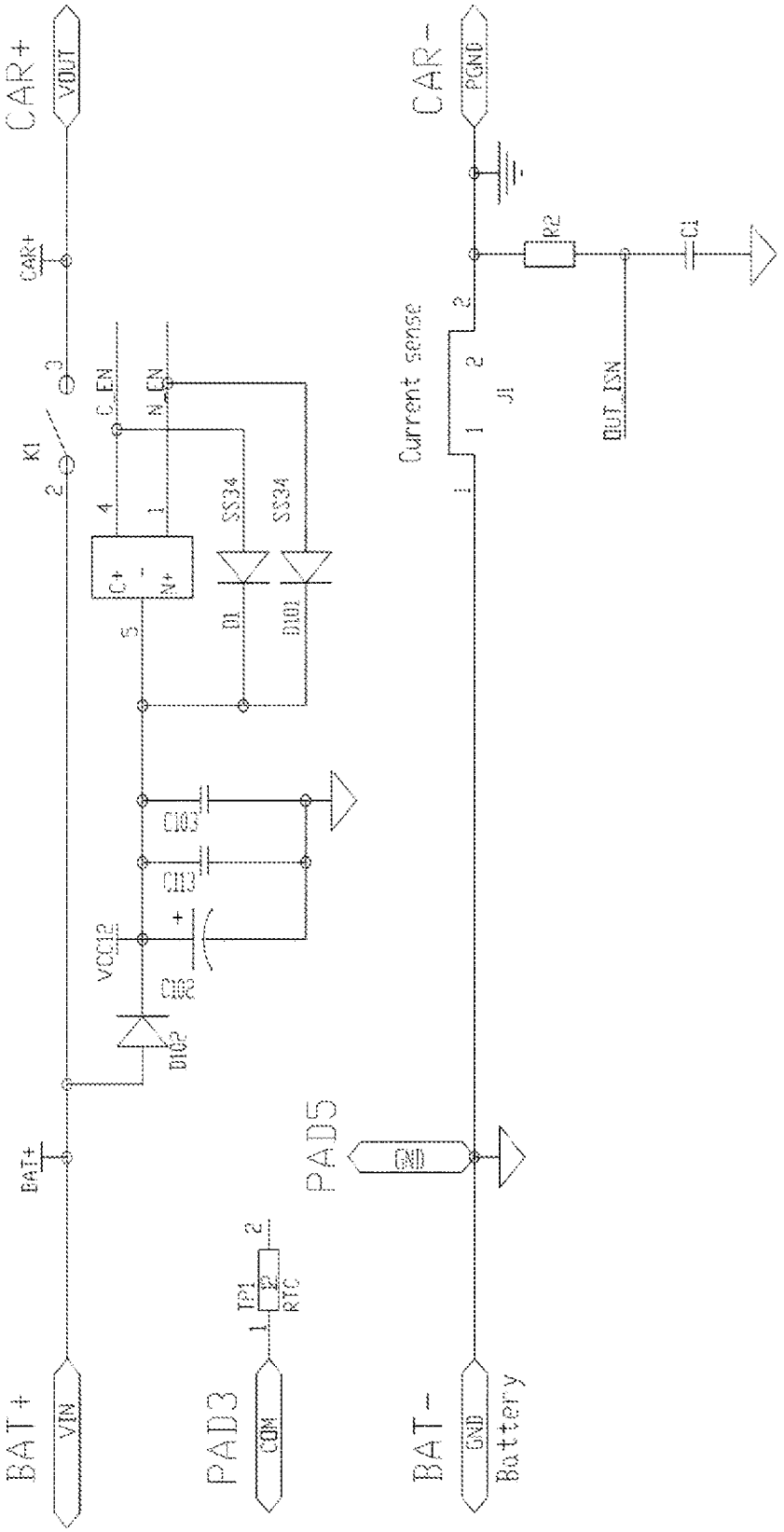
CAR+
VOUT
CAR+
K1
C_EN
N_EN
SS34
SS34
C+
N+
D1
D101
C103
C113
VCC12
C102
D102
BAT+
BAT+
VIN
PAD3
COM
TP1
RTC
PAD5
GND
BAT-
GND
Battery
CAR-
PGND
R2
C1
Current sense
J1
OUT_ISN

Fig. 5

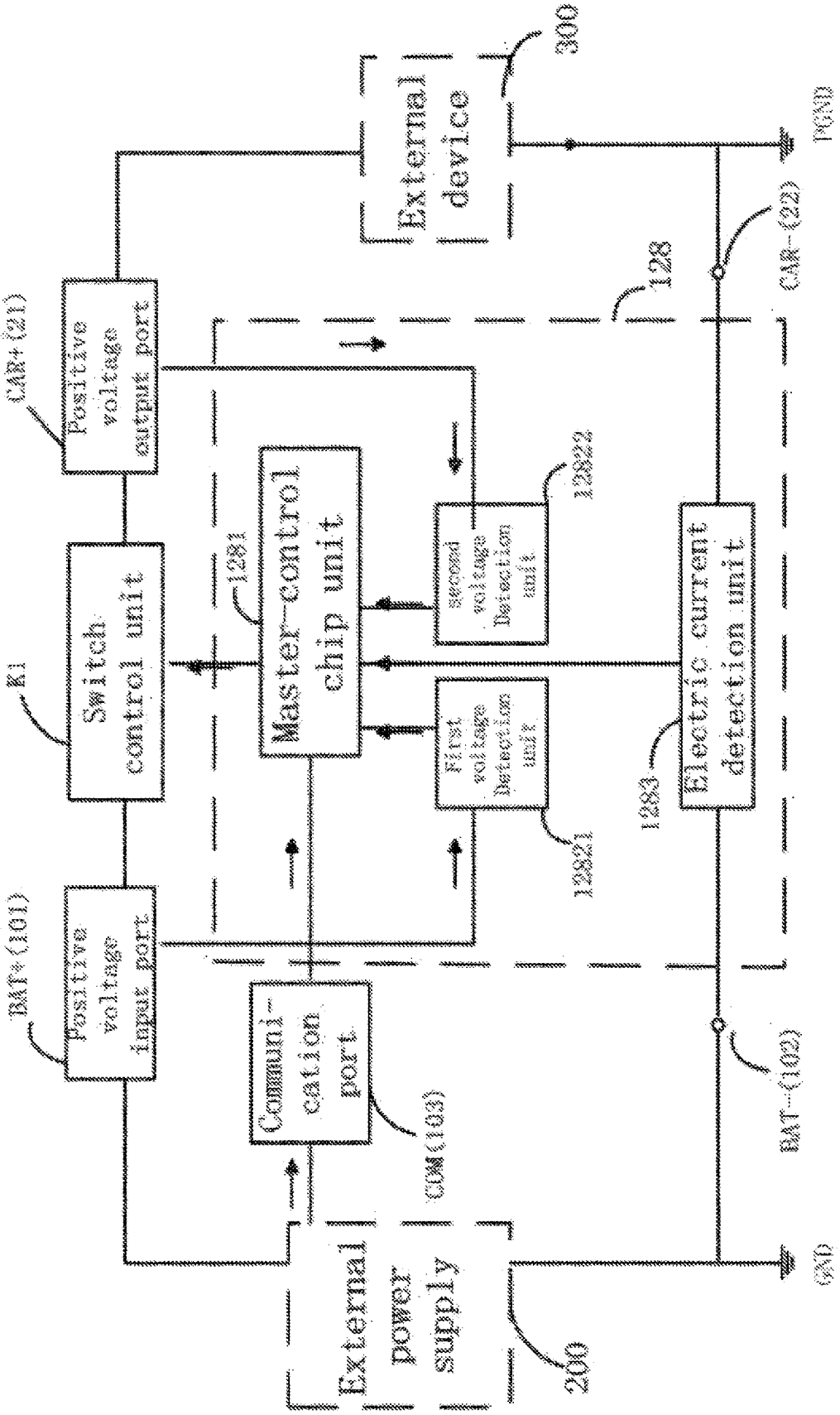
External device
300
PGND
CAR−(22)
128
CAR+(21)
Positive voltage output port
Switch control unit
K1
Master-control chip unit
1281
second voltage Detection unit
12822
First voltage Detection unit
12821
Electric current detection unit
1283
BAT+(101)
Positive voltage input port
Communi-cation port
CM(103)
BAT−(102)
External power supply
200
GND

Fig. 6

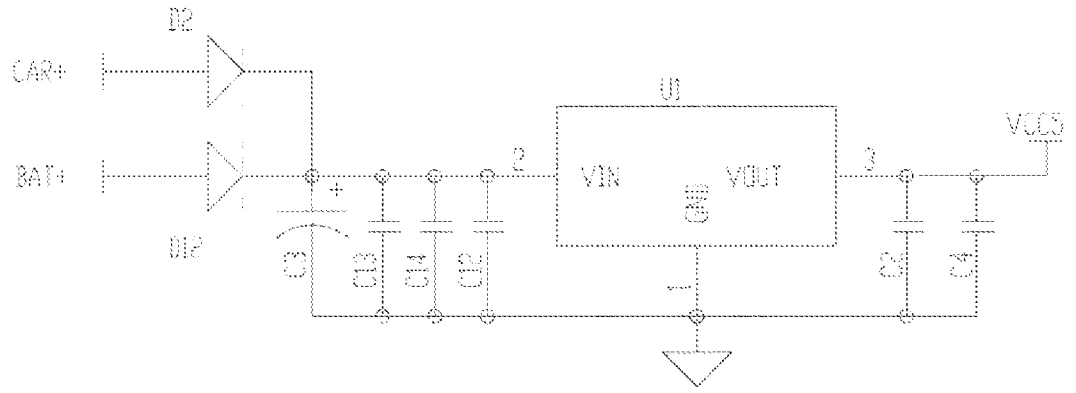
D2
CAR+
BAT+
D12
U1
VIN
VOUT
GND
VCC5
C3
C13
C14
C12
C2
C4

Fig. 7

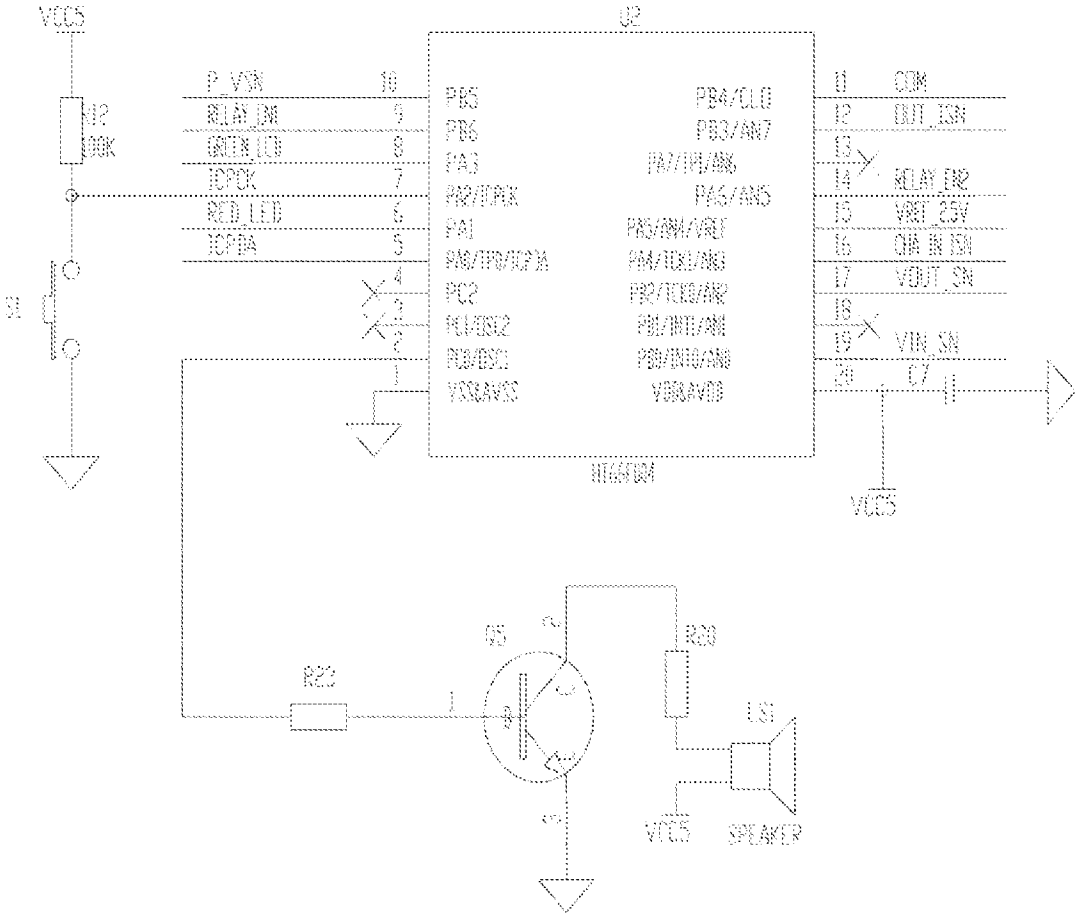
VCC5
U2
P_VSN
RELAY_EN1
GREEN_LED
ICPCK
RED_LED
ICPDA
PB5
PB6
PA3
PA2/ICPCK
PA1
PA0/TP0/ICPDA
PC2
PC1/OSC2
PC0/OSC1
VSS&AVSS
PB4/CLO
PB3/AN7
PA7/TP1/AN6
PA6/AN5
PA5/AN4/VREF
PA4/TCK1/AN3
PB2/TCK0/AN2
PB1/INT1/AN1
PB0/INT0/AN0
VDD&AVDD
COM
OUT_ISN
RELAY_EN2
VREF_2.5V
CHA_IN_ISN
VOUT_SN
VIN_SN
C7
S1
R23
Q5
R20
LS1
SPEAKER

Fig. 8

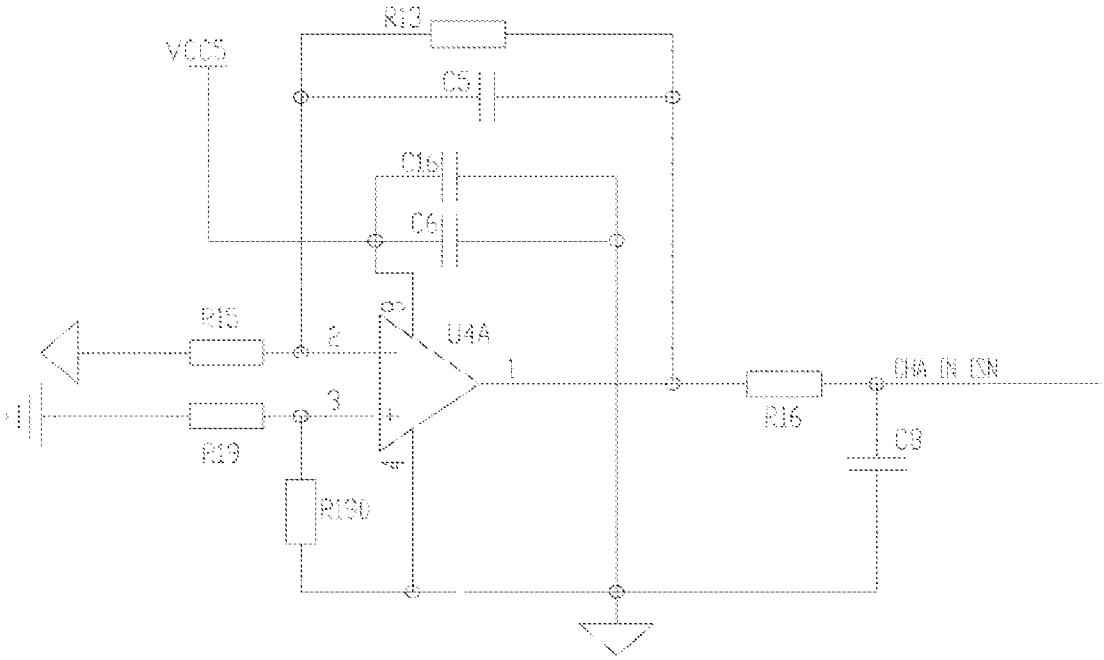
R13
VCC5
C5
C16
C6
R15
2
U4A
1
CHA_IN_ISN
3
R16
R19
C8
R130

Fig. 9

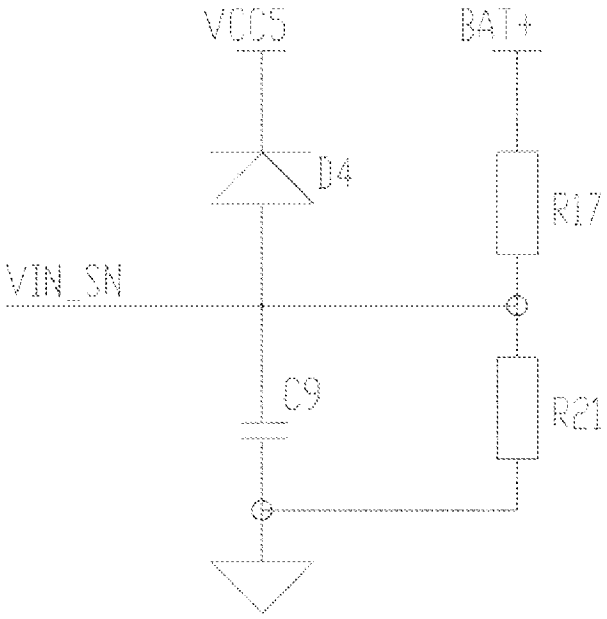
VCC5
BAT+
D4
R17
VIN_SN
C9
R21

Fig. 10

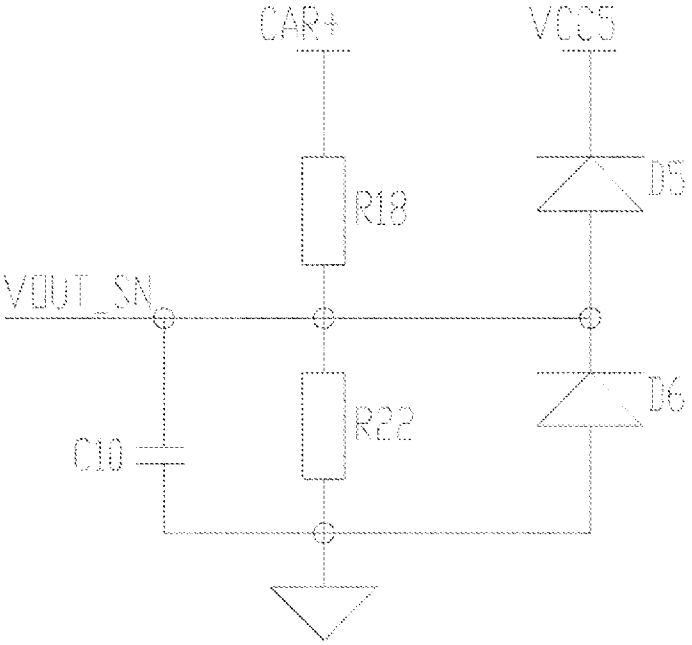

Fig. 11

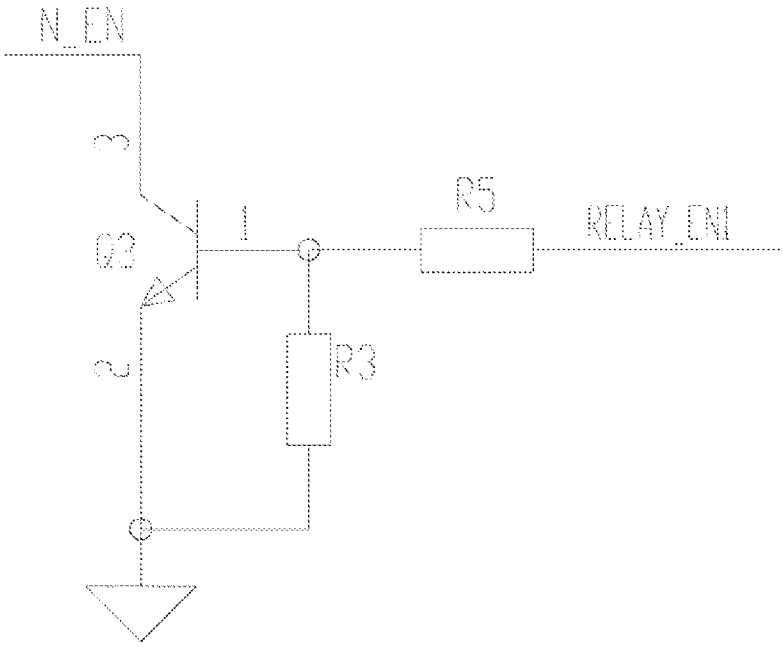

Fig. 12

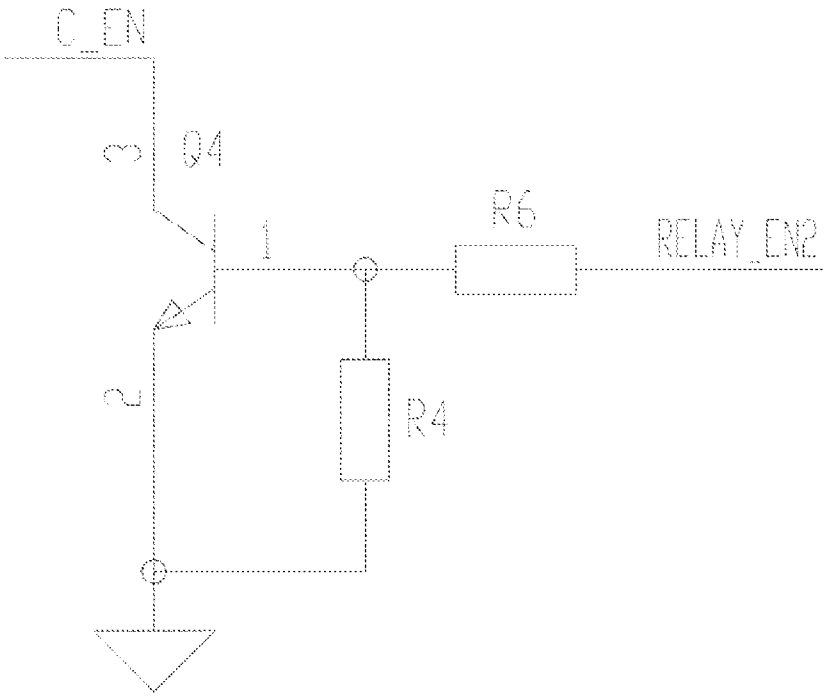

Fig. 13

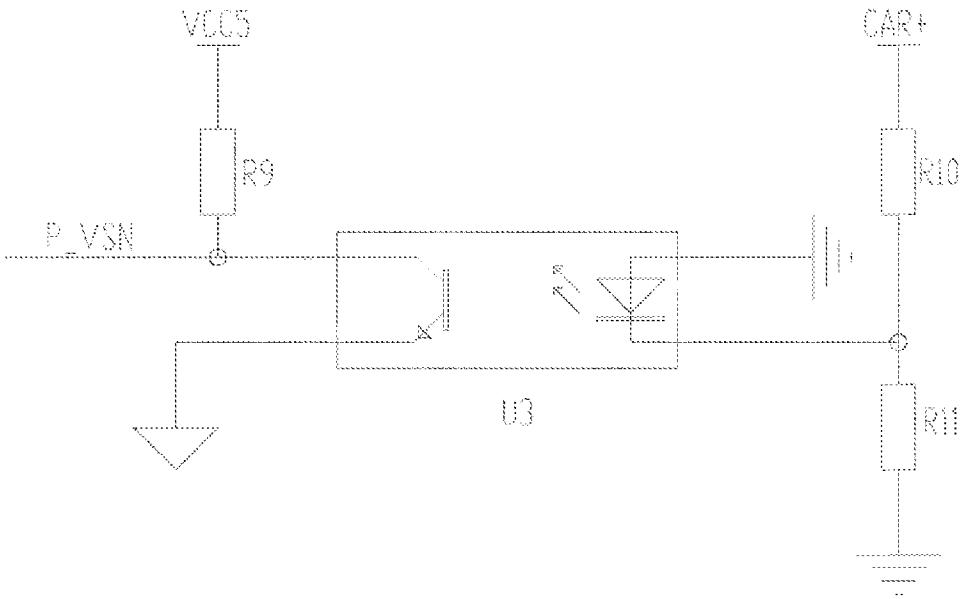

Fig. 14

US010148105B2

(12) **United States Patent**
Lei

(10) **Patent No.: US 10,148,105 B2**
(45) **Date of Patent: Dec. 4, 2018**

(54) **BATTERY CLAMP**

(71) Applicant: **Shenzhen Carku Technology Co., Ltd.**, Shenzhen (CN)

(72) Inventor: **Yun Lei**, Shenzhen (CN)

(73) Assignee: **SHENZHEN CARKU TECHNOLOGY CO, LTD.**, Longgang District, Shenzhen (CN)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/245,146**

(22) Filed: **Aug. 23, 2016**

(65) **Prior Publication Data**

US 2018/0006478 A1 Jan. 4, 2018

(30) **Foreign Application Priority Data**

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Jun. 30, 2016 (CN) 2016 1 0506137
Jun. 30, 2016 (CN) ..... 2016 2 0692248 U

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

(52) **U.S. Cl.**
CPC ***H02J 7/0045*** (2013.01); ***H02J 7/0029*** (2013.01); ***H02J 7/0047*** (2013.01); ***H02J 7/0054*** (2013.01); *H02J 2007/0096* (2013.01)

(58) **Field of Classification Search**
CPC H02J 7/0034; H02J 7/0054; H02J 7/0042; H02J 2001/006; Y02E 60/12
(Continued)

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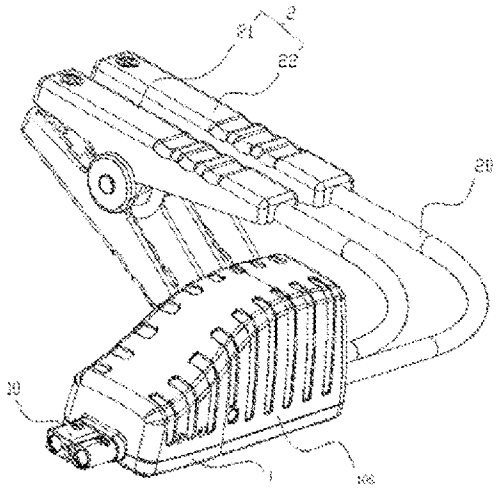
Primary Examiner — Arun Williams
(74) *Attorney, Agent, or Firm* — Jun He Law Offices P.C.; James J. Zhu

(57) **ABSTRACT**

The present invention provides a battery clamp, comprising: a first and second wire clamps and a control device. Each of the first and second wire clamps is electrically connected to the control device. The control device comprises: a housing; a master-control board mounted within the housing; and connectors disposed at one side of the housing, and being electrically connected to the master-control board, comprising: at least a first and second electrode connectors, which are connected to an external power supply for receiving power, and at least one communication connector connected to the external power supply for building a communication connection between the battery clamp and the external power supply. The battery clamp is communicatively connected to the external power supply by the communication connector, thereby effectively solving the problems of a lithium battery in an external power supply e.g. battery bulge or explosion resulted from improper uses.

10 Claims, 10 Drawing Sheets



(58) **Field of Classification Search**
USPC 320/105
See application file for complete search history.

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PTO/SB/56 (03-13)
Approved for use through 01/31/2020. OMB 0651-0033
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REISSUE APPLICATION FEE TRANSMITTAL FORM

Docket Number (Optional): 240001.00005

Application as Filed – Part 1

	(1) Claims in Patent	(2) Claims Filed in Reissue Application	(3) Number Extra	Micro Entity Rate ($)	Micro Entity Fee ($)	Small Entity Rate ($)	Small Entity Fee ($)	Undiscounted Rate ($)	Undiscounted Fee ($)
Total Claims (37 CFR 1.16(i))	(A) 10	(B) 21	* 1 =	x =		x =	$50.00	x =	
Ind. Claims (37 CFR 1.16(h))	(C) 1	(D) 2	** 0 =	x =		x =		x =	
Application Size Fee (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $400 ($200 for small entity, $100 for micro entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).								
	Filing Fee (37 CFR 1.16(e))						$160.00		
	Search Fee (37 CFR 1.16(n))						$350.00		
	Examination Fee (37 CFR 1.16(r))						$1,160.00		
	Total Filing Fee						$1,720.00		

Application as Amended – Part 2

	(1) Claims Remaining After Amendment	(2) Highest Number Previously Paid For	(3) Extra Claims Present	Micro Entity Rate ($)	Micro Entity Fee ($)	Small Entity Rate ($)	Small Entity Fee ($)	Undiscounted Rate ($)	Undiscounted Fee ($)
Total Claims (37 CFR 1.16(i))	*** -	****	=	x =		x =		x =	
Ind. Claims (37 CFR 1.16(h))	*** -	*****	=	x =		x =		x =	
Application Size Fee (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $400 ($200 for small entity, $100 for micro entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).								
			Total Additional Fee						

* Enter (B) – 20, or enter "0" if (B) is less than 20.
** Enter (D) – minus 3, or enter "0" if (D) is less than 3.
*** After any cancellation of claims.
**** If the "Highest Number of Total Claims Previously Paid For" is less than 20, enter "20" in this space.
***** If the "Highest Number of Independent Claims Previously Paid For" is less than 3, enter "3" in this space.

- [x] Applicant asserts small entity status. See 37 CFR 1.27.
- [ ] Applicant certifies micro entity status. See 37 CFR 1.29.
  Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.
- [x] The Director is hereby authorized to charge any additional fees under 37 CFR 1.16 or 1.17 which may be required, or credit any overpayment to Deposit Account No. 60-2239.
- [ ] A check in the amount of $ _____ to cover the filing/additional fee is enclosed.
- [x] Payment made via EFS-Web.
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/Hao Tan/
Signature

December 4, 2020
Date

Hao Tan
Typed or Printed Name

73,711
Registration Number, if applicable

312-558-1368
Telephone Number

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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).
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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.

REMARKS

This application is an application for reissue of U.S. Patent No. 10,148,105 ("the '105 patent), filed August 23, 2016, which claims priority to Chinese Patent Application No. 2016206922483 filed Jun. 30, 2016. The '105 patent also claims priority to Chinese Patent Application No. 2016105061068 filed Jun. 30, 2016. The '105 patent further claims priority to Chinese Patent Application No. 2016105061373 filed Jun. 30, 2016. The disclosure of these applications is incorporated by reference herein in its entirety.

Applicant submits that U.S. Pat. No. 10,148,105 has not been involved in any other prior or concurrent proceedings.

The present request amends claims 1-4 and 6-7, cancels claim 5 and 8-10, and adds claims 11-25.

Status of the Claims and Statement of Support for Claim Chan es under 37 C.F.R. 1.173(c)

As required under 37 CFR § 1.173(c), the above amended and newly added claims are supported in the disclosure of the '105 patent, e.g., as set forth below.

Claims 1-10 were issued in US. Pat. No. 10,148,105. Without prejudice or disclaimer, solely to more particularly point out and distinctly claim the invention, claims 1-4 and 6-7 have been amended; claims 5 and 8-10 has been canceled; and new claims 11-25 have been added.

Independent claim 1 has been broadened, among other things, to delete features "a housing" and "connectors disposed at one side of the housing..." New claims 11-25 have been added to claim certain features of the originally issued claims. Support for the amendments to claim 1 can be found throughout the '105 patent. Claims 1-4, 6-7 and 11-25 are pending for examination.

Reissue Declaration

Applicant submits herewith a reissue declaration executed by the Assignee of US. Patent No. 10,148,105, according to the provisions of MPEP 1414 and (post-AIA) 37 C.F.R. 1.175.

Applicant provides the following statement pursuant to (post-AIA) 37 C.F.R. 1.175(d) and MPEP1414.03(1).

> Applicant believes US. Pat. No. 10,148,105 is wholly or partially inoperative by reason of Patentee claiming less than Patentee had a

right to claim in the patent. For example, originally issued independent claim 1 include, among others, features "a housing" and "connectors disposed at one side of the housing…," which render the scope of claims unnecessarily narrow. In the present Reissue Application, claim 1 of underlying US. Pat. No. 10,148,105 is amended by broadening amendments to delete these limitations. New claims 11-25, which are derived from the originally issued claims 1-4 and 6-7, are added. Accordingly, Applicant seeks the present broadening reissue.

CONCLUSION

Based on foregoing Remarks and the arguments presented in the prosecution history of the granted patent, Applicant respectfully submits that the pending claims of the present application are allowable over the prior art of record. The Examiner is invited to direct any questions to the practitioner of record at the blow-listed telephone and email address. The Commissioner is hereby authorized to charge any additional fees which may be required or to credit any overpayment to Deposit Account 60-2239.

Respectfully submitted,

Date: December 4, 2020

/Hao Tan/

Hao Tan
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Arch & Lake LLP
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Suite 2100
Chicago, IL 60601
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AMENDMENTS TO CLAIMS

As required under 37 CFR § 1.173(b)(2), set forth below is the entire text of each claim being changed or added by this Preliminary Amendment. Each amended, cancelled, or added claim is marked as required under 37 CFR § 1.173(d).

Please cancel claims 5, 8-10.

Please amend claims 1-4 and 6-7.

Please add new claims 11-25.

1. (Amended) A battery clamp for delivering an instantaneous starting current [from an external power supply] to an external device, the battery clamp comprising:

a control device, comprising:

[a housing;]

a master-control board [mounted within the housing; and];

[connectors disposed at one side of the housing, and being electrically connected to the master-control board, comprising:]

at least a first and second electrode connectors being electrically connected to the master-control board, which are connected to a[n external] power supply for receiving power, and

at least one communication connector connected to the [external] power supply for receiving status information of the [external] power supply, and sending the status information to the master-control board;

[a first and second wire clamps, each having an end configured to receive power from the external power supply via the control device, and another end connected to the external device for supplying power to the external device;]

wherein the control device is configured to control power supply from the [external] power supply to the external device based on the status information.

2. (Amended) The battery clamp of claim 1, wherein the control device is configured to allow the power supply from the [external] power supply to the external device when the status

information is normal, wherein the status information comprises at least one of the following: temperature, voltage of a battery unit of the [external] power supply.

3. (Amended) The battery clamp of claim 11, wherein the master-control board comprises:

a first and second voltage input ports electrically connected to the first and second electrode connectors respectively;

a communication port electrically connected to the communication connector;

a first and second voltage output ports electrically connected to the first and second wire clamps for supplying power to the external device via the first and second wire clamps;

a switch control unit for controlling connection between the first voltage input port and the first voltage output port; and

a master-control circuit unit connected to the communication port for obtaining the status information of the [external] power supply;

wherein the master-control circuit unit is configured to control the switch control unit based on the status information of the [external] power supply, thereby controlling connection on/off between the first voltage input port and the first voltage output port.

4. (Amended) The battery clamp of claim 3, wherein the master-control circuit unit further comprises <u>at least one of the following</u>:

an electric current detection unit for detecting electric current from the [external] power supply to the external device;

a <u>first</u> voltage detection unit for detecting <u>a first</u> voltage of the [external] power supply<u>; or</u> [and the external device; and]

<u>a second voltage detection unit for detecting a second voltage of the external device;</u>

wherein the master-control circuit unit is configured to <u>control the switch control unit based on the detected electric current value, the detected first voltage value, the detected second voltage value, or a combined set of any of the three detected values</u> [compare the electric current value and the voltage value with a predefined electric current range and a predefined voltage range respectively, thereby controlling the switch control unit].

5. (Cancelled)

6. (Amended) The battery clamp of claim [4]1, wherein the master-control circuit unit further comprises:

an indicator light circuit unit connected to the master-control chip unit for indicating operating status of the control device.

7. (Amended) The battery clamp of claim [4]1, wherein the master-control circuit unit further comprises:

a buzzing circuit unit connected to the master-control chip unit for alerting users about abnormal condition.

8-10. (Cancelled)

11. (New) The battery clamp of claim 1, further comprising a first and second wire clamps, configured to receive power from the power supply via the control device and supply power to the external device.

12. (New) The battery clamp of claim 4, wherein the master-control circuit unit is configured to control the switch control unit based on a comparison result between the detected electric current value and a predefined electric current range.

13. (New) The battery clamp of claim 4, wherein the master-control circuit unit is configured to control the switch control unit based on a comparison result between the detected first voltage value and a first predefined voltage range.

14. (New) The battery clamp of claim 14, wherein the master-control circuit unit is configured to control the switch control unit based on both a comparison result between the second detected voltage value and a second predefined voltage range.

15. (New) The battery clamp of claim 1, wherein the control device further comprises:

an indicator light for indicating operating status of the control device.

16. (New) A master-control board for delivering an instantaneous starting current to an external device, comprising:

an output port;

a switch control unit for controlling the output port; and

a voltage detection unit for detecting voltage of the external device;

wherein the switch control unit outputs on/off control signal based on the voltage of the external device, thereby controlling the output port.

17. (New) The control board of claim 16, wherein the voltage detection unit is further configured to detect the voltage change rate of the external power device and the switch control unit outputs on/off control signal based on the information of voltage change rate.

18. (New) The control board of claim 16, further comprising an input port;

wherein the switch control unit controls the connection between the input port and the output port.

19. (New) The control board of claim 16, further comprising a master-control circuit unit, which obtains a status information of a power supply.

20. (New) The control board of claim 19, wherein the master-control circuit unit further comprises at least one of the following:

an electric current detection unit for detecting electric current from the power supply to the external device;

a first voltage detection unit for detecting a first voltage of the power supply; or

a second voltage detection unit for detecting a second voltage of the external device;

wherein the master-control circuit unit is configured to control the switch control unit based on the detected electric current value, the detected first voltage value, the detected second voltage value, or a combined set of any of the three detected values.

21. (New) The control board of claim 20, wherein the master-control circuit unit is configured to control the switch control unit based on a comparison result between the detected electric current value and a predefined electric current range.

22. (New) The control board of claim 20, wherein the master-control circuit unit is configured to control the switch control unit based on a comparison result between the detected first voltage value and a first predefined voltage range.

23. (New) The control board of claim 20, wherein the master-control circuit unit is configured to control the switch control unit based on both a comparison result between the second detected voltage value and a second predefined voltage range.

24. (New) The control board of claim 19, wherein the master-control circuit unit further comprises:

an indicator light circuit unit connected to the master-control chip unit for indicating operating status of the control device.

25. (New) The control board of claim 19, wherein the master-control circuit unit further comprises:

a buzzing circuit unit connected to the master-control chip unit for alerting users about abnormal condition.

AMENDMENTS TO THE SPECIFICATION

Please amend the first paragraph of the specification, appearing at column 1, lines 5-12 of US. Pat. No. 10,148,105, as follows:

This application is an application for reissue of U.S. Patent No. 10,148,105 ("the '105 patent), filed August 23, 2016, which claims priority to Chinese Patent Application No. 201620692248.3 filed Jun. 30, 2016. [This application] The '105 patent also claims priority to Chinese Patent Application No. 201610506106.8 filed Jun. 30, 2016. [This application] The '105 patent further claims priority to Chinese Patent Application No. 201610506137.3 filed Jun. 30, 2016. The disclosure of these applications are incorporated by reference herein in its entirety.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Shenzhen Carku Technology Co., Ltd.
Inventor(s):	Yun LEI
Application No.:	To Be Assigned
Date of Filing:	December 4, 2020
Title:	Battery Clamp
Art Unit:	To be assigned
Examiner:	To be assigned
Confirmation No.:	To be assigned
Attorney Docket No.:	240001.00005

PRELIMINARY AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

INTRODUCTORY COMMENTS

Concurrently with the filing of the present broadening reissue application, Applicant submits the following Amendments and Remarks for entry into the file of the above-referenced application.

Amendments to the Specification are on page 2 of this paper.

Amendments to the Claims are on page 3 of this paper.

Remarks begin on page 8 of this paper.

PTO/AIA/14 (02-18)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	240001.00005
	Application Number	
Title of Invention	BATTERY CLAMP	

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
	Yun		LEI	

Residence Information (Select One) US Residency ● Non US Residency Active US Military Service

City	Shenzhen	Country of Residence i	CN

Mailing Address of Inventor:

Address 1	Building A, Qixing Creative Square, Lianrun Rd.,		
Address 2	Gaofeng Community, Dalang Street, Longhua District		
City	Shenzhen, Guangdong	**State/Province**	
Postal Code	518109	**Country** i	CN

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	153979		
Email Address	ip@archlakelaw.com	Add Email	Remove Email
Email Address	haotan@archlakelaw.com	Add Email	Remove Email
Email Address	shenwang@archlakelaw.com		Remove Email

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	240001.00005
	Application Number	
Title of Invention	BATTERY CLAMP	

Application Information:

Title of the Invention	BATTERY CLAMP		
Attorney Docket Number	240001.00005	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	10	**Suggested Figure for Publication (if any)**	

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	153979		

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	240001.00005
	Application Number	
Title of Invention	BATTERY CLAMP	

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: Patented — Remove

Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
	reissued of	15245146	2016-08-23	10148105	2018-12-04

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)
201610506137.3	CN	2016-06-30	

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
201610506106.8	CN	2016-06-30	

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
201620692248.3	CN	2016-06-30	

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

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	240001.00005
	Application Number	
Title of Invention	BATTERY CLAMP	

☐ 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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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	240001.00005
	Application Number	
Title of Invention	BATTERY CLAMP	

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 Data Sheet 37 CFR 1.76	Attorney Docket Number	240001.00005
	Application Number	
Title of Invention	BATTERY CLAMP	

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	SHENZHEN CARKU TECHNOLOGY CO., LTD.		
Mailing Address Information For Applicant:			
Address 1	Building A, Qixing Creative Square, Lianrun Rd.,		
Address 2	Gaofeng Community, Dalang Street, Longhua District		
City	Shenzhen, Guangdong	**State/Province**	
Country	CN	Postal Code	518109
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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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	240001.00005
	Application Number	
Title of Invention	BATTERY CLAMP	

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	SHENZHEN CARKU TECHNOLOGY CO., LTD.

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1	Building A, Qixing Creative Square, Lianrun Rd.,		
Address 2	Gaofeng Community, Dalang Street, Longhua District		
City	Shenzhen, Guangdong	**State/Province**	
Country i	CN	Postal Code	518109
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	/Hao Tan/			Date (YYYY-MM-DD)	2020-12-04
First Name	Hao	Last Name	Tan	Registration Number	73,711

Additional Signature may be generated within this form by selecting the Add button. Add

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Approved for use through 11/30/2020. OMB 0651-0032
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	240001.00005
	Application Number	
Title of Invention	BATTERY CLAMP	

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.**

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	BATTERY CLAMP
First Named Inventor/Applicant Name:	Yun LEI
Filer:	Hao Tan/Kimberly Ewing
Attorney Docket Number:	240001.00005

Filed as Small Entity

Filing Fees for Reissue (Utility)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY REISSUE BASIC	2014	1	160	160
REISSUE OR REISSUE DESIGN CPA SEARCH FEE	2114	1	350	350
REISSUE OR REISSUE DESIGN CPA EXAM. FEE	2314	1	1160	1160
Pages:				
Claims:				
REISSUE CLAIMS IN EXCESS OF 20 FOR SMALL	2205	1	50	50
Miscellaneous-Filing:				
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1720**

Electronic Acknowledgement Receipt

EFS ID:	41291192
Application Number:	17112920
International Application Number:	
Confirmation Number:	5982
Title of Invention:	BATTERY CLAMP
First Named Inventor/Applicant Name:	Yun LEI
Customer Number:	153979
Filer:	Hao Tan
Filer Authorized By:	
Attorney Docket Number:	240001.00005
Receipt Date:	04-DEC-2020
Filing Date:	
Time Stamp:	20:54:29
Application Type:	Reissue (Utility)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1720
RAM confirmation Number	E2020B4K55191222
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Reissue Application	Reissue_Application_Transmittal.pdf	397711 2bb52137c06c75bc40a2c8ec8747638b2d99e084	no	2
Warnings:					
Information:					
2	Reissue dec filed in accordance with MPEP 1414	Reissue_Declaration_by_Assignee.pdf	1873968 6129a8b56c37d1fe2490ad89ef10456dff28fee0	no	3
Warnings:					
Information:					
3	Consent of Assignee accompanying the declaration	Consent_of_Assignee.pdf	1201337 31b25148539063aad84e0ae298f64921233abdd2	no	2
Warnings:					
Information:					
4	Assignee showing of ownership per 37 CFR 3.73	Statement_373c.pdf	386172 520e4af6d97239c101f5bd853836a47299b2ddb5	no	2
Warnings:					
Information:					
5		US10148105B2.pdf	16734259 c9333c466b6e9d7f7de41dc584fe1d8ae06c99bb	yes	18

Multipart Description/PDF files in .zip description

Document Description	Start	End
Claims	18	18
Specification	13	17
Drawings-only black and white line drawings	3	12

	Abstract		1	2	
Warnings:					
Information:					
6	Transmittal Reissue Application	Reissue_Fee_Transmittal.pdf	384569 d9283cceb1c52fcb9180d9f21b1c5c4353717e5f	no	2
Warnings:					
Information:					
7		Preliminary_Amendment.pdf	182889 997e5002b2bf9dd1cf406bda750cf969b949c8f0	yes	10
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Applicant Arguments/Remarks Made in an Amendment		8	10	
	Claims		3	7	
	Specification		2	2	
	Preliminary Amendment		1	1	
Warnings:					
Information:					
8	Application Data Sheet	ADS.pdf	2904982 7ee4cc7778b09dc799d015ea28f4c3569c0dcf18	no	8
Warnings:					
Information:					
9	Fee Worksheet (SB06)	fee-info.pdf	36521 de30ef1ca73ca59ddaca700420274360502 6f0fc	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	24102408		

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.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 17/112,920

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	160		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	350		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	1160		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	21 minus 20 =	* 1	x 50 =	50	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*	x 240 =	0.00			
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).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	1720		TOTAL	

APPLICATION AS AMENDED - PART II

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

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

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** 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 found in the appropriate box in column 1.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
17/112,920	12/04/2020	2859	1720	240001.00005	21	2

CONFIRMATION NO. 5982

153979
Arch & Lake LLP
203 North LaSalle Street, Suite 2100
Chicago, IL 60601

FILING RECEIPT

OC000000121862939

Date Mailed: 12/08/2020

Receipt is acknowledged of this reissue patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Yun LEI, Shenzhen, CHINA;

Applicant(s)

SHENZHEN CARKU TECHNOLOGY CO., LTD., Shenzhen, Guangdong, CHINA, Assignee (with 37 CFR 1.172 Interest);

Assignment For Published Patent Application

SHENZHEN CARKU TECHNOLOGY CO., LTD., Shenzhen, Guangdong, CN

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a REI of 15/245,146 08/23/2016 PAT 10148105

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
CHINA 201610506137.3 06/30/2016 No Access Code Provided
CHINA 201620692248.3 06/30/2016 No Access Code Provided
CHINA 201610506106.8 06/30/2016 No Access Code Provided

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 12/07/2020

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 17/112,920**

Projected Publication Date: None, application is not eligible for pre-grant publication

Non-Publication Request: No

Early Publication Request: No

** **SMALL ENTITY** **

Title

BATTERY CLAMP

Preliminary Class

320

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop

technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

WINPLUS Ex. 1003, p. 59

PLUS Search Results for S/N 17112920, Searched Wed Oct 20 15:56:45 EDT 2021

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

5220207 99
4796827 83
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PLUS Search Results for S/N 17112920, Searched Wed Oct 20 15:54:20 EDT 2021

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/112,920	12/04/2020	Yun LEI	240001.00005	5982

153979 7590 02/04/2022

Arch & Lake LLP
203 North LaSalle Street, Suite 2100
Chicago, IL 60601

EXAMINER
WHITTINGTON, KENNETH

ART UNIT	PAPER NUMBER
3992	

NOTIFICATION DATE	DELIVERY MODE
02/04/2022	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):

USPTO@dockettrak.com
haotan@archlakelaw.com
shenwang@archlakelaw.com

Office Action Summary	Application No. 17/112,920	Applicant(s) LEI, Yun	
	Examiner KENNETH WHITTINGTON	Art Unit 3992	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 4 December 2020.

☐ 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) 1-4,6-7 and 11-25 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) 1-4,6-7 and 11-25 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 4 December 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. 15/245,146.

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 _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

NON-FINAL OFFICE ACTION

This non-final office action addresses U.S. Application No. 17/112,920, which is a broadening reissue application of U.S. Application No. 15/245,146 (hereinafter the "**146 Application**"), entitled BATTERY CLAMP, which issued as U.S. Patent No. 10,148,105 (hereinafter the "**105 Patent**") on December 4, 2018.

The status of the claims is as follows:

Claims 1-4, 6, 7 and 11-25 are pending and examined herein.

Claims 1-4, 6, 7 and 11-25 are rejected.

I. STATUS OF CLAIMS

The 105 Patent issued with claims 1-10.

Applicant filed a preliminary amendment on December 4, 2020 (hereinafter the "**2020 Preliminary Amendment**") along with the filing of the present application. In the 2020 Preliminary Amendment, patent claims 1-4, 6 and 7 were amended, patent claims 5 and 8-10 were cancelled and new claims 11-25 were added.

Therefore, claims 1-4, 6, 7 and 11-25 are pending and will be examined herein.

II. PRIORITY

Examiners acknowledge that the present application is a reissue of the 146 Application, now the 105 Patent. Examiners further acknowledge the Applicant's claims of foreign priority to CN201610506106, CN201610506137 and CN201620692248, each filed June 30, 2016.

III. OBJECTIONS TO AMENDMENTS

37 C.F.R. §1.173 (in part)

> (c) Status of claims and support for claim changes. Whenever there is an amendment to the claims pursuant to paragraph (b) of this section, there must also be supplied, on pages separate from the pages containing the changes, the status (i.e., pending or canceled), as of the date of the amendment, of all patent claims and of all added claims, and an explanation of the support in the disclosure of the patent for the changes made to the claims.
> (d) Changes shown by markings. Any changes relative to the patent being reissued which are made to the specification, including the claims, upon filing, or by an amendment paper in the reissue application, must include the following markings:
>
> (1) The matter to be omitted by reissue must be enclosed in brackets; and
> (2) The matter to be added by reissue must be underlined, except for amendments submitted on compact discs (§§ 1.96 and 1.821(c)). Matter added by reissue on compact discs must be preceded with "U" and end with "/U" to properly identify the material being added.
>
> (g) Amendments made relative to the patent. All amendments must be made relative to the patent specification, including the claims, and drawings, which are in effect as of the date of filing of the reissue application.

The amendments to the claims provided in the 2020 Preliminary Amendment are objected to because they are not compliant with §1.173, which requires an explanation of support for the claim changes. Simply stating that "[s]upport for the amendments to claim 1 can be found throughout the '105 patent" is not proper under the rules. Furthermore, this statement does not address any of the changes of the original patent claims via the presentation of new claims 11-25 and further Examiners find no statement of support for any of the new claims. Appropriate correction is required in response to this Office action and will be required in any future response by Applicant. Specifically, Applicant is required to identify how the newly added claims differ from the patent claims and further provide a proper explanation of support for all of the amended patent claims and the newly added claims. See MPEP §1453.

Claim 3 is further objected to because it does not have proper markings under 37 C.F.R. §1.173 which require all amendments to be made with respect to the original patent. Since the claim has been amended to now depend from claim 11 (instead of claim 1), proper markings making such an amendment should be shown.

IV. CLAIM OBJECTIONS

Claim 14 is objected to because it is recited to depend from itself, which appears to merely be a typographical error. Based on a review of the claims, Examiners submit claim 14 should depend from claim 4 and will be interpreted as such. Appropriate correction of this typographical error is required.

V. REISSUE OATH/DECLARATION

37 C.F.R. §1.175 Reissue oath or declaration (in part).

> (a) The inventor's oath or declaration for a reissue application, in addition to complying with the requirements of § 1.63, § 1.64, or § 1.67, must also specifically identify at least one error pursuant to 35 U.S.C. 251 being relied upon as the basis for reissue and state that the applicant believes the original patent to be wholly or partly inoperative or invalid by reason of a defective specification or drawing, or by reason of the patentee claiming more or less than the patentee had the right to claim in the patent.
> (b) If the reissue application seeks to enlarge the scope of the claims of the patent (a basis for the reissue is the patentee claiming less than the patentee had the right to claim in the patent), the inventor's oath or declaration for a reissue application must identify a claim that the application seeks to broaden. A claim is a broadened claim if the claim is broadened in any respect.

The reissue declaration by assignee filed December 4, 2020 (hereinafter the "**2020 Reissue Declaration**") is acknowledged. However, Examiners object to the error statement in the 2020 Reissue Declaration on the basis that it fails to state a proper error in the claims on which to base this reissue. While Examiners recognize in the

2020 Reissue Declaration that Applicant states an error in "U.S. Pat. No. 10,148,105 is wholly or partially inoperative because the patentee claims less than he had a right to claim in the patent. Claim 1 and other claims of U.S. Pat. No. 10,148,105 are amended by broadening amendments to the limitation, and new claims 11-25 are added."

Examiners do not find this statement sufficient under the rules. An error statement should identify an "a single word, phrase, or expression" in error from the claims and how this error renders the 105 Patent partially or wholly inoperative or invalid. See MPEP §1414.

Accordingly, Applicant is required to provide a new declaration by the inventor or assignee with a statement of error with respect to 105 Patent identifying the claim Applicant seeks to broaden and further identify an "a single word, phrase, or expression" from this claim and how this error renders the 476 Patent partially or wholly inoperative or invalid.

Examiners recognize that Applicant has attempted to provide an error statement in the remarks to the 2020 Preliminary Amendment (pages 8-9). However, before Applicant can rely on remarks to supplement an oath or declaration as provided in 37 C.F.R. §1.175(d) and outlined in MPEP §1414.03(I), Applicant must first provide a proper reissue oath or declaration on the record in the application. As discussed above, Examiners do not find a proper reissue declaration on the record in this reissue application.

REJECTIONS – 35 U.S.C. §112

The following is a quotation of the first paragraph of 35 U.S.C. §112(a):

> (a) IN GENERAL.—The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

Claims 4 and 20-23 are rejected under 35 U.S.C. §112(a) as failing to comply with the written description requirement. The claims contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor at the time the application was filed, had possession of the claimed invention. Regarding these claims, claims 4 and 20 recite the master control unit controls the switch based on "a combined set of any of the three detected values." However, while Examiners find support for the master control unit controlling the switch based on each of the detected electric current, the first voltage and the second voltage, Examiners do not find a description of a combined set of these values or a control of the switch based on a combined set of these values. Accordingly, Examiners do not find this claim limitation was described in the specification of the 105 Patent and thus is new matter herein.

Claim 17 is rejected under 35 U.S.C. §112(a) as failing to comply with the written description requirement. The claim contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor at the time the application was filed, had possession of the claimed invention. Claim 17 requires a voltage detection unit that detects the "voltage change rate" of the external device which is not disclosed in the specification of the 105 Patent. The only device that detects the voltage of the external device is shown

in FIG. 11 and discussed at col. 9, lines 3-29 of the 105 Patent which merely discloses measuring the voltage of the external device, not the change rate thereof.

Claims 16-25 are rejected under 35 U.S.C. §112(a) as failing to comply with the written description requirement. The claims contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor at the time the application was filed, had possession of the claimed invention. Regarding these claims, claim 16 recites the "switch control unit" outputs an on/off control signal based on the voltage of the external device. Following a careful review of the specification, the "switch control unit" is merely a switch K1 as shown in FIGS. 4-6. It does not output any control signal. Rather the portions of the device that outputs a control signal based on the voltage of the external device is the master-control circuit unit 1281 shown in FIGS. 4-6. Accordingly, to now recite the switch performs this function lacks a clear written description and thus is new matter herein.

Furthermore, regarding claims 20-23, these claims recite the switch control unit outputting a control signal based on the voltage of the external device and further recites a master-control circuit unit that also controls the switch control unit based on the detected second voltage value from of the external device. Thus, Examiners find these claims require two devices that output a control signal based on the voltage of the external device, which additionally lacks a clear written description and thus is new matter herein.

REJECTIONS – 35 U.S.C. §251

The following is a quotation of 35 U.S.C. §251(a):

> (a) IN GENERAL.—Whenever any patent is, through error, deemed wholly or partly inoperative or invalid, by reason of a defective specification or drawing, or by reason of the patentee claiming more or less than he had a right to claim in the patent, the Director shall, on the surrender of such patent and the payment of the fee required by law, reissue the patent for the invention disclosed in the original patent, and in accordance with a new and amended application, for the unexpired part of the term of the original patent. No new matter shall be introduced into the application for reissue.

A. Rejections Based on Defective Oath/Declaration

Claims 1-4, 6, 7 and 11-25 and this reissue application as a whole are rejected as being based upon a defective reissue declaration under 35 U.S.C. §251. See also 37 C.F.R. §1.175. The nature of the defects in the 2020 Reissue Declaration is set forth in the discussion above.

B. Rejections Based on New Matter

Claims 4 and 16-25 and this reissue application as a whole are rejected under 35 U.S.C. §251 for containing new matter and further for failing the original patent requirement because the invention recited therein is not unequivocally disclosed in the specification of the 105 Patent. The nature of the new matter is discussed above in the rejections under pre-AIA 35 U.S.C. §112 (1st ¶).

CLAIM INTERPRETATION

During examination, claims are given the broadest reasonable interpretation consistent with the specification and limitations in the specification are not read into the claims. See MPEP §2111, MPEP §2111.01 and *In re Yamamoto et al.*, 222 USPQ 934 (Fed. Cir. 1984). Under a broadest reasonable interpretation, words of the claim must

be given their plain meaning, unless such meaning is inconsistent with the specification. See MPEP §2111.01(I). It is further noted it is improper to import claim limitations from the specification, i.e., a particular embodiment appearing in the written description may not be read into a claim when the claim language is broader than the embodiment. See MPEP §2111.01(II). Therefore, unless one of the exceptions applies below, Examiners will interpret the limitations of the pending and examined claims using the broadest reasonable interpretation.

A. Lexicographic Definitions

A first exception to the prohibition of reading limitations from the specification into the claims is when the Applicant for patent has provided a lexicographic definition for the term. See MPEP §2111.01(IV). Following an independent review of the claims in view of the specification herein, Examiners find that Patent Owner has not provided any lexicographic definitions related to claim terms with any reasonable clarity, deliberateness and precision.

B. Claim Interpretation Under 35 U.S.C. §112(6th ¶)

A second exception to the prohibition of reading limitations from the specification into the claims is when the claimed feature is written as a means-plus-function or a step-plus-function. See 35 U.S.C. §112(6th ¶) and MPEP §2181-2183. As noted in MPEP §2181, a three prong test is used to determine the scope of a means-plus-function or step-plus-function limitation in a claim:

(A) the claim limitation uses the term "means" or "step" or a term used as a substitute for "means" that is a generic placeholder (also called a nonce

term or a non-structural term having no specific structural meaning) for performing the claimed function

(B) the term "means" or "step" or the generic placeholder is modified by functional language, typically, but not always linked by the transition word "for" (e.g., "means for") or another linking word or phrase, such as "configured to" or "so that"

(C) the term "means" or "step" or the generic placeholder is not modified by sufficient structure, material, or acts for performing the claimed function.

Examiners find herein that the claims include one or more claim limitations that do not use the word "means," but are nonetheless being interpreted under 35 U.S.C. §112 (6th ¶) because the claim limitations uses a generic placeholder that is coupled with functional language without reciting sufficient structure to perform the recited function and the generic placeholder is not preceded by a structural modifier. Examiners do not find the remaining limitations invoke interpretation under 35 U.S.C. §112 (6th ¶) because they are either not written in a proper means-plus-function format or there is sufficient structures within the limitation for performing the function. Each limitation Examiners submit invokes interpretation under 35 U.S.C. §112 (6th ¶) will be discussed in turn as follows:

B1. FL #1: "control device..." (Claims 1-4, 6, 7 and 11-15)

A first means-plus-function phrase is recited in claim 1 (and included in each of dependent claims 2-4, 6, 7 and 11-15), which recites "a control device..." or hereinafter FL #1. Examiners determine herein that FL #1 meets the three prong test and thus will be interpreted as a means-plus-function limitation under 35 U.S.C. §112(6th ¶).

The Examiners find that FL #1 in claim 3 recites:

a control device comprising a master-control board mounted;

> at least a first and second electrode connectors being electrically connected to the master-control board, which are connected to a power supply for receiving power, and
>
> at least one communication connector connected to the power supply for receiving status information of the power supply, and sending the status information to the master-control board;
>
> wherein the control device is configured to control power supply from the external power supply to the external device based on the status information....

(B1)(a) 3-Prong Analysis: Prong (A)

FL #1 meets invocation prong (A) because "means ... for" type language is recited. Examiners first find that "device" is a generic placeholder or nonce term equivalent to "means" because the term "device" does not convey any particular structure. Examiners further note that the specification of the 105 Patent does not lexicographically define "device" and thus the specification of the 105 Patent does not impart or require any structure for the phrase. Furthermore, the addition phrase "control" merely recites further functionality of the device, but does not impart or imply any specific structure.

Furthermore, there is no disclosure or suggestion from the prior art or the 105 Patent that a "device" is a sufficient structure to perform the functions recited in FL #1. Specifically, there is no suggestion that any known device or control device of a prior art device can control a power supply based on status information as recited in claim 3. Finally, Examiners find that the Federal Circuit has held "device" to be a nonce term. See MPEP §2181(I)(A).

Accordingly, Examiners find nothing in the specification, prosecution history or the prior art to construe "control device..." in FL #1 as the name of a sufficiently definite structure for performing the functions recited in FL #1 so as to take the overall claim

limitation out of the ambit of §112(6th ¶). *See Williamson v. Citrix Online, L.L.C.,* 115 USPQ2d 1105, 1112 (Fed. Cir. 2015).

In light of the above, the Examiners conclude that the term "control device..." is a generic placeholder having no specific structure associated therewith. Because "control device..." is merely a generic placeholder having no specific structure associated therewith to perform the recited function, the Examiners conclude that FL #1 meets invocation Prong (A).

(B1)(b) 3-Prong Analysis: Prong (B)

FL #1 meets invocation prong (B) because it recites the function to "to control power supply from the external power supply to the external device based on the status information."

(B1)(c) 3-Prong Analysis: Prong (C)

FL #1 meets invocation prong (C) because FL #1 does *not* recite sufficient structure for performing the claimed function. Based upon a review of claims 1-4, 6, 7, and 11-15, particularly claim 1 itself, the Examiners find that FL #1 recites very little structure, if any, for performing the functions as set forth of FL #1. While Examiners recognize the recited structures of a master-control board, the first and second electrode connectors and the communication connector, Examiners do not find these recited structures are sufficient to perform the function of controlling the power supply as recited in FL #1. Rather other un-recited structures would be required to perform this function.

In view of the Examiners findings above that FL #1 meets invocation prongs (A)-(C), the Examiners conclude FL #1 invokes interpretation under 35 U.S.C. §112 (6th ¶).

(B1)(d) Corresponding Structure

After a claimed phrase has been shown to invoke 35 U.S.C. §112 (6th ¶), as found above, the next step is to determine the corresponding structure or material as described in the specification for performing the recited function. See MPEP §2181(II).

Based upon a review of the specification of the 105 Patent, the Examiners find that the closest corresponding hardware structure for performing the functions of FL #1 is a combination of the switch K1 and the master-control circuit unit 1281 shown in FIGS. 4-6 and 8. The switch is turned on and off to control the power line and is controlled via an on/off control signal from the master-control circuit unit 1281, which is a controller or microcontroller, with some sort of memory (See 105 Patent at col. 9, line 61 to col. 10, line 9).

Regarding the software or programming of the master-control circuit unit, Examiners find the appropriate algorithm stored or programmed into the controller or microcontroller would be that disclosed at col. 9, line 61 to col. 10, line 9 of the 105 Patent wherein the master control circuit unit compares the status information, i.e., temperature of the battery, to predefined ranges and outputs a signal to maintain or turn off the switch control unit.

In view of these findings, pursuant to 35 U.S.C. §112 (6th ¶), FL #1 in claims 1-4, 6, 7 and 11-15 will be limited to the corresponding structures discussed above, specifically the hardware and software structures as discussed above and equivalents thereof.

Regarding claim 3, Examiners note this claim recites a switch control unit for controlling the connection between the first and second voltage input ports. Following a

review of the specification, Examiners find this switch control unit corresponds to switch K1 as shown in FIGS. 4-6 and 8. However, as found above for FL #1, this switch is already part of the corresponding structures for the control device. Accordingly, for claims 3, 4 and 12-14, the switch control unit will correspond to the switch as part of the corresponding structures of FL #1.

Further regarding claim 3, Examiners note this claim recites a master-control circuit unit for obtaining the status information and controlling the switch control unit based on the status information. Following a review of the specification, Examiners find this master-control circuit unit corresponds to an appropriate programmed master-control circuit unit 1281 as shown in FIGS. 4-6 and 8. However, as found above for FL #1, the corresponding structures for this master-control circuit unit is already part of the corresponding structures for the control device. Accordingly, for claims 3, 4 and 12-14, the master-control circuit unit will correspond to the programmed master-control circuit unit as part of the corresponding structures of FL #1.

Regarding claims 4 and 12-14, Examiners find these claims recite additional functionality of the master-control circuit unit, as part of the control device to further control the switch control unit based on the detected electric current value, the detected first voltage value and the detected second voltage value. Examiners thus find the appropriate algorithm stored or programmed into the controller or microcontroller would be that disclosed at col. 7, line 62 to col. 8, line 12 and col. 9, lines 14-29 of the 105 Patent wherein the master control circuit unit compares detected electric current value, the detected first voltage value and or the detected second voltage value with stored predefined ranges and outputs a signal to maintain or turn off the switch control unit.

Regarding the functions recited in claims 4 and 12-14 related to the "combined set of any of the three detected values," Examiners do not find any corresponding discussion or algorithm of such functionality and thus do not find this function as limiting of the master-control circuit unit or the control device.

If applicant does not intend to have this limitation interpreted under 35 U.S.C. §112 (6th ¶) applicant may: (1) amend the claim limitation(s) to avoid it/them being interpreted under 35 U.S.C. §112 (6th ¶) (e.g., by reciting sufficient structure to perform the claimed function); or (2) present a sufficient showing that the claim limitation recites sufficient structure to perform the claimed function so as to avoid it/them being interpreted under 35 U.S.C. §112 (6th ¶).

B2. FL #2: "switch control unit…" (Claims 16-25)

A further means-plus-function phrase is recited in claim 16 (and included in each of dependent claims 17-25), which recites "a switch control unit…" or hereinafter FL #2. Examiners determine herein that FL #2 meets the three prong test and thus will be interpreted as a means-plus-function limitation under 35 U.S.C. §112(6th ¶).

The Examiners find that FL #2 in claim 16 recites:

> a switch control unit for controlling the output port; …
> wherein the switch control unit outputs on/off control signal based on the voltage of the external device, thereby controlling the output port….

(B2)(a) 3-Prong Analysis: Prong (A)

FL #2 meets invocation prong (A) because "means ... for" type language is recited. Examiners first find that "unit" is a generic placeholder or nonce term equivalent to "means" because the term "unit" does not convey any particular structure. Examiners

further note that the specification of the 105 Patent does not lexicographically define "unit" and thus the specification of the 105 Patent does not impart or disclose any structure for the phrase. Furthermore, the additional phrase "switch control" merely recites further functionality of the unit, but does not impart or imply any specific structure.

Furthermore, there is no disclosure or suggestion from the prior art or the 105 Patent that a "unit" is a sufficient structure to perform the functions recited in FL #2. Specifically, there is no suggestion that any known unit or circuit unit of a prior art device can control a switch control unit based on status information as recited in claim 16. Furthermore, the Federal Circuit has held that unit is a generic placeholder equivalent to means. See MPEP §2181(I)(A).

Accordingly, Examiners find nothing in the specification, prosecution history or the prior art to construe "unit…" in FL #2 as the name of a sufficiently definite structure for performing the functions recited in FL #2 so as to take the overall claim limitation out of the ambit of §112(6th ¶). *See Williamson v. Citrix Online, L.L.C.,* 115 USPQ2d 1105, 1112 (Fed. Cir. 2015).

In light of the above, the Examiners conclude that the term "unit…" is a generic placeholder having no specific structure associated therewith. Because "unit …" is merely a generic placeholder having no specific structure associated therewith to perform the recited function, the Examiners conclude that FL #2 meets invocation Prong (A).

(B2)(b) 3-Prong Analysis: Prong (B)

FL #2 meets invocation prong (B) because it recites the function to "control[ling] the output port" and to "output[s] on/off control signal based on the voltage of the external device, thereby controlling the output port."

(B2)(c) 3-Prong Analysis: Prong (C)

FL #2 meets invocation prong (C) because FL #2 does *not* recite sufficient structure for performing the claimed function. Based upon a review of claims 16-25, particularly claim 16 itself, the Examiners find that FL #2 recites very little structure, if any, for performing the functions as set forth of FL #2.

In view of the Examiners findings above that FL #2 meets invocation prongs (A)-(C), the Examiners conclude FL #3 invokes interpretation under 35 U.S.C. §112 (6th ¶).

(B2)(d) Corresponding Structure

After a claimed phrase has been shown to invoke 35 U.S.C. §112 (6th ¶), as found above, the next step is to determine the corresponding structure or material as described in the specification for performing the recited function. See MPEP §2181(II).

Based upon a review of the specification of the 105 Patent, the Examiners find that the closest corresponding hardware structure for the FL #2 is a combination of the switch K1 and the master-control circuit unit 1281 shown in FIGS. 4-6 and 8. The switch is turned on and off to control the power line and is controlled via an on/off control signal from the master-control circuit unit 1281, which is a controller or microcontroller, with some sort of memory (See 105 Patent at col. 9, line 61 to col. 10, line 9), which receives status information regarding the voltage of the external device taken oat the output of the switch K1.

Regarding the software or programming of the master-control circuit unit, Examiners find the appropriate algorithm stored or programmed into the controller or microcontroller would be that disclosed at col. 9, lines 14-29 of the 105 Patent wherein the master control circuit unit compares the voltage of detected at the output the switch K1 to predefined ranges and outputs a signal to maintain or turn off the switch control unit.

In view of these findings, pursuant to 35 U.S.C. §112 (6th ¶), FL #2 in claims 16-25 will be limited to the corresponding structures discussed above, specifically the hardware and software structures as discussed above and equivalents thereof.

Regarding claims 20-23, Examiners find these claims recite additional functionality of the switch control unit via an included master-control circuit unit to further control the switch control unit based on the detected electric current value, the detected first voltage value and the detected second voltage value. Examiners thus find the appropriate algorithm stored or programmed into the controller or microcontroller would be that disclosed at col. 7, line 62 to col. 8, line 12 and col. 9, lines 14-29 of the 105 Patent wherein the master control circuit unit compares detected electric current value, the detected first voltage value and or the detected second voltage value with stored predefined ranges and outputs a signal to maintain or turn off the switch control unit.

Regarding the functions recited in claims 20-23 related to the "combined set of any of the three detected values," Examiners do not find any corresponding discussion or algorithm of such functionality and thus do not find this function as limiting of the master-control circuit unit.

If applicant does not intend to have this limitation interpreted under 35 U.S.C. §112 (6th ¶) applicant may: (1) amend the claim limitation(s) to avoid it/them being interpreted under 35 U.S.C. §112 (6th ¶) (e.g., by reciting sufficient structure to perform the claimed function); or (2) present a sufficient showing that the claim limitation recites sufficient structure to perform the claimed function so as to avoid it/them being interpreted under 35 U.S.C. §112 (6th ¶).

CLAIM REJECTIONS – 35 U.S.C. §102

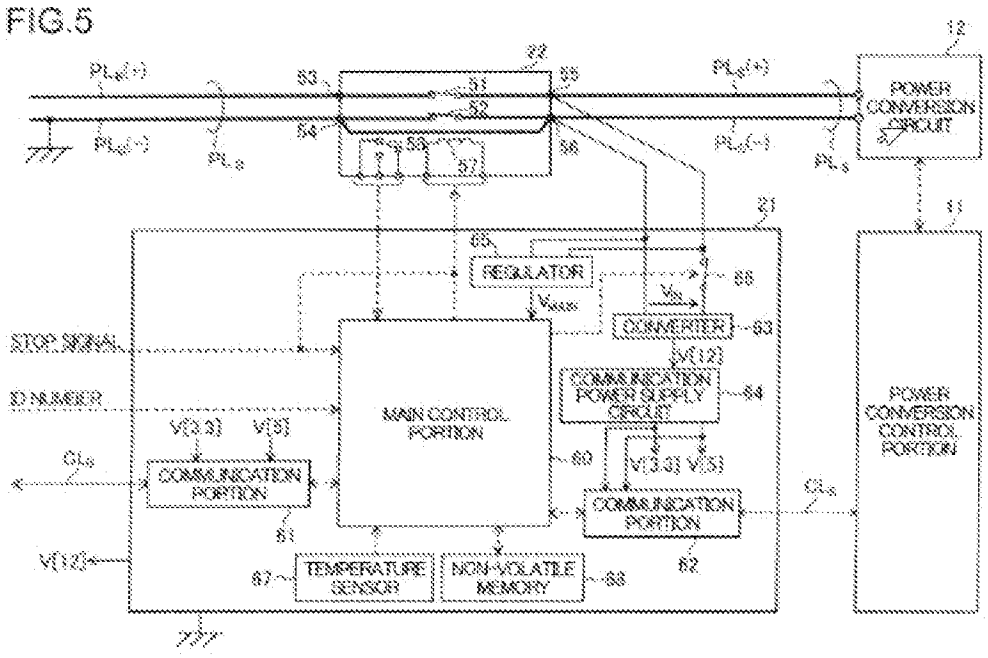
The following is a quotation of the appropriate paragraphs of 35 U.S.C. §102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a)(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.
>
> (a)(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.

Anticipation Rejections Applying Muto

Claim 1 and 2 are rejected under 35 U.S.C. 102(a) as being anticipated by U.S. Patent Application Publication No. 2015/0054467 to Takano et al. (hereinafter "**Takano**").

Regarding claim 1, Takano discloses a battery clamp for delivering an instantaneous starting current to an external device, the battery clamp (**See Takano FIG. 5, reprinted below, clamp shown**) comprising:



Takano FIG. 5

a control device comprising a master-control board mounted (**See Claim Interpretation section regarding interpretation of FL #1. Thus, see FIG. 5 above and ¶0043, master-control circuit board 21 on which main control portion is mounted**);

at least a first and second electrode connectors being electrically connected to the master-control board, which are connected to a power supply for receiving power (**See FIG. 5 above, connectors 55 and 56 electrically connected to board 21**), and

at least one communication connector connected to the power supply for receiving status information of the power supply, and sending the status information to the master-control board (**See FIG. 5 above, communication portion 61**);

wherein the control device is configured to control power supply from the external power supply to the external device based on the status information (**See ¶¶0040-0058 wherein the control device monitors the status information, i.e., temperature of**

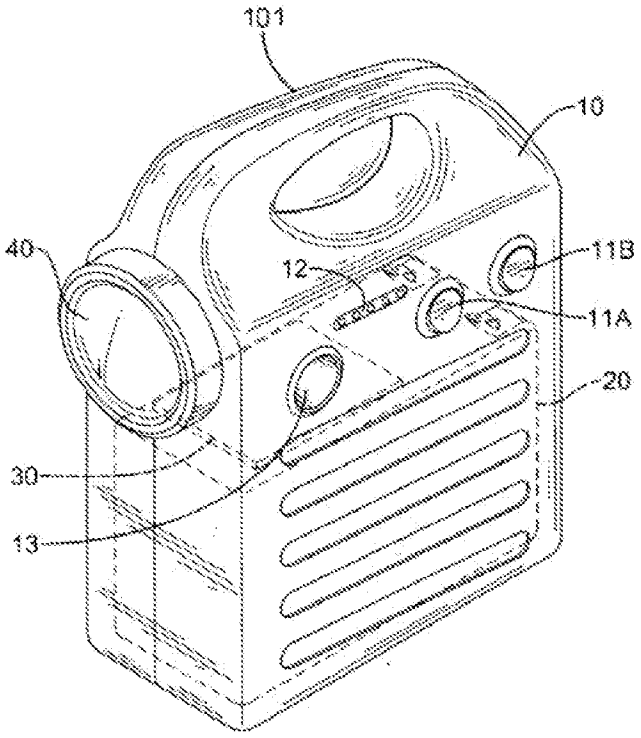
the battery and controls the switch 22 based on the measured temperature as protection operations).

Regarding claim 2, Takano discloses the clamp of claim 1 and further wherein the control device is configured to allow the power supply from the power supply to the external device when the status information is normal, wherein the status information comprises at least one of the following: temperature, voltage of a battery unit of the power supply (**See ¶¶0040-0058 wherein the control device monitors the status information, i.e., temperature of the battery and controls the switch 22 based on the measured temperature as protection operations**).

Anticipation Rejections Applying Hung

Claim 16, 18-20 and 22-24 are rejected under 35 U.S.C. 102(a) as being anticipated by U.S. Patent Application Publication No. 2005/0258797 to Hung (hereinafter "**Hung**").

Regarding claim 16, Hung discloses a master-control board for delivering an instantaneous startup voltage to an external device (**See Hung FIGS. 1 and 4B, reprinted below and ¶¶0013-0015**), comprising:



Hung FIG. 1

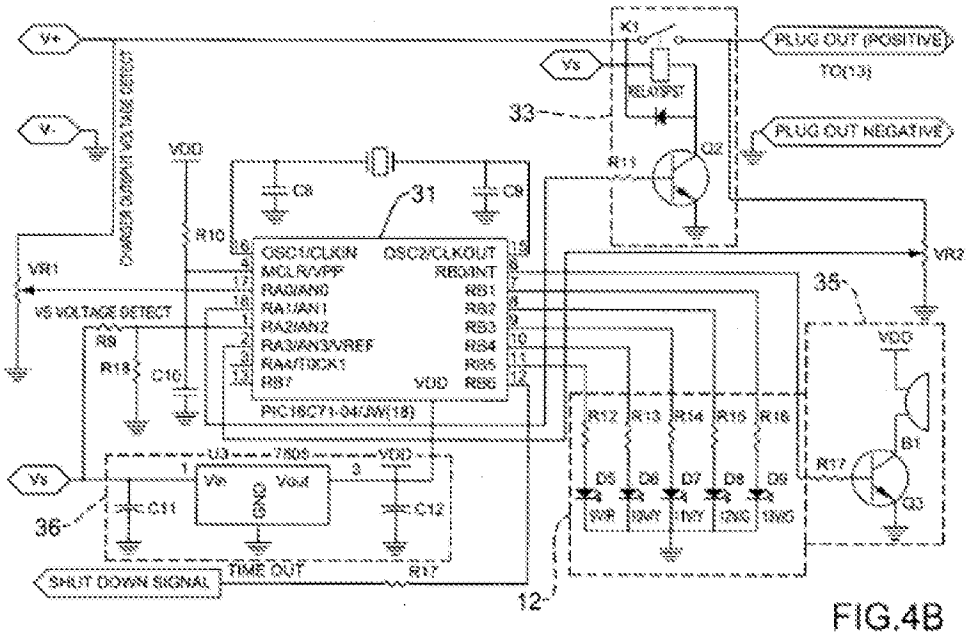


FIG.4B

Hung FIG. 4B

an output port (**See FIG. 4B above, output port plug out to jack 13**):

a switch control unit for controlling the output port (**See Claim Interpretation section above wherein this limitation FL #2 invokes interpretation under 35 U.S.C. §112, 6th ¶. Thus see FIGS. 1 and 4B above, switch K1 and microcontroller 31 which controls the switch based on various inputs, including a voltage of the external device from sensor 30 from sensor VR2**); and

a voltage detection unit for detecting voltage of the external device (**See FIG. 1 above, sensor VR2**);

wherein the switch control unit outputs on/off control signal based on the voltage of the external device, thereby controlling the output port (**See Claim Interpretation section above wherein this limitation FL #2 invokes interpretation under 35 U.S.C. §112, 6th ¶. Thus see FIGS. 1 and 4B above, switch K1 and microcontroller 31 which controls the switch based on various inputs, including a voltage of the external device from sensor 30 from sensor VR2**).

Regarding claim 18, Hung discloses the board of claim 16 and further comprising an input port and further wherein the switch control unit controls the connection between the input port and the output port (**See Hung FIGS. 1 and 4A above, note ports would be present on the master-control circuit board 30 between battery pack 20 and the circuit board 30 and further and further the switch K1 controls connection between the input and output ports**).

Regarding claim 19, Hung discloses the board of claim 16 and further comprising a master-control circuit unit, which obtains a status information of a power supply (**See Hung FIGS. 1 and 4B above, master-control circuit unit comprising microcontroller 31**).

Regarding claim 20, Hung discloses the board of claim 19 and further wherein the master-control circuit unit further comprises at least one of the following: an electric current detection unit for detecting electric current from the power supply to the external device: a first voltage detection unit for detecting a first voltage of the power supply; or a second voltage detection unit for detecting a second voltage of the external device, wherein the master-control circuit unit is configured to control the switch control unit based on the detected electric current value, the detected first voltage value, the detected second voltage value, or a combined set of any of the three detected values (**See Claim Construction above for this feature FL #2. Further see Hung FIGS. 1 and 4B above, battery voltage sensor VR1 and VR2 and see ¶¶0028-0046**).

Regarding claim 22, Hung discloses the board of claim 20 and further wherein the master-control circuit unit is configured to control the switch control unit based on a comparison result between the detected first voltage value and a first predefined voltage range (**See Hung FIGS. 1 and 4B above, battery voltage sensors VR1 and VR2 and see ¶¶0041-0042**).

Regarding claim 23, Hung discloses the board of claim 20 further wherein the master-control circuit unit is configured to control the switch control unit based on both a comparison result between the second detected voltage value and a second predefined voltage range (**See Hung FIGS. 1 and 4B above, battery voltage sensors VR1 and VR2 and see ¶¶0041-0042**).

Regarding claim 24, Hung discloses the board of claim 19 and further the master-control circuit unit further comprises an indicator light circuit unit connected to

the master-control chip unit for indicating operating status of the control device (**See Hung FIG. 1 above, LEDs 12**).

CLAIM REJECTIONS – 35 U.S.C. §103

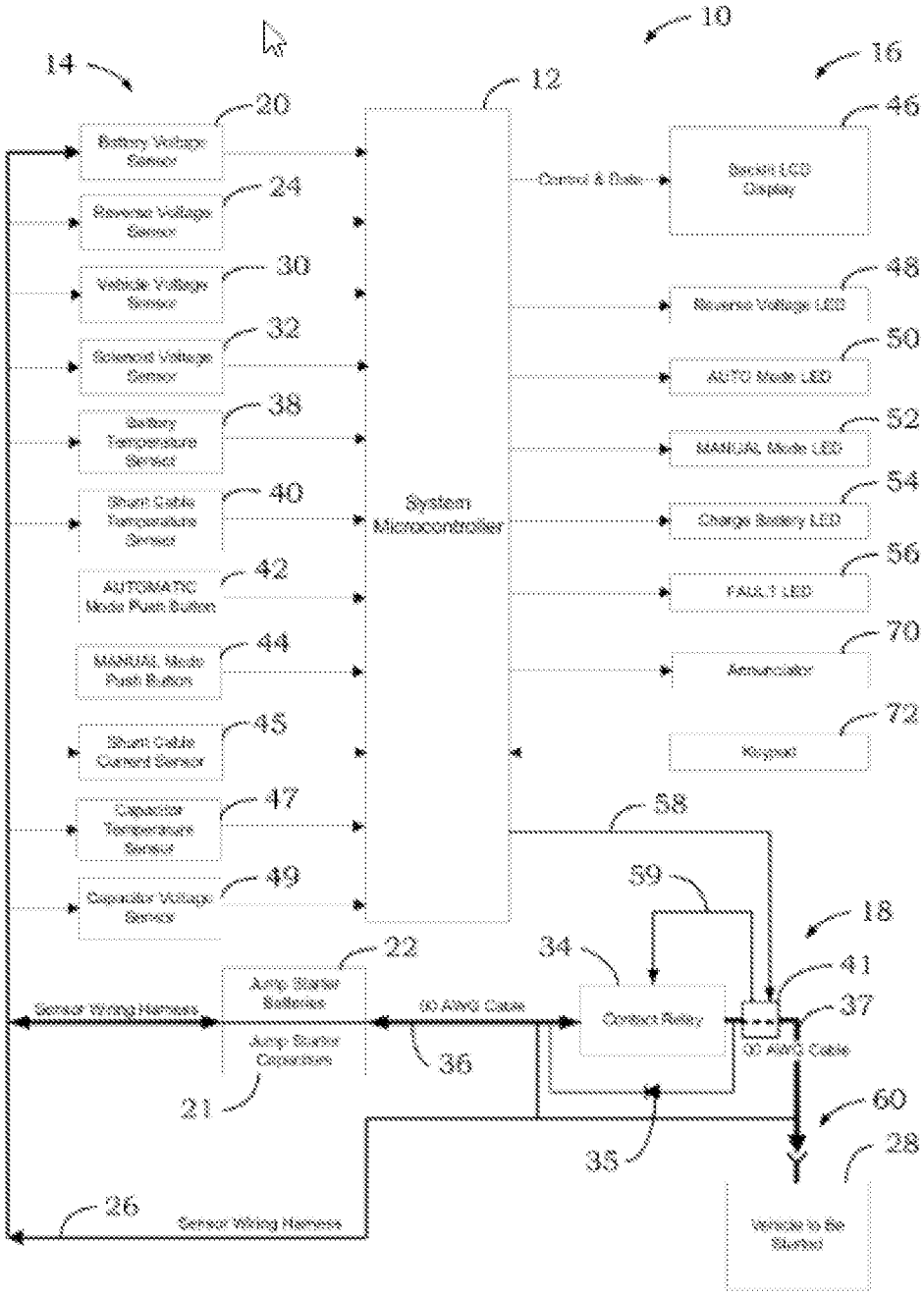
The following is a quotation of 35 U.S.C. §103 which forms the basis for all obviousness rejections set forth in this Office action:

> 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 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.

Obviousness Rejections Applying Richardson and Hung

Claim 16 and 18-25 are rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent Application Publication No. 2013/0154543 to Richardson et al. (hereinafter "**Richardson**") in view of Hung.

Regarding claim 16, Richardson teaches an apparatus for delivering an instantaneous starting current to an external device, comprising:



Richardson FIG. 1

an output port (**See FIG. 1 above, output port to jumper cables 60**):

a switch control unit for controlling the output port (**See Claim Interpretation section above wherein this limitation FL #2 invokes interpretation under 35 U.S.C. §112, 6th ¶. Thus see FIG. 1 above, switch 34 and microcontroller 12 which**

controls the switch based on various inputs, including a voltage of the external device from sensor 30); and

a voltage detection unit for detecting voltage of the external device (**See FIG. 1 above, sensor 30**);

wherein the switch control unit outputs on/off control signal based on the voltage of the external device, thereby controlling the output port (**See Claim Interpretation section above wherein this limitation FL #2 invokes interpretation under 35 U.S.C. §112, 6th ¶. Thus see FIG. 1 above, switch 34 and microcontroller 12 which controls the switch based on various inputs, including a voltage of the external device from sensor 30**).

However, while Examiners find that Richardson discloses the components and operations of claim 16, Examiners do not find that Richardson explicitly discloses a board for the recited components or the manner of assembling its apparatus. Nevertheless, Hung teaches portable battery charger using a battery power supply for proving start-up current to a vehicle using jumper cables (**See Hung FIGS. 1 and 4B above**) comprising a housing for the general components thereof (**See Hung FIG. 1, housing 10**), a battery pack within the housing (**See Hung FIGS 1 and 4B above, battery pack 20**) and a master-control circuit board with the control components thereon (**See FIG. 1, control circuit board 30 which contains the circuit shown in FIGS. 3 and 4B**) and an output socket for receiving jumper cables (**See FIG. 1 above, output jack 13 and FIG. 4B, plug out connectors to jack 13**).

It would have been obvious at the time the invention was made to incorporate the control circuit of Richardson into the housing arrangement as taught by Hung. One

having ordinary skill in the art would do so because Richardson does not explicitly disclose or teach the manner of assembling its battery clamp for its jump start apparatus and thus one having ordinary skill in the art would look to other prior art for guidance to such a manner of assembly, like Hung, which teaches a jump start system which houses the battery pack and the master-control circuit board with a jack assembly for connecting jumper cables.

Furthermore, Examiners find such a combination is merely applying a known technique to a known device, ready for improvement to yield predictable results. See MPEP §2143(I)(D). First, as discussed above, Examiners find Richardson teaches a base device, i.e., a jump starting apparatus, having the recited componentry and operations as recited in the claim. Second, Examiners find Hung teaches a technique as to the manner to incorporate the known components of a jump start apparatus into a housing. Furthermore, Examiners find one having ordinary skill in the art would have recognized the application of the system as taught by Hung with the known system taught by Richardson. Specifically, Examiners find that the jump starting apparatus of Richardson would necessarily be incorporated into some housing system such that the general control components are provided on circuit board. Finally, Examiners find the combination would be predictable because such a combination would not affect the operation or components of Richardson, but merely provides a technique for housing its components, which is not the subject the teachings of Richardson. Accordingly, based on the above findings, Examines conclude such a combination would be obvious.

In view of the combination, the combination is the switch control unit and the voltage detection unit and the other control components of Richardson would be

provided on the master-control circuit board of Hung in the manner as recited in claim 16.

Regarding claim 18, Richardson and Hung teach the board of claim 16 and further comprising an input port and further wherein the switch control unit controls the connection between the input port and the output port (**See Richardson FIG. 1 above, note contact relay 34 which controls the connection between the power supply 22 and the vehicle to be started 28. Further see Hung FIGS. 1 and 4B above, note ports would be present on the master-control circuit board 30 between battery pack 20 and the circuit board 30 and further and further the switch K1 controls connection between the input and output ports**).

Regarding claim 19, Richardson and Hung teaches the board of claim 16 and further comprising a master-control circuit unit, which obtains a status information of a power supply (**See Richardson FIG. 1 above, note system microcontroller 12 which monitors the temperature of the battery via sensor 38 on the battery**).

Regarding claim 20, Richardson and Hung teaches the board of claim 19 and further wherein the master-control circuit unit further comprises at least one of the following: an electric current detection unit for detecting electric current from the power supply to the external device: a first voltage detection unit for detecting a first voltage of the power supply; or a second voltage detection unit for detecting a second voltage of the external device, wherein the master-control circuit unit is configured to control the switch control unit based on the detected electric current value, the detected first voltage value, the detected second voltage value, or a combined set of any of the three detected values (**See Claim Construction above for this feature FL #2. Further see**

Richardson FIG. 1 above, battery voltage sensors 20/49, vehicle voltage sensor 30, shunt cable current sensor 47 and see ¶¶0028-0046).

Regarding claim 21, Richardson and Hung teach the board of claim 20 and further wherein the master-control circuit unit is configured to control the switch control unit based on a comparison result between the detected electric current value and a predefined electric current range (**See Richardson FIG. 1 above, shunt current sensor 45 and see ¶¶0036-0046**).

Regarding claim 22, Richardson and Hung teach the board of claim 20 and further wherein the master-control circuit unit is configured to control the switch control unit based on a comparison result between the detected first voltage value and a first predefined voltage range (**See Richardson FIG. 1 above, battery voltage sensors 20/49 and see ¶¶0028-0046**).

Regarding claim 23, Richardson and Hung teach the board of claim 20 further wherein the master-control circuit unit is configured to control the switch control unit based on both a comparison result between the second detected voltage value and a second predefined voltage range (**See Richardson FIG. 1 above, vehicle voltage sensors 20/49 and see ¶¶0028-0046**).

Regarding claim 24, Richardson and Hung teach the board of claim 19 and further the master-control circuit unit further comprises an indicator light circuit unit connected to the master-control chip unit for indicating operating status of the control device (**See Richardson FIG. 1 above, LEDs 48-56**).

Regarding claim 25, Richardson and Hung teach the board of claim 19 and further wherein the master-control circuit unit further comprises a buzzing circuit unit

connected to the master-control chip unit for alerting users about abnormal condition (**See Richardson FIG. 1 above, annunciator 70**).

Obviousness Rejections Applying Richardson, Hung and Takano

Claim 1-4, 6, 7 and 11-15 are rejected under 35 U.S.C. §103 as being unpatentable over Richardson and Hung, as applied to claim 16 above, and further in view of Takano.

Regarding these claims, the proposed combination above teaches the features of claim 16, particularly the circuitry and operation of Richardson in the housing arrangement as taught by Hung. Thus regarding claim 1, the combination of Richardson and Hung teaches a batter clamp for delivering an instantaneous starting current to an external device (**See combination proposed above**), the clamp comprising a control device (**See Claim Interpretation section above for interpretation of FL #1**) comprising:

a master-control board (**See Richardson FIG. 1 above, note control circuitry shown in general, particularly the system controller 12 and various sensors, which as discussed above, would be provided on the control circuit board 30 as shown in FIGS. 1 and 4B of Hung**);

at least first and second electrode connectors being electrically connected to the master-control board, which are connected to a power supply for receiving power (**See Richardson FIG. 1 above, connections for 00 AWG cable between relay and battery pack 21/22. See also Hung FIGS. 1, 4A and 4B wherein there would be**

connections between the battery pack 20 and the master-control circuit board 30 via some electrode connections);

wherein the control device is configured to control power supply from the power supply to the external device based on the status information (**See Claim Interpretation section above wherein this limitation FL #1 invokes interpretation under 35 U.S.C. §112, 6th ¶. Thus see Richardson FIG. 1 above, switch 34 and microcontroller 12 which controls the switch based on various inputs, including a temperature of the battery from sensors 38/47**).

However, while Examiners submit that there would be some connector structure at some location between the battery power supply and the microcontroller of the proposed combination, neither Richardson nor Hung explicitly discuss such connector. Nevertheless, Takano teaches a communication connector assembly located between a battery pack and a control portion for allowing communication of status information of the battery (**See Takano FIG. 5, note communication portion 61 for transfer of battery status information CL_B to control portion 60**). It would have been obvious at the time the invention was made to incorporate a communication connector assembly between the battery power supply and the microcontroller of the proposed combination of Richardson and Hung in the manner as explicitly shown in Takano. One having ordinary skill in the art would do so to facilitate communication of battery status information (**See Takano ¶0042**).

Regarding claim 2, Richardson, Hung and Takano teach the clamp of claim 1 and further wherein the control device is configured to allow the power supply from the power supply to the external device when the status information is normal, wherein the

status information comprises at least one of the following: temperature, voltage of a battery unit of the power supply (**See Claim Interpretation section above wherein this limitation FL #1 invokes interpretation under 35 U.S.C. §112, 6th ¶. Thus see Richardson FIG. 1 above, switch 34 and microcontroller 12 which controls the switch based on various inputs, including a temperature of the battery from sensors 38/47**).

Regarding claim 11, Richardson, Hung and Takano teach the clamp of claim 1 and further comprising first and second wire clamps configured to receive power from the power supply via the control device and supply power to the external device (**See Richardson FIG. 1 above and ¶¶0004-0005, 0027-0028, jumper cables 60 connected to terminals of battery. See also Hung FIGS. 1 and 4B above wherein jumper cables are connect to port terminals at 13**).

Regarding claim 3, Richardson, Hung and Takano teach the clamp of claim 11 and further wherein the master-control board comprises:

a first and second voltage input ports electrically connected to the first and second electrode connectors respectively; (**See Richardson FIG. 1 above, connections for 00 AWG cable between relay and battery pack 21/22. See also Hung FIGS. 1 and 4B above wherein the battery 30 is connected to the input ports of the master-control circuit board 30**);

a communication port electrically connected to the communication connector (**See Richardson FIG. 1 above, note connection between temperature sensor 38 and microcontroller 12 which would be connected the communication port/connector in the manner as taught by Takano**);

a first and second voltage output ports electrically connected to the first and second wire clamps for supplying power to the external device via the first and second wire clamps (**See Richardson FIG. 1 above, connections for 00 AWG cable between relay and vehicle to be started 28. See also Hung FIGS. 3 and 1 wherein jumper cables are connectable to the master-control circuit board via the jack 13**);

a switch control unit for controlling connection between the first voltage input port and the first voltage output port (**See Richardson FIG. 1 above, switch relay 34. See also Hung FIGS. 1 and 4B, switch K1**); and

a master-control circuit unit connected to the communication port for obtaining the status information of the external power supply; wherein the master-control circuit unit is configured to control the switch control unit based on the status information of the external power supply, thereby controlling connection on/off between the first voltage input port and the first voltage output port (**See Claim Interpretation section above wherein this limitation FL #1 as part of the control device invokes interpretation under 35 U.S.C. §112, 6th ¶. Thus see FIG. Richardson 1 above, switch 34 and microcontroller 12 which controls the switch based on various inputs, including a temperature of the battery from sensors 38/47**).

Regarding claim 4, Richardson, Hung and Takano teach the clamp of claim 3 and further wherein the master-control circuit unit further comprises: an electric current detection unit for detecting electric current from the external power supply to the external device; a voltage detection unit for detecting voltage of the external power supply and the external device; and wherein the master-control circuit unit is configured to compare the electric current value and the voltage value with a predefined electric

current range and a predefined voltage range respectively, thereby controlling the switch control unit (**See Claim Construction above for this feature FL #1. Further see Richardson FIG. 1 above, battery voltage sensors 20/49, vehicle voltage sensor 30, shunt cable current sensor 47 and see ¶¶0028-0046**).

Regarding claim 6, Richardson, Hung and Takano teach the clamp of claim 1 and further wherein the master-control circuit unit further comprises an indicator light circuit unit connected to the master-control chip unit for indicating operating status of the control device (**See Richardson FIG. 1 above, LEDs 48-56**).

Regarding claim 7, Richardson, Hung and Takano teach the clamp of claim 1 and further wherein the master-control circuit unit further comprises a buzzing circuit unit connected to the master-control chip unit for alerting users about abnormal condition (**See Richardson FIG. 1 above, annunciator 70**).

Regarding claim 12, Richardson, Hung and Takano teach the clamp of claim 4 and further wherein the master-control circuit unit is configured to control the switch control unit based on a comparison result between the detected electric current value and a predefined electric current range (**See Richardson FIG. 1 above, shunt current sensor 45 and see ¶¶0036-0046**).

Regarding claim 13, Richardson, Hung and Takano teach the clamp of claim 4 and further wherein the master-control circuit unit is configured to control the switch control unit based on a comparison result between the detected first voltage value and a first predefined voltage range (**See Richardson FIG. 1 above, battery voltage sensors 20/49 and see ¶¶0028-0046**).

Regarding claim 14, Richardson, Hung and Takano teach the clamp of claim 4 further wherein the master-control circuit unit is configured to control the switch control unit based on both a comparison result between the second detected voltage value and a second predefined voltage range (**See Richardson FIG. 1 above, vehicle voltage sensors 20/49 and see ¶¶0028-0046**).

Regarding claim 15, Richardson, Hung and Takano teach the clamp of claim 4 further comprising an indicator light for indicating the operating status of the control device (**See Richardson FIG. 1 above, LEDs 48, 50, 52, 54 and 56**).

PRIOR OR CONCURRENT PROCEEDINGS

Applicant is reminded of the obligation apprise the Office of any prior or concurrent proceedings in which the 105 Patent is or was involved, such as interferences or trials before the Patent Trial and Appeal Board, reissues, reexaminations, or litigations and the results of such proceedings.

INFORMATION MATERIAL TO PATENTABILITY

Applicant is further reminded of the continuing obligation under 37 C.F.R. §1.56 to timely apprise the Office of any information which is material to patentability of the claims under consideration in this reissue application.

CONCLUSION

Claims 1-4, 6, 7 and 11-25 are pending and examined.

Claims 1-4, 6, 7 and 11-25 are rejected.

The prior art made of record which is considered pertinent to Applicant's disclosure is listed on the document titled 'Notice of Reference Cited' ("PTO-892"). Unless expressly noted otherwise by the Examiners, all documents listed on the PTO-892 are cited in their entirety.

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to KENNETH WHITTINGTON whose telephone number is (571)272-2264. The Examiner can normally be reached on 8:30am - 5:00pm, Monday - Friday.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Andrew J. Fischer, SPE Art Unit 3992, can be reached at (571) 272-6779. The fax phone number for the organization where this application or proceeding is assigned is 571-273-9900.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KENNETH WHITTINGTON/
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Conferees:

/MY TRANG TON/
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/ANDREW J. FISCHER/
Supervisory Patent Examiner, Art Unit 3992

Notice of References Cited	Application/Control No. 17/112,920	Applicant(s)/Patent Under Reexamination LEI, Yun	
	Examiner KENNETH WHITTINGTON	Art Unit 3992	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20150054467-A1	02-2015	Takano; Kyoichi	H02J7/0068	320/136
*	B	US-20050258797-A1	11-2005	Hung, Chien-Ming	H02J7/342	320/105
*	C	US-20130154543-A1	06-2013	Richardson; Francis D.	B60L53/62	320/104
*	D	US-20170334299-A1	11-2017	CHANG; Yi-Fan	H02J1/06	1/1
*	E	US-20160240834-A1	08-2016	Manka; David	H01M50/543	1/1
*	F	US-20160049819-A1	02-2016	Butler; Brian F.	H02J7/0045	320/105
*	G	US-20160036096-A1	02-2016	YOSHIDA; Tadahiro	H02J7/0063	429/50
*	H	US-20150153416-A1	06-2015	UMEMURA; Takuya	H01M10/443	320/107
*	I	US-20160001666-A1	01-2016	Nook; Jonathan Lewis	H02J7/0029	320/105
*	J	US-20140159509-A1	06-2014	Inskeep; Mathew	H02J7/342	307/150
*	K	US-20130099736-A1	04-2013	Roberts; Julie Christine	H02J7/0042	320/109
*	L	US-20100283623-A1	11-2010	Baxter; Jeffrey	H02J7/00308	340/687
*	M	US-5796255-A	08-1998	McGowan; Ricky Dean	H02J7/0034	324/429

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/112,920	LEI, Yun
	Examiner	Art Unit
	KENNETH WHITTINGTON	3992

CPC - Searched*		
Symbol	Date	Examiner
H02J7/0045 OR F02N11/10 OR F02N11/12 OR H01R11/24 OR H01R13/6666 OR H02J7/0029 OR H02J7/0047 OR H02J7/0063 OR H02J7/342 OR F02N11/14 OR F02N2200/063 OR H01M10/4257 OR H02J7/00034 OR H02J2007/0067 OR Y02E60/10	10/28/2021	KJW

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
320	105	10/29/2021	KJW

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
PLUS searches, regular and claims.	10/20/2021	KJW
Prosecution history of US10148105 reviewed.	10/29/2021	KJW
PE2E searched, see attached search history.	10/29/2021	KJW

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/KENNETH WHITTINGTON/ Primary Examiner, Art Unit 3992	

WINPLUS Ex. 1003, p. 102

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/112,920	LEI, Yun
	Examiner	Art Unit
	KENNETH WHITTINGTON	3992

✓	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	10/29/2021								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	-								
	6	✓								
	7	✓								
	8	-								
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	23	✓								
	24	✓								
	25	✓								

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	1	"10148105".pn.	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/15 01:52 PM
L2	13	("20050110467" | "20070018609" | "20070123316" | "20100173182" | "20120139491" | "20130099736" | "20130169038" | "20130264995" | "20140265592" | "20140315048" | "20150054467" | "20160001666" | "20160336770").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/15 03:46 PM
L3	284	(battery NEAR2 clamp).ti.	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/18 09:10 AM
L4	107	L3 AND @ad<"20160330"	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/18 09:10 AM
L5	116	("3889248" | "4423378" | "4876515" | "5583416" | "5589757" | "5592093" | "5721688" | "6037778").pn. OR ("6667624").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/18 09:20 AM
L6	71	("4675255" | "5700089" | "5877563").pn. OR ("6218805").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/18 09:33 AM
L7	5920	(jumper NEAR2 cable)	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/18 10:33 AM
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L11	76	("D47781" | "3933140" |	(US-PGPUB; USPAT;	OR	ON	ON	2021/10/18

		"4041445" | "D260626" | "4885524" | "4910628" | "4931731" | "5019767" | "5083076" | "5111130" | "5189359" | "5486434" | "5635817" | "5635818" | "5793185" | "5795182" | "5921809" | "5965998" | "6054779" | "6130519" | "6140796" | "6147471" | "6212054" | "6262492" | "6262559" | "D447334" | "6362599" | "6632103" | "6648701" | "D485810" | "6756764" | "6803743" | "6822425" | "7148580" | "7301303" | "7749031" | "D625653" | "D628650" | "7872361" | "D634313" | "8076900" | "D654246" | "D654854" | "8172603" | "8199024" | "D664207" | "D664501" | "8376775" | "D681550" | "8493021" | "D687768" | "D694176" | "D694180" | "D701490" | "D745455" | "D746770" | "D815863" | "D832781" | "D836064" | "D845229" | "D845230" | "20020041174" | "20040130298" | "20050040788" | "20050110467" | "20050252573" | "20060201558" | "20070285049" | "20080213653" | "20100301800" | "20110068734" | "20110116861" | "20120091944" | "20130154543" | "20130164600" | "20130314041" | "20140159509").pn. AND (PGPB | USPT | USOC).dbnm.	USOCR)				10:44 AM
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		| "20020155752" | "20060145655").pn. OR ("8199024").urpn. AND (PGPB | USPT | USOC).dbnm.					
L13	53	("3590357" | "3806790" | "4157492" | "4258305" | "4617506" | "4746853" | "4757250" | "4769586" | "4829223" | "4831321" | "4885524" | "5194799" | "5214368" | "5254927" | "5343135" | "5367243").pn. OR ("5635817").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/18 03:58 PM
L14	37	("4885524" | "5083076" | "5111130" | "5189359" | "5635817" | "5635818" | "5793185" | "5795182" | "5921809" | "5965998" | "6130519" | "6140796" | "6212054" | "6262492" | "6262559" | "6362599" | "6632103" | "6756764" | "6803743" | "7148580" | "7301303" | "7872361" | "8172603" | "8199024" | "8376775" | "8493021" | "20020041174" | "20040130298" | "20050040788" | "20050110467" | "20050252573" | "20070285049" | "20100301800" | "20120091944" | "20130154543" | "20130314041" | "20140159509").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/18 04:14 PM
L15	159730	(H02J7/0045 OR F02N11/10 OR F02N11/12 OR H01R11/24 OR H01R13/6666 OR H02J7/0029 OR H02J7/0047 OR H02J7/0063 OR H02J7/342 OR F02N11/14 OR F02N2200/063 OR H01M10/4257 OR H02J7/00034 OR H02J2007/0067 OR	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/19 09:34 AM

		Y02E60/10).cpc.					
L16	97723	L15 AND @ad<"20160330"	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/19 09:35 AM
L17	1251	L16 AND jump$4 AND (vehicle car automobile)	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/19 09:35 AM
L18	5	(smart NEAR2 battery NEAR2 clamp)	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/19 11:41 AM
L19	525	((jumper NEAR2 cable) (jump NEAR2 start)) AND (batter$3 NEAR2 pack)	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/19 12:53 PM
L20	292	L19 AND @ad<"20160330"	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/19 12:53 PM
L21	11644	((jumper NEAR2 cable) (jump NEAR2 start))	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/19 01:38 PM
L22	8963	L21 AND @ad<"20160330"	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/19 01:38 PM
L23	2743	L22 AND battery	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/19 01:38 PM
L24	292	L22 AND (battery NEAR2 pack)	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/19 01:38 PM
L25	2743	L22 AND (battery)	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/19 01:39 PM
L26	1938	L22 AND (battery) AND (vehicle car auto automobile)	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/19 01:39 PM
L27	76	("5793185").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/19 02:44 PM
L28	3611	(battery NEAR2 pack) WITH temperature WITH (sensor detector)	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/19 03:22 PM
L29	12005749	L28AND @ad<"20160330"	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/19 03:22 PM
L30	2374	L28 AND @ad<"20160330"	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/19 03:22 PM
L31	24	("3911350" | "4297630" | "5029266" | "5592070" | "5803215" | "5844399" | "7061209" | "7598710" | "7675265" | "7733064" | "7737665" | "8035351" | "8450982" | "9325191" | "9365123" | "20040135553" | "20080030172" | "20100026246" | "20100085021" | "20120274280" | "20130002200" | "20140042983" | "20140084851" | "20140111162").pn.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/19 03:30 PM

		AND (PGPB | USPT | USOC).dbnm.					
L32	12	("20100241377" | "20110089907" | "20130033102" | "20130049762" | "20140139191" | "20140152232" | "20140229129" | "20140242432" | "20150079433" | "20150130404" | "20150364935" | "20160294019").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/19 03:37 PM
L33	4	("20080224667" | "20090058370" | "20090085527" | "20140035537").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/19 03:42 PM
L34	7	("4871957" | "5230637" | "5635817" | "5795182" | "20020057542" | "20100283623" | "20160181587").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/20 02:39 PM
L35	100	("5220207" "4796827" "5461658" "5521686" "5552331" "4567425" "4617508" "4761641" "4831999" "5264718" "5339782" "5342120" "5354703" "5502924" RE35356 "5719474" "5836889" "5955904" "6021418" "6150639" "4275643" "4280530" "4327322" "4345194" "4347918" "4382311" "4398889" "4400656" "4461958" "4465982" "4499347" "4503310" "4546426" "4546847" "4564038" "4578632" "4603708" "4622059" "4626911" "4782804" "4785472" "4810973" "4815792" "4833798" "4836700" "4878876" "4886123" "4890515" "4922796" "4957782" "4966191" "4974183" "4975678" "5199849" "5214515" "5241570"	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/20 04:23 PM

		"5300726" "5307467" "5339165" "5403047" "5419301" "5434903" "5445188" "5446552" "5461559" "5494263" "5522416" "5528268" "5531407" "5544056" "5616061" "5618216" "5630741" "5634700" "5644188" "5644190" "5647998" "5700176" "5703380" "5715694" "5724565" "5735546" "5783876" "5791388" "5812811" "5811929" "5814962" "5835676" "5862160" "5863012" "5874854" "5877747" RE36209 "5920148" "5930142" "5933346" "5939696" "5959952" "5990571" "5995998").pn.				
L36	99	("4734872" "8515581" "4959767" "4993480" "5331537" "5418858" "5602747" "5629986" "5883482" "6314333" "6473669" "6856850" "7925461" "7925461" "8265562" "8781013" "8989788" "9148858" "9929745" "11050070" "11052905" "11139669" "20020059013" "20030014760" "20090006014" "20090316821" "20100061317" "20120009969" "20120208578" "20140066319" "20160094241" "20190229355" "20190270444" "20200021117" "20200217534" "3554067" "3554073" "3554079" "3554084" "3554085" "3554086" "3554089" "3554091" "3554103" "3554104" "3554107" "3554128" "3554153" "3554170" "3554175" "3554177" "3554178" "3554186" "3554188" "3554204"	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/20 04:24 PM

		"3554205" "3554206" "3554210" "3554212" "3554213" "3554219" "3554220" "3554221" "3554222" "3554233" "3554234" "3554277" "3554291" "3554292" "3554302" "3554312" "3554325" "3554326" "3554390" "3554408" "3554411" "3554445" "3554451" "3554452" "3554458" "3554464" "3554467" "3554469" "3554481" "3554497" "3554524" "3554537" "3554547" "3555167" "3555181" "3555182" "3555192" "3555194" "3555195" "3555196" "3555199" "3555200" "3555202" "3555204" "3555234").pn.					
L37	199	L35 L36	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/20 04:24 PM
L38	15329	L16 AND board	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/26 10:53 AM
L39	587	L16 AND (board WITH plastic)	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/26 10:53 AM
L40	66	((US-10148105-B2 OR US-6667624-B1 OR US-9244100-B2 OR US-6218805-B1 OR US-8493022-B2 OR US-5795182-A OR US-10840716-B2 OR US-8199024-B2 OR US-6212054-B1 OR US-5796255-A OR US-10279689-B2 OR US-9007015-B1 OR US-6632103-B1 OR US-6262492-B1 OR US-5965998-A OR US-4769586-A OR US-4757250-A OR US-4746853-A OR US-6803743-B2 OR US-10298034-B2 OR US-8493021-B2 OR US-6222342-B1 OR US-5982138-A OR US-5793185-A OR US-9397513-B2 OR US-8084989-B2 OR US-6734651-B2 OR US-5343351-A OR US-	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; 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	2021/10/26 03:41 PM

		11072256-B2).did. AND USPT.dbnm.) OR ((US-20160336770-A1 OR US-20150054467-A1 OR US-20160001666-A1 OR US-20140315048-A1 OR US-20130264995-A1 OR US-20140265592-A1 OR US-20130169038-A1 OR US-20130099736-A1 OR US-20120139491-A1 OR US-20100173182-A1 OR US-20050110467-A1 OR US-20160240834-A1 OR US-20150200470-A1 OR US-20160268645-A1 OR US-20160181587-A1 OR US-20140002941-A1 OR US-20060145655-A1 OR US-20020155752-A1 OR US-20130154543-A1 OR US-20020041174-A1 OR US-20170141591-A1 OR US-20160046199-A1 OR US-20160011271-A1 OR US-20120004875-A1 OR US-20090174362-A1 OR US-20080129252-A1 OR US-20180006490-A1 OR US-20140159509-A1 OR US-20090218988-A1 OR US-20160036096-A1 OR US-20150153416-A1 OR US-20150084554-A1 OR US-20150084600-A1 OR US-20150032394-A1 OR US-20150025825-A1 OR US-20130193881-A1 OR US-20130127424-A1).did. AND PGPB.dbnm.)					
L41	48	((US-10148105-B2 OR US-6667624-B1 OR US-9244100-B2 OR US-6218805-B1 OR US-8493022-B2 OR US-5795182-A OR US-	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO;	OR	ON	ON	2021/10/26 03:41 PM

		10840716-B2 OR US-8199024-B2 OR US-6212054-B1 OR US-5796255-A OR US-10279689-B2 OR US-9007015-B1 OR US-6632103-B1 OR US-6262492-B1 OR US-5965998-A OR US-4769586-A OR US-4757250-A OR US-4746853-A OR US-6803743-B2 OR US-10298034-B2 OR US-8493021-B2 OR US-6222342-B1 OR US-5982138-A OR US-5793185-A OR US-9397513-B2 OR US-8084989-B2 OR US-6734651-B2 OR US-5343351-A OR US-11072256-B2).did. AND USPT.dbnm.) OR ((US-20160336770-A1 OR US-20150054467-A1 OR US-20160001666-A1 OR US-20140315048-A1 OR US-20130264995-A1 OR US-20140265592-A1 OR US-20130169038-A1 OR US-20130099736-A1 OR US-20120139491-A1 OR US-20100173182-A1 OR US-20050110467-A1 OR US-20160240834-A1 OR US-20150200470-A1 OR US-20160268645-A1 OR US-20160181587-A1 OR US-20140002941-A1 OR US-20060145655-A1 OR US-20020155752-A1 OR US-20130154543-A1 OR US-20020041174-A1 OR US-20170141591-A1 OR US-20160046199-A1 OR US-20160011271-A1 OR US-20120004875-A1 OR US-20090174362-A1 OR US-20080129252-A1	JPO; DERWENT; IBM_TDB)				

		OR US-20180006490-A1 OR US-20140159509-A1 OR US-20090218988-A1 OR US-20160036096-A1 OR US-20150153416-A1 OR US-20150084554-A1 OR US-20150084600-A1 OR US-20150032394-A1 OR US-20150025825-A1 OR US-20130193881-A1 OR US-20130127424-A1).did. AND PGPB.dbnm.) AND (jump$3)					
L42	38	((US-10148105-B2 OR US-6667624-B1 OR US-9244100-B2 OR US-6218805-B1 OR US-8493022-B2 OR US-5795182-A OR US-10840716-B2 OR US-8199024-B2 OR US-6212054-B1 OR US-5796255-A OR US-10279689-B2 OR US-9007015-B1 OR US-6632103-B1 OR US-6262492-B1 OR US-5965998-A OR US-4769586-A OR US-4757250-A OR US-4746853-A OR US-6803743-B2 OR US-10298034-B2 OR US-8493021-B2 OR US-6222342-B1 OR US-5982138-A OR US-5793185-A OR US-9397513-B2 OR US-8084989-B2 OR US-6734651-B2 OR US-5343351-A OR US-11072256-B2).did. AND USPT.dbnm.) OR ((US-20160336770-A1 OR US-20150054467-A1 OR US-20160001666-A1 OR US-20140315048-A1 OR US-20130264995-A1 OR US-20140265592-A1 OR US-20130169038-A1 OR US-20130099736-A1 OR US-20120139491-	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/10/26 04:29 PM

		A1 OR US-20100173182-A1 OR US-20050110467-A1 OR US-20160240834-A1 OR US-20150200470-A1 OR US-20160268645-A1 OR US-20160181587-A1 OR US-20140002941-A1 OR US-20060145655-A1 OR US-20020155752-A1 OR US-20130154543-A1 OR US-20020041174-A1 OR US-20170141591-A1 OR US-20160046199-A1 OR US-20160011271-A1 OR US-20120004875-A1 OR US-20090174362-A1 OR US-20080129252-A1 OR US-20180006490-A1 OR US-20140159509-A1 OR US-20090218988-A1 OR US-20160036096-A1 OR US-20150153416-A1 OR US-20150084554-A1 OR US-20150084600-A1 OR US-20150032394-A1 OR US-20150025825-A1 OR US-20130193881-A1 OR US-20130127424-A1).did. AND PGPB.dbnm.) AND (board PCB)						
L43	17	L40 AND (board PCB)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/10/26 04:30 PM
L44	319	L16 AND (board PCB) AND (jumper)	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/26 09:31 PM
L45	4	("4791347" | "4794058" | "5955866" | "20020030466").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/27 08:43 AM
L46	31	("2978596" | "2991376" | "3536051" | "3763415"	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/27 08:45 AM

		| "3963972" | "4004208" | "4161682" | "4321522" | "4350746" | "4511637" | "4540929").pn. OR ("4791347").urpn. AND (PGPB | USPT | USOC).dbnm.					
L47	36	("4431717" | "4516168" | "4791347" | "5255782" | "5283137" | "6144562" | "6243449" | "6356054" | "6456038" | "6493644" | "6495988" | "6574111" | "7045236" | "7554815" | "7733635" | "7848088" | "8421404" | "8724337" | "20050163237" | "20080007931" | "20090092075" | "20090270140" | "20100042820" | "20100258626" | "20100328861" | "20110066840" | "20110228473" | "20120113613" | "20120206100" | "20120212378" | "20120249072" | "20120329532" | "20130063904" | "20130165847" | "20130265700" | "20140045558").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/27 08:57 AM
L48	23	("3936744" | "5214368" | "5426371" | "5589292" | "5793185").pn. OR ("5955866").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/27 08:58 AM
L49	40	("3963972" | "4489223" | "4791347" | "4885524" | "4902955" | "4924176" | "5083076").pn. OR ("5214368").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/27 09:08 AM
L50	65	("762684" | "2610987" | "2626972" | "2659042" | "2718540" | "2991376" | "4037720" | "4161682" | "4215306" | "4258305" | "4300087" | "4355275" | "4443751" | "4444853" | "4489223" | "4564797" |	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/27 09:12 AM

		"4653833" | "4667141" | "4692680" | "4885524" | "4942964" | "D310204" | "D310207" | "4983473" | "5039930" | "5077513" | "D329636" | "5166478" | "5167529" | "5183407" | "5214368" | "5367243" | "5389462" | "D366026" | "D374859" | "5982138" | "D429482" | "RE37482" | "6636015").pn. OR ("6799993").urpn. AND (PGPB | USPT | USOC).dbnm.					
L51	29	("4983473" | "5367243" | "5633623" | "5754029" | "5793185" | "5982138" | "6002235" | "6222342" | "6394040").pn. OR ("6636015").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/27 09:19 AM
L52	187	("D300920" | "D316397" | "D321680" | "D334560" | "D364602" | "D374859" | "D393446" | "D407065" | "D413098" | "D417429" | "D420324" | "3165689" | "4392661" | "5220269" | "5589292" | "5637978" | "5681668" | "5955866" | "5982138" | "5993983" | "5998961" | "6002235").pn. OR ("6222342").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/27 09:29 AM
L53	1	"20170334299".pn.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/27 03:43 PM
L54	7	("4871957" | "5230637" | "5635817" | "5795182" | "20020057542" | "20100283623" | "20160181587").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/27 04:07 PM
L55	585	L16 AND (battery NEAR2 pack NEAR2 connector)	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/28 10:14 AM
L56	10	L16 AND (battery NEAR2 pack NEAR2 connector NEAR2 cable)	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/28 10:17 AM
L57	220	L16 AND (battery	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/28

		NEAR2 pack WITH (connector AND cable))					10:19 AM
L58	20	("3539898" | "5122721" | "5686808" | "5780993" | "5847545" | "20050189905" | "20050231159" | "20060152193" | "20070103113" | "20070285053" | "20080007215").pn. OR ("7880431").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/28 10:25 AM
L59	133	L16 AND (battery NEAR2 pack NEAR2 cable)	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/28 10:31 AM
L60	73	((US-10148105-B2 OR US-6667624-B1 OR US-9244100-B2 OR US-6218805-B1 OR US-8493022-B2 OR US-5795182-A OR US-10840716-B2 OR US-8199024-B2 OR US-6212054-B1 OR US-5796255-A OR US-10279689-B2 OR US-9007015-B1 OR US-6632103-B1 OR US-6262492-B1 OR US-5965998-A OR US-4769586-A OR US-4757250-A OR US-4746853-A OR US-6803743-B2 OR US-10298034-B2 OR US-8493021-B2 OR US-6222342-B1 OR US-5982138-A OR US-5793185-A OR US-9397513-B2 OR US-8084989-B2 OR US-6734651-B2 OR US-5343351-A OR US-11072256-B2 OR US-8964406-B2 OR US-7199555-B2 OR US-6636015-B1).did. AND USPT.dbnm.) OR ((US-20160336770-A1 OR US-20150054467-A1 OR US-20160001666-A1 OR US-20140315048-A1 OR US-20130264995-A1 OR US-20140265592-	(USPAT; US-PGPUB; FPRS; USOCR; IBM_TDB; EPO; JPO; DERWENT; 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	2021/10/28 01:16 PM

		A1 OR US-20130169038-A1 OR US-20130099736-A1 OR US-20120139491-A1 OR US-20100173182-A1 OR US-20050110467-A1 OR US-20160240834-A1 OR US-20150200470-A1 OR US-20160268645-A1 OR US-20160181587-A1 OR US-20140002941-A1 OR US-20060145655-A1 OR US-20020155752-A1 OR US-20130154543-A1 OR US-20020041174-A1 OR US-20170141591-A1 OR US-20160046199-A1 OR US-20160011271-A1 OR US-20120004875-A1 OR US-20090174362-A1 OR US-20080129252-A1 OR US-20180006490-A1 OR US-20140159509-A1 OR US-20090218988-A1 OR US-20160036096-A1 OR US-20150153416-A1 OR US-20150084554-A1 OR US-20150084600-A1 OR US-20150032394-A1 OR US-20150025825-A1 OR US-20130193881-A1 OR US-20130127424-A1 OR US-20140043780-A1 OR US-20050258797-A1 OR US-20020030466-A1 OR US-20170334299-A1).did. AND PGPB.dbnm.)					
L61	22	L60 AND (board PCB)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/10/28 01:16 PM

L62	45	(yun NEAR2 lei).in.	(US-PGPUB; USPAT)	OR	ON	ON	2021/10/29 08:57 AM
L63	4	("5189359" | "5623550" | "6130519" | "6624535").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/29 09:00 AM
L64	13	(shenzhen NEAR2 carku).as.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/29 09:01 AM
L65	28	(shenzhen NEAR2 carku)	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/10/29 09:01 AM

PE2E SEARCH - Search History (Interference)

There are no Interference searches to show.

Bibliographic Data

Application No: 17/112,920

Foreign Priority claimed: (•) Yes ( ) No

35 USC 119 (a-d) conditions met: [✓] Yes [ ] No [ ] Met After Allowance

Verified and Acknowledged: /KENNETH WHITTINGTON/ Examiner's Signature | Initials

Title: BATTERY CLAMP

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/04/2020	320	3992	240001.00005
RULE			

APPLICANTS

SHENZHEN CARKU TECHNOLOGY CO., LTD., Shenzhen, Guangdong, CHINA

INVENTORS

Yun LEI, Shenzhen, CHINA

CONTINUING DATA

This application is a REI of 15245146 08/23/2016 PAT 10148105

FOREIGN APPLICATIONS

CHINA CN201610506106.8 06/30/2016

CHINA CN201620692248.3 06/30/2016

CHINA CN201610506137.3 06/30/2016

IF REQUIRED, FOREIGN LICENSE GRANTED**

12/07/2020

**** SMALL ENTITY ****

STATE OR COUNTRY

CHINA

ADDRESS

Arch & Lake LLP
203 North LaSalle Street, Suite 2100
Chicago, IL 60601
UNITED STATES

FILING FEE RECEIVED

$1,720

Electronic Patent Application Fee Transmittal

Application Number:	17112920
Filing Date:	04-Dec-2020
Title of Invention:	BATTERY CLAMP
First Named Inventor/Applicant Name:	Yun LEI
Filer:	Yichen Cao
Attorney Docket Number:	240001.00005

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:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 1 month with $0 paid	2251	1	110	110
Miscellaneous:				
			Total in USD ($)	**110**

Electronic Acknowledgement Receipt

EFS ID:	45608370
Application Number:	17112920
International Application Number:	
Confirmation Number:	5982
Title of Invention:	BATTERY CLAMP
First Named Inventor/Applicant Name:	Yun LEI
Customer Number:	153979
Filer:	Yichen Cao
Filer Authorized By:	
Attorney Docket Number:	240001.00005
Receipt Date:	02-MAY-2022
Filing Date:	04-DEC-2020
Time Stamp:	11:39:26
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$110
RAM confirmation Number	E202252B40113052
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Fee Worksheet (SB06)	fee-info.pdf	37432 ab8e5cdada9e75d7401db6fec5340ed43c505ba9	no	2

Warnings:

Information:

Total Files Size (in bytes):	37432

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for 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.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 17/112,920	Filing Date 12/04/2020	☐ 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 $240 =	
☐ 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	08/04/2022	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 10	Minus	** 20	= 0		x $50 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	***	=		x $240 =	
	☐ 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.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/PATRICIA F LEWIS/
*** 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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.: 17/112,920	Confirmation No.: 5982
Applicant: Shenzhen Carku Technology Go., LTD.	Art Unit: 3992
First Inventor: Yun LEI	Examiner: Whittington, Kenneth
Title: Battery Clamp	

RESPONSE TO OFFICE ACTION MAILED February 4, 2022

Commissioner for Patents
P O Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

Applicant submits this paper in response to the Non-Final Office Action Mailed February 4, 2022. Please consider the following **Amendments** and **Remarks**.

Amendments to the Claims begin on page 2 of this paper.

Remarks begin on page 5 of this paper.

AMENDMENTS TO THE CLAIMS

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

1. (Twice Amended) A battery clamp for delivering an instantaneous starting current from an external power supply to an external device, the battery clamp comprising:

a control device, comprising:

[a housing;]

a master-control board [mounted within the housing; and];

connectors [disposed at one side of the housing, and] being electrically connected to the master-control board, comprising:

at least a first and second electrode connectors, which are connected to an external power supply for receiving power, and

at least one communication connector connected to the external power supply for receiving status information of the external power supply, and sending the status information to the master-control board;

a first and second wire clamps, each having an end configured to receive power from the external power supply via the control device, and another end connected to the external device for supplying power to the external device;

wherein the control device is configured to control power supply from the external power supply to the external device based on the status information.

2. (Original) The battery clamp of claim 1, wherein the control device is configured to allow the power supply from the external power supply to the external device when the status information is normal, wherein the status information comprises at least one of the following: temperature, voltage of a battery unit of the external power supply.

3. (Original) The battery clamp of claim 1, wherein the master-control board comprises:

a first and second voltage input ports electrically connected to the first and second electrode connectors respectively;

a communication port electrically connected to the communication connector;

a first and second voltage output ports electrically connected to the first and second wire clamps for supplying power to the external device via the first and second wire clamps;

a switch control unit for controlling connection between the first voltage input port and the first voltage output port; and

a master-control circuit unit connected to the communication port for obtaining the status information of the external power supply;

wherein the master-control circuit unit is configured to control the switch control unit based on the status information of the external power supply, thereby controlling connection on/off between the first voltage input port and the first voltage output port.

4. (Original) The battery clamp of claim 3, wherein the master-control circuit unit further comprises:

an electric current detection unit for detecting electric current from the external power supply to the external device;

a voltage detection unit for detecting voltage of the external power supply and the external device; and

wherein the master-control circuit unit is configured to compare the electric current value and the voltage value with a predefined electric current range and a predefined voltage range respectively, thereby controlling the switch control unit.

Cancel claim 5.

6. (Original) The battery clamp of claim 4, wherein the master-control circuit unit further comprises:

an indicator light circuit unit connected to the master-control chip unit for indicating operating status of the control device.

7. (Original) The battery clamp of claim 4, wherein the master-control circuit unit further comprises:

a buzzing circuit unit connected to the master-control chip unit for alerting users about abnormal condition.

Cancel claims 8-10.

Cancel claims 11-25.

26. (New) The battery clamp of claim 4, wherein the predefined electric current range is from 0A to about 600A.

27. (New) The battery clamp of claim 4, wherein the predefined voltage range is from about 8 V to about 17 V.

28. (New) The battery clamp of claim 4, wherein the voltage detection unit comprises:

a first voltage detection unit for detecting voltage value of the external power supply; and

a second voltage detection unit for detecting voltage value of the external device.

29. (New) The battery clamp of claim 1, wherein the communication connector is disposed between the first and second electrode connectors.

REMARKS

Applicant's responses to each of objections or rejections are provided below.

Response to Objection to Amendments.

The Examiner rejected the amendments to the claims provided in 2020 Preliminary Amendment for not being in compliance with 37 CFR 1.173.

Pursuant to the Examiner's request, Applicant provides a newly executed copy of Assignee Declaration (Reissue Oath/Declaration), which is in compliance with MPEP 1414.

Further, Applicant amended the section "Status of the Claims and Statement of Support for Claim Changes under 37 C.F.R. 1.173(c)" as following:

> As required under 37 CFR § 1.173(c), the above amended and newly added claims are supported in the disclosure of the '105 patent, e.g., as set forth below.
>
> Claims 1-10 were issued in US. Pat. No. 10,148,105. Without prejudice or disclaimer, solely to more particularly point out and distinctly claim the invention, claims 1-4 and 6-7 have been amended; claims 5 and 8-10 has been canceled; and new claims 11-25 have been added.
>
> U.S. Pat. No. 10,148,105 is wholly or partially inoperative because the patentee claims less than he had a right to claim in the patent. Claim 1 and other claims of U.S. Pat. No. 10,148,105 were amended by broadening amendments to the limitations; and new 11-25 claims were added. Originally issued independent claim 1 include, among others, features "a housing" and "connectors disposed at one side of the housing…," which render the scope of claims unnecessarily narrow. In the present Reissue Application, claim 1 of underlying US. Pat. No. 10,148,105 was amended by broadening amendments to delete these limitations. New claims 11-25, which are derived from the originally issued claims 1-4 and 6-7, are added. Accordingly, Applicant seeks the present broadening reissue.

(The above 1.173(c) statement and Reissue Oath/Declaration reflect the changes made in the 2020 Preliminary Amendment. Since claims 11-25 have been cancelled and

new amendments are made in this paper, support for the Preliminary Amendment is omitted in the Reissue Declaration.)

As required under 37 CFR § 1.173(b)(2), set forth below is the entire text of each claim being changed or added by this Amendment. Each amended, cancelled, or added claim is marked as required under 37 CFR § l.l73(d).

Claim 1 is amended (twice amended) to restore its original limitations except that the limitations relating to the "housing" are deleted.

Original claims 5, 8-10 were cancelled in the preliminary amendment and remain so in this amendment. Previously added new claims 11-25 are cancelled in this amendment. New claims 26-29 are added. Previously amended claims 2-4 and 6-7 are amended to restore their original limitations.

New claims 26 and 27 are added. Claim 26 is directed to the predefined electric current range as recited in claim 4 and is supported at least by the specification at col. 7, l. 62 – col. 8, l. 45 and Table 1. Claim 27 is directed to the predefined voltage range as recited in claim 4 and is supported at least by the specification at col. 8, l. 46 – col. 9, l. 46 and Table 1.

New claim 28 is identical to the original claim 5, and new 29 is identical to the original claim 8.

No new matter is added.

Response to Claim Objection, §112 Rejection, §251 Rejection, and Mean-Plus-Function Claim Interpretation

Since (1) that previously added new claims 11-25 are cancelled; (2) that claims 1-4 and 6-7 are amended to restore their original limitations except that claim 1 is amended to delete "housing" limitations; and (3) new claims 26-29 are fully supported by the specification and/or the original claims, Applicant submits that the Claim Objection, §112 Rejection, §251 Rejection, and Mean-Plus-Function Claim Interpretation in the outstanding Office Action are moot.

Therefore, in view of the current claim amendments, Applicant respectfully requests withdrawal of aforementioned objections, rejections, and claim interpretation.

Response to Anticipation/Obviousness Rejections

Claim Interpretation

As set forth above, the pending claims are amended to closely resemble their original forms and claims 11-25 are cancelled. As a result, the mean-plus-function interpretation of pending claims becomes moot. The Examiner's anticipation and obviousness rejections were based on mean-plus-function claim interpretation of the previously pending claims. Therefore, Applicant submits that the corresponding anticipation/obviousness rejections also become moot and withdrawal of 102 and 103 rejections is respectfully solicited.

Rejections of Claims 11-25

Since claims 11-25 are cancelled in the current amendment, Applicant submits that any 102 and 103 rejections of these claims become moot.

Anticipation Rejection of claims 1 and 2 over Takano.

The Claim Interpretation arguments set forth above are incorporated herein.

Claim 1 is amended (twice amended) to restore its original limitations except that the limitations relating to the "housing" are deleted.

Further, without conceding with the Examiner's interpretation of disclosure of Takano, Applicant respectfully points out that Takano does not disclose a battery clamp. Instead, it discloses a generic design of so-called battery control device, which can switch between intermittent operation mode and normal operation mode. (*See* Takano claim 1 and paragraph [0006]). Takano does not disclose application of such design in jump starters, which require an output of a strong electric current within a short period of time to start a vehicle. Further, Takano does not disclose a battery clamp, much less a battery clamp having all the features as recited in the pending claim 1. Therefore, Takano fails to anticipates claim 1.

Claim 2 depends from claim 1 and therefore incorporates each and every element of claim 1. For the same reason that claim 1 is not anticipated by Takano, Applicant submits that Takano fails to disclose each and every element of claim 2.

Obviousness Rejection of Claims 1-4 and 6-7

Previously pending claims 1-4 and 6-7 were rejected as being obvious over the disclosure of Richardson and Hung and further in view of Takano.

The Claim Interpretation arguments set forth above are incorporated herein.

Claim 1 is amended (twice amended) to restore its original limitations except that the limitations relating to the "housing" are deleted.

Without conceding with the Examiner's interpretation of the disclosure of Richardson, Huang, and Takano, Applicant submits that the three references in combination still fail to render the pending claims 1-4 and 6-7 obvious.

Richardson and Hung references disclose a portable vehicle charger, which may or may not contain a battery clamp. The very limited disclosure relating to a battery clamp in the two references, if any at all, do not even remotely resemble the recited battery clamp in claims 1-4 and 6-7.

As set forth above, Takano discloses a generic design of so-called battery control device, which can switch between intermittent operation mode and normal operation mode. (*See* Takano claim 1 and paragraph [0006]). Takano does not disclose application of such design in jump starters, which require an output of a strong electric current within a short period of time to start a vehicle. Further, Takano does not disclose a battery clamp, much less a battery clamp having all the features as recited in the pending claim 1.

Even further, Richard, Hung, or Takano fails to teach, suggest, or motivate a person of ordinary skill in the art to incorporate all the features as recited in claim 1 into a battery clamp considering the cost of such incorporation and limited space in the battery clamp. Alternatively, the question remains that why a skilled artisan would relocate complex circuitries from the main machine as disclosed in Richardson, Hung, and Takano into a battery clamp with rather cramped space. (Note: Applicant does not concede that Richard, Huang, and Takano in combination disclose all the limitations of pending claim 1). Therefore, a skilled artisan would not be motivated to combine Richard, Hung, and Takano to reach the invention of pending claim 1.

As discussed above, Applicant respectfully requests withdrawal of anticipation and/or obviousness rejections of claims 1-4 and 6-7.

Conclusion

These remarks are believed to address all of the objections and rejections in the Office Action. Applicant respectfully requests that the objections and rejections be withdrawn and that a Notice of Allowance be granted. The Examiner is respectfully requested to contact the undersigned in the event that a telephone interview would expedite consideration of the application.

Date: August 4, 2022

Respectfully submitted,
/Yichen Cao/
Yichen Cao, Reg. No. 73,489
203 N LaSalle Street
Suite 2100
Chicago, IL, 60601
Tel: 630.386.5514

Electronic Patent Application Fee Transmittal

Application Number:	17112920
Filing Date:	04-Dec-2020
Title of Invention:	BATTERY CLAMP
First Named Inventor/Applicant Name:	Yun LEI
Filer:	Yichen Cao
Attorney Docket Number:	240001.00005

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:				
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Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 3 months with $0 paid	2253	1	740	740
Miscellaneous:				
			Total in USD ($)	**740**

Electronic Acknowledgement Receipt

EFS ID:	46346975
Application Number:	17112920
International Application Number:	
Confirmation Number:	5982
Title of Invention:	BATTERY CLAMP
First Named Inventor/Applicant Name:	Yun LEI
Customer Number:	153979
Filer:	Yichen Cao
Filer Authorized By:	
Attorney Docket Number:	240001.00005
Receipt Date:	04-AUG-2022
Filing Date:	04-DEC-2020
Time Stamp:	19:43:18
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$740
RAM confirmation Number	E202284J43482096
Deposit Account	
Authorized User	

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Supplemental reissue declaration filed in accord with Manual of Patent Examining Procedure(MPEP) 1414.01	reissiue_declaration_signed_P.pdf	5843627 61d1d44f0668d7af33b53c16425525344b4e22a6	no	4
Warnings:					
Information:					
2	Extension of Time	aia0022.pdf	181754 bd33fa8ee6deb1ac6116cac8f3d26b74bbb66470	no	2
Warnings:					
Information:					
3		Response_Non_Final_OA.pdf	123446 c2734dc40da80795629d8762b7288159753fbaad	yes	9

Multipart Description/PDF files in .zip description

Document Description	Start	End
Amendment/Request for Reconsideration-After Non-Final Rejection	1	1
Claims	2	4
Applicant Arguments/Remarks Made in an Amendment	5	9

Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	37635 c41fa07982ef03ef8c6109cc33f813265374adb5	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	6186462	

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Doc Code: REIS.DECL

Document Description: Reissue Declaration Filed In Accordance With MPEP 1414

PTO/AIA/06 (09-20)

Approved for use through 03/31/2023. OMB 0651-0033

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REISSUE APPLICATION DECLARATION BY THE ASSIGNEE	Docket Number (optional) 240001.00005

I hereby declare that:

The residence and mailing address of the inventor or joint inventors are stated below.

Name of the Assignee:

Shenzhen Carku Technology Go., LTD.

I am authorized to act on behalf of the assignee (if the assignee is a juristic entity).

The entire title to the patent identified below is vested in said assignee, or if there are multiple assignees/owners, all assignees/owners have executed a Reissue Application Declaration to account for the entire title of the patent identified below.

Inventor Yun Lei

Residence: City	State	Country
Bantian, Longgang Distric, Shenzhen		CN

Mailing Address

Building A, Qixing Creative Square, Lianrun Rd., Gaofeng Community, Dalang Street, Longhua District, Shenzhen,Guangdong,China 518109

City	State	Zip	Country

☐ Additional Inventors are named on separately numbered sheets attached hereto.

Patent Number 10,148,105	Patent Issue Date December 4, 2018

I believe said inventor(s) to be the original inventor or original joint inventors of the subject matter which is described and claimed in said patent, for which a reissue patent is sought on the invention titled:

Battery Clamp

the specification of which

☐ is attached hereto.

☑ was filed on 12/04/2020 as reissue application number 17/112,920.

The above-identified application was made or authorized to be made by me.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

I believe the original patent to be wholly or partly inoperative or invalid, for the reasons described below.
(Check all boxes that apply.)

☐ by reason of a defective specification or drawing.

☑ by reason of the patentee claiming more or less than he had the right to claim in the patent

☐ by reason of other errors.

This collection of information is required by 37 CFR 1.175. 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 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, 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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PTO/AIA/06 (09-20)
Approved for use through 03/31/2023. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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REISSUE APPLICATION DECLARATION BY THE ASSIGNEE	Docket Number (Optional)

At least one error upon which reissue is based is described below. If the reissue is a broadening reissue, a claim that the application seeks to broaden must be identified and the box below must be checked:

U S. Pat. No. 10,148,105 is wholly or partially inoperative because the patentee claims less than he had a right to claim in the patent. Claim 1 and other claims of U.S. Pat. No. 10,148,105 were amended by broadening amendments to the limitations; and new 11-25 claims were added. Originally issued independent claim 1 include, among others, features "a housing" and "connectors disposed at one side of the housing ...," which render the scope of claims unnecessarily narrow. In the present Reissue Application, claim 1 of underlying US. Pat. No. 10,148,105 was amended by broadening amendments to delete these limitations. New claims 11-25, which are derived from the originally issued claims 1-4 and 6-7, are added. Accordingly, Applicant seeks the present broadening reissue.

[Attach additional sheets, if needed]

☑ **The application for the original patent was filed under 37 CFR 1.46 by the assignee of the entire interest.**

I hereby appoint:

☑ Practitioners associated with Customer Number: 153979

OR

☐ Practitioner(s) named below:

Name	Registration Number

as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith.

Correspondence Address: Direct all communications about the application to:

☑ The address associated with Customer Number: 153979

OR

☐ Firm or Individual Name					
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WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

Signature	Kevin Zhang	Date (Optional)	2022.7.5
Legal name of person signing	Kevin Zhang, IP Manager of Shenzhen Carku Technology Co., LTD.		
Address of Assignee	Building A, Qixing Creative Square, Lianrun Rd., Gaofeng Community, Dalang Street, Longhua District, Shenzhen,Guangdong,China 518109		

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.

PTO/AIA/22 (10-20)
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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)

Docket Number (Optional): 240001.00005

Application Number: 17/112,920

Filed: 12/04/2020

For: Battery Clamp

Art Unit: 3992

Examiner: Whittington, Kenneth

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	Fee	Small Entity Fee	Micro Entity Fee	
☐ One month (37 CFR 1.17(a)(1))	$220	$110	$55	$
☐ Two months (37 CFR 1.17(a)(2))	$640	$320	$160	$
☑ Three months (37 CFR 1.17(a)(3))	$1,480	$740	$370	$ 740
☐ Four months (37 CFR 1.17(a)(4))	$2,320	$1,160	$580	$
☐ Five months (37 CFR 1.17(a)(5))	$3,160	$1,580	$790	$

☑ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29.
Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☐ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number _____.

☑ Payment made via EFS-Web.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant.

☑ attorney or agent of record. Registration number 73,489.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/Yichen Cao/ — Signature

August 4, 2022 — Date

Yichen Cao — Typed or printed name

6303865514 — Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☑ * Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.136(a). 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 6 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: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Privacy Act Statement

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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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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/112,920	12/04/2020	Yun LEI	240001.00005	5982

153979 7590 09/09/2022

Arch & Lake LLP
203 North LaSalle Street, Suite 2100
Chicago, IL 60601

EXAMINER	
WHITTINGTON, KENNETH	

ART UNIT	PAPER NUMBER
3992	

NOTIFICATION DATE	DELIVERY MODE
09/09/2022	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):

USPTO@dockettrak.com
haotan@archlakelaw.com
shenwang@archlakelaw.com

Office Action Summary	Application No. 17/112,920	Applicant(s) LEI, Yun	
	Examiner KENNETH WHITTINGTON	Art Unit 3992	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 4 August 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) 1-4,6-7 and 26-29 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) 1-4,6-7 and 26-29 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 4 December 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. 15/245,146.

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 _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

NON-FINAL OFFICE ACTION

This non-final office action addresses U.S. Application No. 17/112,920, which is a broadening reissue application of U.S. Application No. 15/245,146 (hereinafter the "**146 Application**"), entitled BATTERY CLAMP, which issued as U.S. Patent No. 10,148,105 (hereinafter the "**105 Patent**") on December 4, 2018.

The status of the claims is as follows:

Claims 1-4, 6, 7 and 26-29 are pending and examined herein.

Claims 1-4, 6, 7 and 26-29 are rejected.

I. STATUS OF CLAIMS AND APPLICATION

Applicant filed a preliminary amendment on August 4, 2022 (hereinafter the "**Aug 2022 Amendment**") in response to the non-final Office action mailed February 4, 2022 (hereinafter the "**Feb 2022 NF Action**"). In the Aug 2022 Amendment, patent claim 1 was amended, patent claims 2-4, 6 and 7 were unchanged and new claims 26-29 were added. Along with the Aug 2022 Amendment, Applicant also filed a new reissue declaration (hereinafter the "**2022 Reissue Declaration**"). Therefore, claims 1-4, 6, 7 and 26-29 are pending and will be examined herein.

Based on a review of the claims as presented herein, Examiners provide new rejections under 35 U.S.C. §251 and §112 and thus this action is made non-final to allow Applicant to address such new rejections.

II. PRIORITY

Examiners acknowledge that the present application is a reissue of the 146 Application, now the 105 Patent. Examiners further acknowledge the Applicant's claims of foreign priority to CN201610506106, CN201610506137 and CN201620692248, each filed June 30, 2016.

III. REJECTIONS UNDER 35 U.S.C. §251 – Original Patent Requirement

The following is a quotation of 35 U.S.C. §251:

> Whenever any patent is, through error without any deceptive intention, deemed wholly or partly inoperative or invalid, by reason of a defective specification or drawing, or by reason of the patentee claiming more or less than he had a right to claim in the patent, the Director shall, on the surrender of such patent and the payment of the fee required by law, reissue the patent for the invention disclosed in the original patent, and in accordance with a new and amended application, for the unexpired part of the term of the original patent. No new matter shall be introduced into the application for reissue.

Rejections of Claims 1-4, 6, 7 and 26-29 Based on the Original Patent Requirement

Claims 1-4, 6, 7 and 26-29 are rejected under 35 U.S.C. §251 because they do not comply with the original patent requirement. As provided in §251, the Director shall issue reissue the patent for the invention disclosed in the "original patent." To meet the original patent requirement, the specification of the original patent "must clearly and unequivocally disclose the newly claimed invention as a separate invention." *See Antares Pharma, Inc. v. Medac Pharma Inc.*, 771 F.3d 1354, 1362 (Fed. Cir. 2014). "[I]t is not enough that an invention might have been claimed in the original patent because it was suggested or indicated in the specification." *Id.* Specifically, the invention now being claimed in reissue must be expressly disclosed in the specification of the original

patent. *Id.* at 1363.[1] Based on these decisions, Examiners find this analysis involves a simple two-step process: (1) determine what is the new scope of invention now being claimed, i.e., how have the claims been broadened, and (2) is that new invention or new scope of invention unequivocally disclosed in the specification as a separate invention.

Claims 1-4, 6, 7 and 26-29

As to step (1), Examiners find that the original patent claims of the 105 Patent have been broadened via the amendment of claims 1-4, 6, 7 and the addition of new claims 26-29 to remove substantial features from the patented claims, i.e., the housing for the control device. In fact, Examiners find that claims 1-4, 6, 7 and 26-29 do not recite any housing in any manner. Furthermore, the locational aspects of the master-control board and the connectors are removed from the claims, which were based on their location within or on the housing. Thus, the Examiners find the new invention now covered by claims 1-4, 6, 7 and 26-29 herein includes a broad and distinct battery clamp without any housing or the positioning of the components therein and thereon.

As to step (2), Examiners do not find any support, discussion or suggestion in the 105 Patent for such a battery clamp without a housing as is now being claimed. Examiners do not find any embodiment or discussion of a battery clamp comprising only the underling circuit components. Rather the only embodiment battery clamp as contemplated by the 105 Patent specifically includes a housing. See e.g., the 105 Patent in the Abstract, the Summary of the Invention and FIGS. 2 and 3 which shown a particular relationship between the positions of the components to the housing for the

[1] *See also Forum US, Inc. v. Flow Valve, LLC*, 926 F.3d 1346 at 1351 (Fed. Cir. 1029, precedential) (For broadening reissue claims, "the specification of the original patent must do more than merely suggest or indicate the invention recited in the reissue claims," rather "it must appear from the face of the instrument that what is covered by the reissue was intended to have been covered and secured by the original.").

control device. For example., see 105 Patent FIGS. 2 and 3, control device 1 includes a housing comprising components 111/112 which holds therein a master-control board 12 and the various connectors/electrodes 101, 102, 103 at various position on the housing. Accordingly, Examiners do not find unequivocal support for such a pared down battery clamp now being claimed in claims 1-4, 6, 7 and 26-29. Furthermore, Examiners do not find any disclosure that such housing is optional or not needed.

As noted above, the original patent requirement puts a limit on the manner to which reissue applicants can broaden the patent claims in reissue. Specifically, claims that are broadened in reissue that cover a new class of invention or new invention must have unequivocal support on the face of the original patent for that new class of invention. Following a careful review of claims 1-4, 6, 7, and 26-29 pending and examined herein with respect to the 105 Patent, Examiners find the new scope of these claims covers a new invention not unequivocally supported on the face the 105 Patent, i.e., Examiners do not find any disclosure or a discussion of the pared down battery clamp that does not require any housing or the positional aspects of components therein or thereon. Examiners find that the Applicant has broadened the original patent claims via claims 1-4, 6, 7 and 26-29 herein so much these new claims cover a battery clamp not disclosed or discussed or even conceivable in the 105 Patent, which is improper in reissue. Thus, Examiners conclude claims 1-4, 6, 7 and 26-29 fail the original patent requirement and thus are rejected under 35 U.S.C. §251.

IV. REISSUE OATH/DECLARATION

37 C.F.R. §1.175 Reissue oath or declaration (in part).

> (a) The inventor's oath or declaration for a reissue application, in addition to complying with the requirements of § 1.63, § 1.64, or § 1.67, must also specifically identify at least one error pursuant to 35 U.S.C. 251 being relied upon as the basis for reissue and state that the applicant believes the original patent to be wholly or partly inoperative or invalid by reason of a defective specification or drawing, or by reason of the patentee claiming more or less than the patentee had the right to claim in the patent.
> (b) If the reissue application seeks to enlarge the scope of the claims of the patent (a basis for the reissue is the patentee claiming less than the patentee had the right to claim in the patent), the inventor's oath or declaration for a reissue application must identify a claim that the application seeks to broaden. A claim is a broadened claim if the claim is broadened in any respect.

The reissue declaration by assignee filed December 4, 2020 (hereinafter the "**2022 Reissue Declaration**") is acknowledged. However, Examiners object to the error statement in the 2022 Reissue Declaration on the basis that it fails to state a proper error in the claims on which to base this reissue. While Examiners recognize in the 2022 Reissue Declaration that Applicant bases this reissue application on the removal of all aspects of the housing from the claims, Examiners do not find this statement sufficient under the rules because as found above, Examiners find this removal runs afoul of the original patent requirement. Accordingly, this asserted basis for reissue is not a proper basis for reissue.

Accordingly, Applicant is still required to provide a new declaration by the inventor or assignee with a statement of error with respect to 105 Patent identifying the claim Applicant seeks to broaden and further identify an "a single word, phrase, or expression" from this claim and how this error renders the 476 Patent partially or wholly inoperative or invalid.

V. ADDITIONAL REJECTIONS – 35 U.S.C. §251

The following is a quotation of 35 U.S.C. §251(a):

> (a) IN GENERAL.—Whenever any patent is, through error, deemed wholly or partly inoperative or invalid, by reason of a defective specification or drawing, or by reason of the patentee claiming more or less than he had a right to claim in the patent, the Director shall, on the surrender of such patent and the payment of the fee required by law, reissue the patent for the invention disclosed in the original patent, and in accordance with a new and amended application, for the unexpired part of the term of the original patent. No new matter shall be introduced into the application for reissue.

Claims 1-4, 6, 7 and 26-29 and this reissue application as a whole are rejected as being based upon a defective reissue declaration under 35 U.S.C. §251. See also 37 C.F.R. §1.175. The nature of the defects in the 2020 Reissue Declaration is set forth in the discussion above.

VI. CLAIM INTERPRETATION

During examination, claims are given the broadest reasonable interpretation consistent with the specification and limitations in the specification are not read into the claims. See MPEP §2111, MPEP §2111.01 and *In re Yamamoto et al.*, 222 USPQ 934 (Fed. Cir. 1984). Under a broadest reasonable interpretation, words of the claim must be given their plain meaning, unless such meaning is inconsistent with the specification. See MPEP §2111.01(I). It is further noted it is improper to import claim limitations from the specification, i.e., a particular embodiment appearing in the written description may not be read into a claim when the claim language is broader than the embodiment. See MPEP §2111.01(II). Therefore, unless one of the exceptions applies below, Examiners will interpret the limitations of the pending and examined claims using the broadest reasonable interpretation.

A. Lexicographic Definitions

A first exception to the prohibition of reading limitations from the specification into the claims is when the Applicant for patent has provided a lexicographic definition for the term. See MPEP §2111.01(IV). Following an independent review of the claims in view of the specification herein, Examiners find that Patent Owner has not provided any lexicographic definitions related to claim terms with any reasonable clarity, deliberateness and precision.

B. Claim Interpretation Under 35 U.S.C. §112(f)

A second exception to the prohibition of reading limitations from the specification into the claims is when the claimed feature is written as a means-plus-function or a step-plus-function. See 35 U.S.C. §112(f) and MPEP §2181-2183. As noted in MPEP §2181, a three prong test is used to determine the scope of a means-plus-function or step-plus-function limitation in a claim:

(A) the claim limitation uses the term "means" or "step" or a term used as a substitute for "means" that is a generic placeholder (also called a nonce term or a non-structural term having no specific structural meaning) for performing the claimed function
(B) the term "means" or "step" or the generic placeholder is modified by functional language, typically, but not always linked by the transition word "for" (e.g., "means for") or another linking word or phrase, such as "configured to" or "so that"
(C) the term "means" or "step" or the generic placeholder is not modified by sufficient structure, material, or acts for performing the claimed function.

Examiners find herein that the claims include one or more claim limitations that do not use the word "means," but are nonetheless being interpreted under 35 U.S.C. §112(f) because the claim limitations uses a generic placeholder that is coupled with functional language without reciting sufficient structure to perform the recited function and the generic placeholder is not preceded by a structural modifier. Examiners do not

find the remaining limitations invoke interpretation under 35 U.S.C. §112(f) because they are either not written in a proper means-plus-function format or there is sufficient structures within the limitation for performing the function. Each limitation Examiners submit invokes interpretation under 35 U.S.C. §112(f) will be discussed in turn as follows:

B1. FL #1: "control device..." (Claims 1-4, 6, 7 and 26-29)

A first means-plus-function phrase is recited in claim 1 (and included in each of dependent claims 2-4, 6, 7, and 26-29), which recites "a control device..." or hereinafter FL #1. Examiners determine herein that FL #1 meets the three prong test and thus will be interpreted as a means-plus-function limitation under 35 U.S.C. §112(f).

The Examiners find that FL #1 in claim 3 recites:

> a control device, comprising:
> a master-control board; and
> connectors being electrically connected to the master-control board, comprising:
> at least a first and second electrode connectors, which are connected to an external power supply for receiving power, and
> at least one communication connector connected to the external power supply for receiving status information of the external power supply, and sending the status information to the master-control board;
> wherein the control device is configured to control power supply from the external power supply to the external device based on the status information....

(B1)(a) 3-Prong Analysis: Prong (A)

FL #1 meets invocation prong (A) because "means ... for" type language is recited. Examiners first find that "device" is a generic placeholder or nonce term equivalent to "means" because the term "device" does not convey any particular

structure. Examiners further note that the specification of the 105 Patent does not lexicographically define "device" and thus the specification of the 105 Patent does not impart or require any structure for the phrase. Furthermore, the addition phrase "control" merely recites further functionality of the device, but does not impart or imply any specific structure.

Furthermore, there is no disclosure or suggestion from the prior art or the 105 Patent that a "device" is a sufficient structure to perform the functions recited in FL #1. Specifically, there is no suggestion that any known device or control device of a prior art device can control a power supply based on status information as recited in claim 1. Finally, Examiners find that the Federal Circuit has held "device" to be a nonce term. See MPEP §2181(I)(A).

Accordingly, Examiners find nothing in the specification, prosecution history or the prior art to construe "control device..." in FL #1 as the name of a sufficiently definite structure for performing the functions recited in FL #1 so as to take the overall claim limitation out of the ambit of §112(f). *See Williamson v. Citrix Online, L.L.C.,* 115 USPQ2d 1105, 1112 (Fed. Cir. 2015).

In light of the above, the Examiners conclude that the term "control device..." is a generic placeholder having no specific structure associated therewith. Because "control device..." is merely a generic placeholder having no specific structure associated therewith to perform the recited function, the Examiners conclude that FL #1 meets invocation Prong (A).

(B1)(b) 3-Prong Analysis: Prong (B)

FL #1 meets invocation prong (B) because it recites the function to "to control power supply from the external power supply to the external device based on the status information."

(B1)(c) 3-Prong Analysis: Prong (C)

FL #1 meets invocation prong (C) because FL #1 does *not* recite sufficient structure for performing the claimed function. Based upon a review of claims 1-4, 6, 7, and 26-29, particularly claim 1 itself, the Examiners find that FL #1 recites very little structure, if any, for performing the functions as set forth of FL #1. While Examiners recognize the recited structures of a master-control board, the first and second electrode connectors and the communication connector, Examiners do not find these recited structures are sufficient to perform the function of controlling the power supply as recited in FL #1. Rather other un-recited structures would be required to perform this function.

In view of the Examiners findings above that FL #1 meets invocation prongs (A)-(C), the Examiners conclude FL #1 invokes interpretation under 35 U.S.C. §112(f).

(B1)(d) Corresponding Structure

After a claimed phrase has been shown to invoke 35 U.S.C. §112(f), as found above, the next step is to determine the corresponding structure or material as described in the specification for performing the recited function. See MPEP §2181(II).

Based upon a review of the specification of the 105 Patent, the Examiners find that the closest corresponding hardware structure for performing the functions of FL #1 is a combination of the switch K1 and the master-control circuit unit 1281 shown in

FIGS. 4-6 and 8. The switch is turned on and off to control the power line and is controlled via an on/off control signal from the master-control circuit unit 1281, which is a chip or other logic circuit (See 105 Patent FIG. 8, chip U2).

Regarding the software/programming/logic of the master-control circuit unit, Examiners find the appropriate algorithm stored or program or logic for the chip would be that disclosed at col. 9, line 3 to col. 10, line 9 of the 105 Patent wherein the master control circuit unit compares the status information, i.e., temperature of the battery or voltage of the battery, to predefined ranges and outputs a signal to maintain or turn off the switch control unit.

In view of these findings, pursuant to 35 U.S.C. §112(f), FL #1, the control device, in claims 1-4, 6, 7 and 26-29 will be limited to the corresponding structures discussed above, specifically the master-control board, a switch K1, a master-control circuit unit comprising a programmed controller/chip, connectors, first and second electrode connectors and at least one communication connector for performing the recited function as discussed above and equivalents thereof.

Regarding claim 3, Examiners note this claim recites a switch control unit for controlling the connection between the first and second voltage input ports. Following a review of the specification, Examiners find this switch control unit corresponds to switch K1 as shown in FIGS. 4-6 and 8. However, as found above for FL #1, this switch is already part of the corresponding structures for the control device. Accordingly, for claims 3, 4, 6, 7, and 26-28, the switch control unit will correspond to the switch as part of the corresponding structures of FL #1.

Further regarding claim 3, Examiners note this claim recites a master-control circuit unit for obtaining the status information and controlling the switch control unit based on the status information. Following a review of the specification, Examiners find this master-control circuit unit corresponds to an appropriate programmed master-control circuit unit 1281 as shown in FIGS. 4-6 and 8. However, as found above for FL #1, the corresponding structures for this master-control circuit unit is already part of the corresponding structures for the control device. Accordingly, for claims 3, 4 and 12-14, the master-control circuit unit will correspond to the programmed master-control circuit unit as part of the corresponding structures of FL #1.

Regarding claim 4, Examiners find this claim recite additional functionality of the master-control circuit unit, as part of the control device to further control the switch control unit based on the detected electric current value and the voltage value. Examiners thus find the appropriate algorithm stored or programmed into the controller or microcontroller would be that disclosed at col. 7, line 62 to col. 8, line 12 and col. 9, lines 14-29 of the 105 Patent wherein the master control circuit unit compares detected electric current value, the detected first voltage value and/or the detected second voltage value with stored predefined ranges and outputs a signal to maintain or turn off the switch control unit.

If applicant does not intend to have this limitation interpreted under 35 U.S.C. §112 (f) applicant may: (1) amend the claim limitation(s) to avoid it/them being interpreted under 35 U.S.C. §112 (f) (e.g., by reciting sufficient structure to perform the claimed function); or (2) present a sufficient showing that the claim limitation recites

sufficient structure to perform the claimed function so as to avoid it/them being interpreted under 35 U.S.C. §112 (f).

VII. CLAIM REJECTIONS – 35 U.S.C. §103

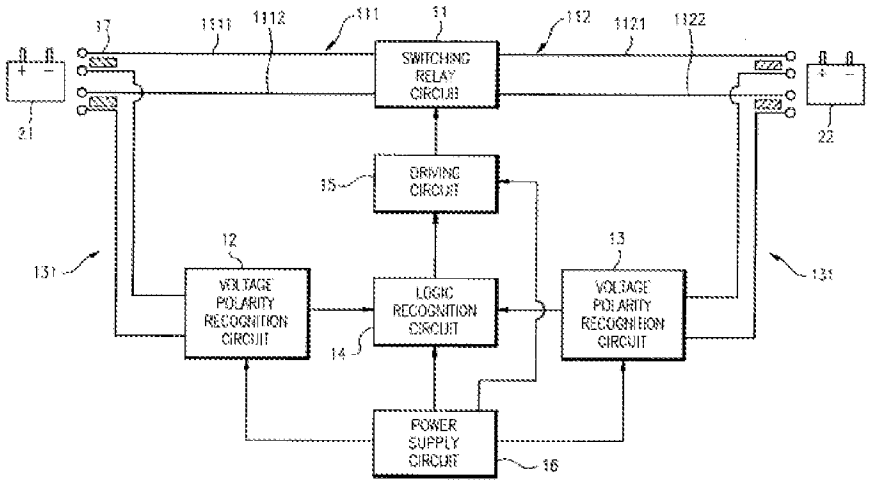
The following is a quotation of 35 U.S.C. §103 which forms the basis for all obviousness rejections set forth in this Office action:

> 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 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.

A. Obviousness Rejections Applying Sheng and Eggert

Claims 1 and 2 are rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 6,262,492 to Shyan-Fang Sheng (hereinafter "**Sheng**") in view of U.S. Patent No. 6,222,342 to Daniel Eggert et al. (hereinafter "**Eggert**").

Regarding claim Sheng teaches a battery clamp for delivering an instantaneous starting current from an external power supply to an external device (See Sheng FIG. 1, reprinted below), the battery clamp comprising:



Sheng FIG. 1

a control device, comprising: a master-control board mounted; and connectors being electrically connected to the master-control board, comprising: at least a first and second electrode connectors, which are connected to an external power supply for receiving power, and at least one communication connector connected to the external power supply for receiving status information of the external power supply, and sending the status information to the master-control board; wherein the control device is configured to control power supply from the external power supply to the external device based on the status information,

Note claim interpretation above wherein this limitation is limited to the master-control board, a switch K1, a master-control circuit unit comprising a programmed controller/chip, connectors, first and second electrode connectors and at least one communication connector for performing the recited function as discussed above and equivalents thereof. Thus, see Sheng FIG. 1 above, logic recognition circuit 14 as the master-control circuit unit, switching relay circuit as switch K1, connectors to the logic recognition circuit/master control circuit unit,

first and second electrode connectors at 17 for connection to an outside power source 21, and wires from clips 17 to voltage polarity recognition circuit for sending status information to logic recognition circuit 14/master-control circuit unit. Further see at least col. 3, lines 1-15 wherein logic recognition circuit 14 has logic/programming to control the switching relay circuit to supply external power to the battery 22/external device based on the voltage signal/status information.

a first and second wire clamps, each having an end configured to receive power from the external power supply via the control device, and another end connected to the external device for supplying power to the external device

See FIG. 1 above, connectors for battery 22 to be jump via jumper cables which as disclosed at col. 1, lines 24-33 have clips to battery to be jumped using power from the battery clamp.

However, while Examiners submit that some sort of board would be provided to hold the necessary components of the circuit shown in FIG. 1 of Sheng above, Examiners find that Sheng does not explicitly discuss such a board. Nevertheless, Eggert discloses mounting the monitoring circuit for jump start battery pack on a printed circuit board (**See Eggert col. 2, lines 27-32**). It would have been obvious at the time the invention was made to provide the salient features of the monitoring circuit of Sheng onto a printed circuit board as taught by Eggert. One having ordinary skill in the art would do so because as noted in Eggert, this is where the noted monitoring circuit would be placed.

Furthermore, Examiners find this combination is merely the use of a known technique to improve similar devices in a similar way. See MPEP §2143(I)(C). As

discussed above, Examiners find that Sheng teaches nearly all recited features of the battery clamp of claim 1, except for a circuit board for the control device. Examiners further find that Eggert teaches an improvement for similar battery clamps by providing the monitoring circuits on printed circuit boards. Examiners further find that such a combination is predictable because Examiners submit that some sort of board would be present in Sheng, Examiners are merely using Eggert to fill in a gap in the teachings of Sheng. Furthermore, such a combination is predictable because no change in operation of Sheng would occur as the combination merely teaches a support for the monitoring circuitry.

Regarding claim 2, Sheng and Eggert teach the battery clamp of claim 1 and further wherein the control device is configured to allow the power supply from the external power supply to the external device when the status information is normal, wherein the status information comprises at least one of the following: temperature, voltage of a battery unit of the external power supply.

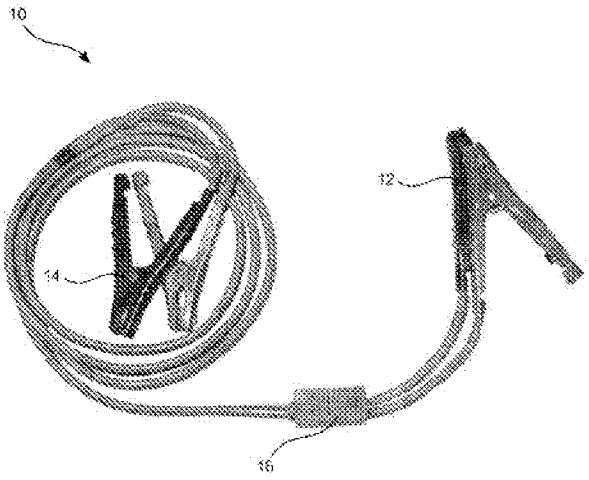
See Sheng at least col. 3, lines 1-15 wherein logic recognition circuit 14 has logic/programming to control the switching relay circuit to supply external power to the battery 22/external device based on the voltage signal/status information, i.e., when the voltage signal indicates the clips are on the wrong terminals of the input battery.

B. Obviousness Rejections Applying Baxter and Richardson

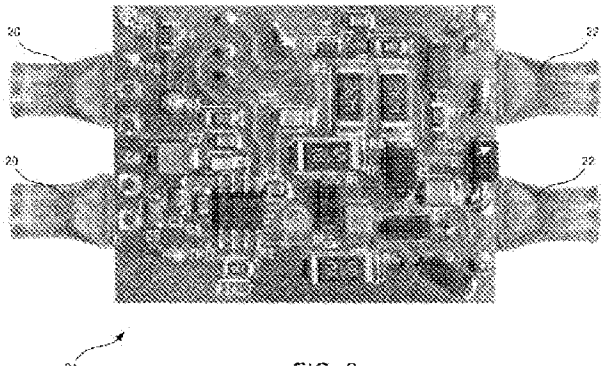
Claims 1 and 2 are rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent Application Publication No. 2010/0173182 to Michael Baxter et al.

(hereinafter "**Baxter**") in view of U.S. Patent Application Publication No. 2013/0154543 to Francis Richardson et al. (hereinafter "**Richardson**").

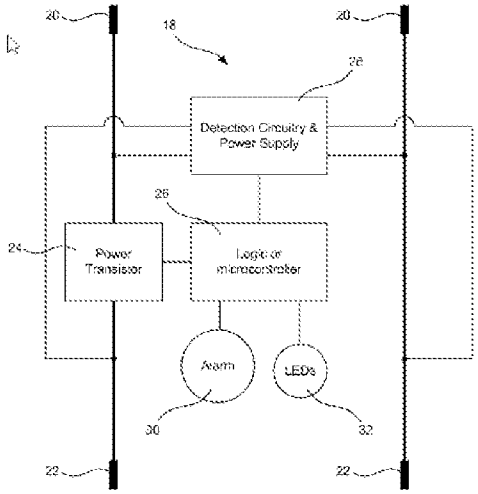
Regarding claim 1, Baxter teaches a battery clamp for delivering an instantaneous starting current from an external power supply to an external device (See Baxter FIGS. 1-3, reprinted below, the battery clamp comprising:



Baxter FIG. 1



Baxter FIG. 3



Baxter FIG. 2

a control device, comprising: a housing; a master-control board mounted within the housing; and connectors disposed at one side of the housing, and being electrically

connected to the master-control board, comprising: at least a first and second electrode connectors, which are connected to an external power supply for receiving power, and;

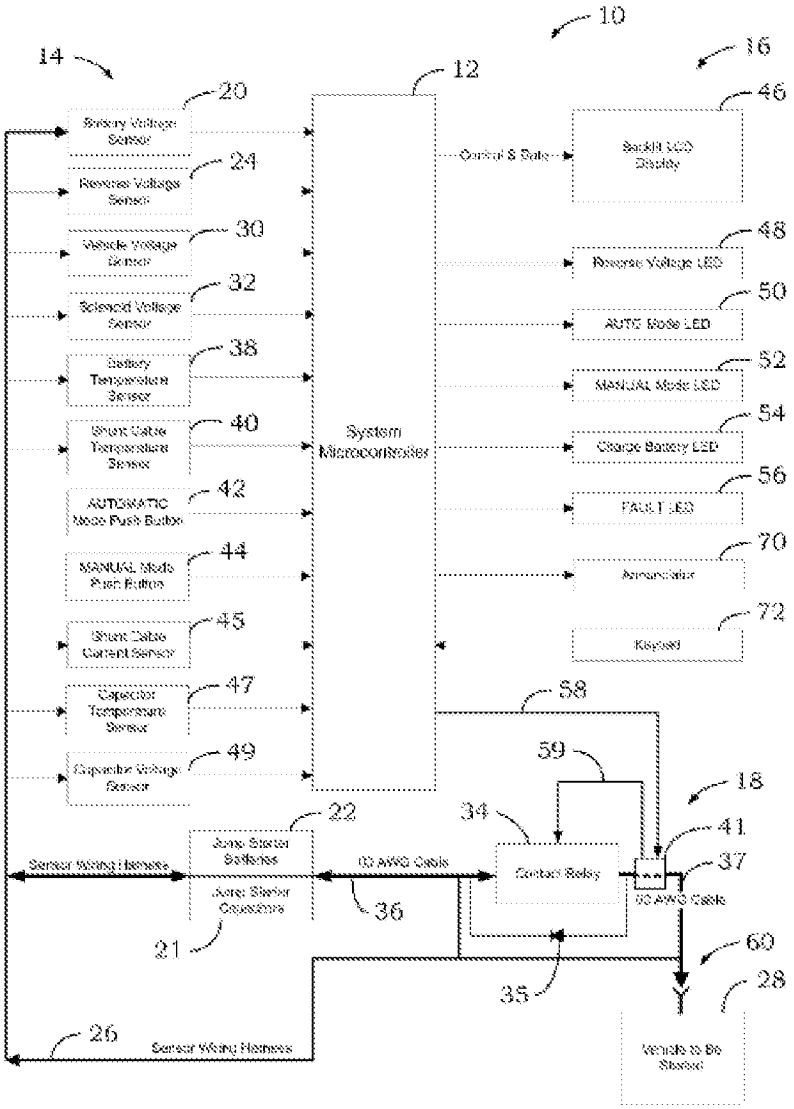
Note claim interpretation above wherein this limitation is limited to the master-control board, a switch K1, a master-control circuit unit comprising a programmed controller/chip, connectors, first and second electrode connectors and at least one communication connector for performing the recited function as discussed above and equivalents thereof.

Thus, see Baxter FIGS. 1 and 3 above for master control board shown having connectors 22 and further first and second electrode connectors 20. Further see FIG. 2 of Baxter which shows the circuit 16 on shown board having logic/microcontroller 26 for controlling operation of the clamp which controls a power transistor 24 for connecting or disconnecting power to jump the dead battery/vehicle.

a first and second wire clamps, each having an end configured to receive power from the external power supply via the control device, and another end connected to the external device for supplying power to the external device;

See Baxter FIG. 1 above, note clamps 12 or 14 which are connected to the battery/vehicle to be jumped.

However, while the disclosure of Baxter teaches the most of the structural recitations of FL #1, Baxter does not teach the communication connector for receiving status information of the battery. Nevertheless, Richardson teaches a jumper cable circuit comprising a system microcontroller and jump starter batteries (**See Richardson FIG. 1, reprinted below, microcontroller 12 and jump starter batteries 22**) wherein



Richardson FIG. 1

at least one communication connector connected to the external power supply for receiving status information of the external power supply, and sending the status information to the master-control board, wherein the control device is configured to control power supply from the external power supply to the external device based on the status information (**See Richardson FIG. 1 above, sensor wiring harness shown but not numbered connected between jump starter batteries 22 and microcontroller 12. Further see Richardson ¶0017 wherein the temperature is monitored and**

jump starting is disable when power source battery is too hot). It would have been obvious at the time the invention was made to further provide a sensor wiring harness between the jump starter battery and microcontroller of Baxter as taught by Richardson. One having ordinary skill in the art would do so to monitor the temperature of the jump start battery to avoid the battery from overheating due to excess current draw (**See Richardson ¶0017**).

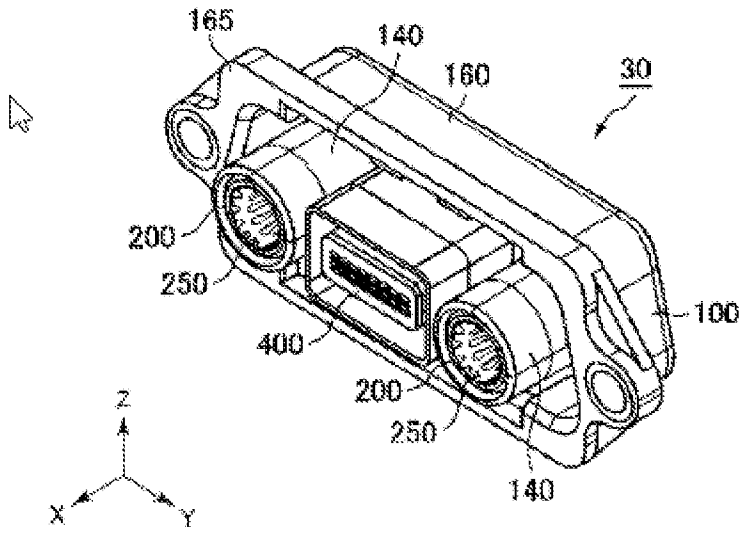
Regarding claim 2, Baxter and Richardson teach the battery clamp of claim 1 and further wherein the control device is configured to allow the power supply from the external power supply to the external device when the status information is normal, wherein the status information comprises at least one of the following: temperature, voltage of a battery unit of the external power supply.

Note combination proposed above wherein in combination, Richardson teach a modification of Baxter to monitor the temperature of the battery. Furthermore, both Baxter and Richardson teach monitoring the voltage of the jump start battery. For example, see Baxter FIG. 2 above and ¶0057 wherein the detection circuitry is used to monitor the voltage of the battery terminals. See also Richardson FIG. 1 above, temperature detection sensor 38 and battery voltage sensor 20.

C. Obviousness Rejections Applying Baxter, Richardson and Higuchi

Claim 29 is rejected under 35 U.S.C. §103 as being unpatentable over Baxter and Richardson as applied to claim 1 above, and further in view of U.S. Patent Application Publication No. 2013/0260586 to Koji Higuchi et al. (hereinafter "**Higuchi**").

Regarding claim 29, the combination of Baxter and Richardson teaches connecting the power source/battery to the master-control board via power via first and second electrode connectors and further connecting the signals from the temperature sensor to the controller, but not a single connector for the lines. Nevertheless, Higuchi teaches a connector (**See Higuchi FIG. 5, reprinted below**) having both first and second power



Higuchi FIG. 2

electrode connectors and a plurality of signal electrode connectors and further wherein the signal/communication connector is provided between the power electrode connectors (**See Higuchi FIG. 2 above, power electrode connectors 200 and signal electrode connectors 400**). It would have been obvious at the time the invention was made to use the connector as taught by Higuchi in the combination of Baxter and Richardson. One having ordinary skill in the art would do so to provide a connector for the noted combination that is water proof (**See Higuchi ¶0002 and ¶0008**).

Furthermore, such a combination is merely use of a known technique to improve similar devices in the same way. As discussed above, Baxter and Richardson teach the more salient features of the claimed invention, except for a particular connector for the

jumper cables shown in FIG. 1 of Baxter above. Furthermore Higuchi teaches a connector for power and signals. Examiners find that one having ordinary skill in the art would have applied the connector of Higuchi to the combination of Baxter and Richardson since the use of the battery clamp of Baxter would be used in the same way as taught by Baxter and further the use of the connector of Higuchi would be used in the same way as taught by Higuchi. Furthermore, Examiners find the combination would be predictable because such a combination would not modify the operation of any of the references.

VIII. ALLOWABLE SUBJECT MATTER

While all claims are rejected under 35 U.S.C. §251 as provided above, claims 3, 4, 6, 7 and 26-28 are allowable over the prior art or record herein. Regarding these claims, the prior art of record herein does not show or teach the recited structures on the master-control board, i.e., the first and second voltage input ports, the communication port, the first and second output ports, the switch control unit and the master-control circuit unit as recited in the claims and in combination with the other features of the claims.

IX. EXAMINERS' RESPONSES TO APPLICANT'S ARGUMENTS

The arguments asserted by Applicant in the Aug 2022 Amendment have been fully considered but are generally moot in view of the amendments to the claims and the new grounds of rejection provided above.

Regarding the claim interpretation invoking 35 U.S.C. §112(f), Applicant argues that the addition of most of the original claim features to claim 1 overcomes the interpretation. Examiners disagree. As discussed above in the claim interpretation section, the claim limitation FL #1 do not recite sufficient structures for performing the functions of the control device. Thus, Examiners maintain the interpretation.

X. PRIOR OR CONCURRENT PROCEEDINGS

Applicant is reminded of the obligation apprise the Office of any prior or concurrent proceedings in which the 105 Patent is or was involved, such as interferences or trials before the Patent Trial and Appeal Board, reissues, reexaminations, or litigations and the results of such proceedings.

XI. INFORMATION MATERIAL TO PATENTABILITY

Applicant is further reminded of the continuing obligation under 37 C.F.R. §1.56 to timely apprise the Office of any information which is material to patentability of the claims under consideration in this reissue application.

XII. CONCLUSION

Claims 1-4, 6, 7 and 26-29 are pending and examined.

Claims 1-4, 6, 7 and 26-29 are rejected.

This action is made non-final in view of the new original patent requirement rejection under 35 U.S.C. §251.

The prior art made of record which is considered pertinent to Applicant's disclosure is listed on the document titled 'Notice of Reference Cited' ("PTO-892").

Unless expressly noted otherwise by the Examiners, all documents listed on the PTO-892 are cited in their entirety.

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to KENNETH WHITTINGTON whose telephone number is (571)272-2264. The Examiner can normally be reached on 8:30am - 5:00pm, Monday - Friday.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Andrew J. Fischer, SPE Art Unit 3992, can be reached at (571) 272-6779. The fax phone number for the organization where this application or proceeding is assigned is 571-273-9900.

/KENNETH WHITTINGTON/
Primary Examiner, Art Unit 3992

Conferees:

/MY TRANG TON/
Primary Examiner, Art Unit 3992

/ANDREW J. FISCHER/
Supervisory Patent Examiner, Art Unit 3992

Notice of References Cited	Application/Control No. 17/112,920	Applicant(s)/Patent Under Reexamination LEI, Yun	
	Examiner KENNETH WHITTINGTON	Art Unit 3992	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-6262492-B1	07-2001	Sheng; Shyan-Fang	H02J7/0034	439/504
*	B	US-6222342-B1	04-2001	Eggert; Daniel M.	H02J7/0045	320/105
*	C	US-20100173182-A1	07-2010	Baxter; Michael	H01M10/488	429/61
*	D	US-20130154543-A1	06-2013	Richardson; Francis D.	B60L53/16	320/109
*	E	US-20130260586-A1	10-2013	Higuchi; Koji	H01R13/5202	439/272
	F					
	G					
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FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/112,920	LEI, Yun
	Examiner	Art Unit
	KENNETH WHITTINGTON	3992

✓	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	10/29/2021	08/30/2022							
	1	✓	✓							
	2	✓	✓							
	3	✓	✓							
	4	✓	✓							
	5	-	-							
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	8	-	-							
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	28		✓							
	29		✓							

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/112,920	LEI, Yun
	Examiner	Art Unit
	KENNETH WHITTINGTON	3992

CPC - Searched*		
Symbol	Date	Examiner
H02J7/0045 OR F02N11/10 OR F02N11/12 OR H01R11/24 OR H01R13/6666 OR H02J7/0029 OR H02J7/0047 OR H02J7/0063 OR H02J7/342 OR F02N11/14 OR F02N2200/063 OR H01M10/4257 OR H02J7/00034 OR H02J2007/0067 OR Y02E60/10	08/30/2022	KJW

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
320	105	08/30/2022	KJW

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
PLUS searches, regular and claims.	10/20/2021	KJW
Prosecution history of US10148105 reviewed.	10/29/2021	KJW
PE2E searched, see attached search history.	10/29/2021	KJW
PE2E searched, see attached search history.	08/30/2022	KJW

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/KENNETH WHITTINGTON/ Primary Examiner, Art Unit 3992	

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L66	3	("5793185" | "7199555").pn. OR ("8084989").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/24 08:35 AM
L67	91	("3118101" | "4161682" | "4215306" | "4902955" | "5075614" | "5077513" | "5083076" | "5297977").pn. OR ("5793185").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/24 08:39 AM
L68	75	("4443751" | "4489223" | "4619437" | "4769586" | "4847545" | "4972135" | "5039930" | "5083076" | "5194799" | "5230637" | "5388384" | "5418776" | "5459391" | "5589292" | "5706976" | "5793185" | "5796255" | "5798577" | "5933491" | "6002235" | "6089588" | "6140796" | "6150793" | "6212054" | "6252378" | "6281600" | "6344733" | "6362599" | "6396240" | "6417668" | "6426606" | "6545445" | "6679212" | "6717291" | "6756764" | "6771073" | "6811906" | "6814413" | "6819083" | "6861767" | "6988475" | "7095135" | "20010035733" | "20020020381" | "20020030466" | "20020038643" | "20020041174" | "20020078914" | "20020082765" | "20020104499" | "20020121877" | "20020155762" | "20020183918" | "20030070645" | "20030080621" | "20030197991" | "20040024546" | "20040036295" | "20040207204" | "20040212351" |	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/24 08:46 AM

		"20040239290" | "20050003710" | "20050051125" | "20050088148" | "20050236900" | "20050269991" | "20060080027" | "20060097577" | "20060119365" | "20060137918" | "20060186738" | "20060192438" | "20060208739" | "20060214508" | "20060244457").pn. AND (PGPB | USPT | USOC).dbnm.					
L69	48	("4079304" | "4829223" | "5793185" | "5796255" | "5814972" | "6756764" | "6819010" | "6871625" | "6988475" | "7161253" | "7345450" | "7528579" | "7808211" | "7834593" | "8237412" | "8575899" | "8947054" | "9007015" | "20020008523" | "20020041174" | "20040239290" | "20050258797" | "20070285049" | "20080061733" | "20080246443" | "20090174362" | "20100301800" | "20100315046" | "20110029157" | "20110100735" | "20120068662" | "20120105010" | "20130241498" | "20130264875" | "20140084844" | "20140139175" | "20140159509").pn. OR ("9397513").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/24 09:29 AM
L70	2	("8076900" "20120068662").pn.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/24 10:40 AM
L71	45	("4161682" | "4595841" | "4902955" | "5162662" | "5212952" | "5444592" | "5982138" | "5998961" | "6002235" | "6155870" | "6577098" | "7301303").pn. OR	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/24 11:03 AM

		("8076900").urpn. AND (PGPB | USPT | USOC).dbnm.					
L72	22	("4217534" | "4366430" | "4871957" | "4969834" | "5103155").pn. OR ("5796255").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/24 11:27 AM
L73	3	("8076900" "20120068662" "5039930").pn.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/24 12:57 PM
L74	81	((US-10148105-B2 OR US-6667624-B1 OR US-9244100-B2 OR US-6218805-B1 OR US-8493022-B2 OR US-5795182-A OR US-10840716-B2 OR US-8199024-B2 OR US-6212054-B1 OR US-5796255-A OR US-10279689-B2 OR US-9007015-B1 OR US-6632103-B1 OR US-6262492-B1 OR US-5965998-A OR US-4769586-A OR US-4757250-A OR US-4746853-A OR US-6803743-B2 OR US-10298034-B2 OR US-8493021-B2 OR US-6222342-B1 OR US-5982138-A OR US-5793185-A OR US-9397513-B2 OR US-8084989-B2 OR US-6734651-B2 OR US-5343351-A OR US-11072256-B2 OR US-8964406-B2 OR US-7199555-B2 OR US-6636015-B1 OR US-9662991-B2 OR US-8076900-B1 OR US-9653933-B2).did. AND USPT.dbnm.) OR ((US-20160336770-A1 OR US-20150054467-A1 OR US-20160001666-A1 OR US-20140315048-A1 OR US-20130264995-A1 OR US-20140265592-A1 OR US-20130169038-A1 OR	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/08/24 03:23 PM

		US-20130099736-A1 OR US-20120139491-A1 OR US-20100173182-A1 OR US-20050110467-A1 OR US-20160240834-A1 OR US-20150200470-A1 OR US-20160268645-A1 OR US-20160181587-A1 OR US-20140002941-A1 OR US-20060145655-A1 OR US-20020155752-A1 OR US-20130154543-A1 OR US-20020041174-A1 OR US-20170141591-A1 OR US-20160046199-A1 OR US-20160011271-A1 OR US-20120004875-A1 OR US-20090174362-A1 OR US-20080129252-A1 OR US-20180006490-A1 OR US-20140159509-A1 OR US-20090218988-A1 OR US-20160036096-A1 OR US-20150153416-A1 OR US-20150084554-A1 OR US-20150084600-A1 OR US-20150032394-A1 OR US-20150025825-A1 OR US-20130193881-A1 OR US-20130127424-A1 OR US-20140043780-A1 OR US-20050258797-A1 OR US-20020030466-A1 OR US-20170334299-A1 OR US-20180006478-A1 OR US-20160241027-A1 OR US-20020121877-A1 OR US-20140139175-A1 OR US-20070285049-A1).did. AND PGPB.dbnm.)					
L75	23	L74 AND (board PCB)	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/24 03:23 PM
L76	7	("4871957" | "5230637" | "5635817" | "5795182"	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/24 10:26 PM

		| "20020057542" | "20100283623" | "20160181587").pn. OR ("10279689").urpn. AND (PGPB | USPT | USOC).dbnm.					
L77	39	("3413487" | "4238722" | "4463402" | "4740740" | "4757250").pn. OR ("4871957").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/24 10:27 PM
L78	47	("1955967" | "4157492" | "4163134" | "4166241" | "4238722" | "4272142" | "4366430" | "4607209" | "4871957" | "4938712").pn. OR ("5230637").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/24 10:29 PM
L79	45	("4161682" | "4595841" | "4902955" | "5162662" | "5212952" | "5444592" | "5982138" | "5998961" | "6002235" | "6155870" | "6577098" | "7301303").pn. OR ("8076900").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 09:22 AM
L80	8	("7771221" | "8076900" | "20040239287" | "20050003710" | "20050162124" | "20070285049" | "20130241488" | "20150171632").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 09:25 AM
L81	52	("4161682").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 09:37 AM
L82	596	connector WITH power WITH (status communication) WITH electrode	(US-PGPUB; USPAT)	OR	ON	ON	2022/08/25 09:39 AM
L83	378	L82 AND @ad<"20160330"	(US-PGPUB; USPAT)	OR	ON	ON	2022/08/25 09:40 AM
L84	16	L83 AND (battery NEAR2 pack)	(US-PGPUB; USPAT)	OR	ON	ON	2022/08/25 09:41 AM
L85	154	("3197830" | "3690397" | "3799063" | "D235555" | "D237718" | "4052655" | "4102273" | "4309644"	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 09:48 AM

		| "4338587" | "4347472" | "4352992" | "4365681" | "4383210" | "4404641" | "D270831" | "D274126" | "4532418" | "4532511" | "D286040" | "D286854" | "4709202" | "4789047" | "4791871" | "4800328" | "D299821" | "4861971" | "4876513" | "4876540" | "4880097" | "D307580" | "D308267" | "4960150" | "4967895" | "D314182" | "5003476" | "5003520" | "5049802" | "5058044" | "5072380" | "5091856" | "5151865" | "5157319" | "5159272" | "5184058" | "5189836" | "5202617" | "5206578" | "5229704" | "5230637" | "5263565" | "5297664" | "5306999" | "5315227" | "D349099" | "5327066" | "5349535" | "5350312" | "5369352" | "5453585" | "5461299" | "5462439" | "5478250" | "5535274" | "5539399" | "D373192" | "5542488" | "5545046" | "5563491" | "5568390" | "5573090" | "5585205" | "5590749" | "5612606" | "5614808" | "5627448" | "5627752" | "5631536" | "5644209" | "5656916" | "5696367" | "5701706" | "5703461" | "5711648" | "5742229" | "5758414" | "5815824" | "5821731" | "5822427" | "5903064" | "5906500" | "5913917" | "5927938" | "5951229" | "D415111" | "5979605" | "5998963" | "6002396" | "6014597" | "D420644" | "6088963" | "6094028" | "D429622" | "6114632" | "6123569" | "D434001" | "6177879" | "6204505" | "6240684" | "6371768" | "6388564" | "6487477" | "6539678" | "6727809" | "6909287" | "D515033" | "7003411" | "D517591" | "D522963" | "7090521" | "7158008" | "7201384" | "7256516" | "D559785"				

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L86	18	("4272142" | "4336975" | "4885524" | "4936796" | "4969834" | "5180310" | "5230637" | "5707250" | "5816849" | "5971799").pn. OR ("6343949").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 09:56 AM
L87	36	("2294085" | "3345601" | "3519977" | "3535899" | "3989544" | "4272142" | "4531798" | "5011437" | "5246379" | "5599210" | "5707250" | "6166454" | "6343949" | "7008259" | "7775365" | "20050070155").pn. OR ("8172603").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 10:16 AM
L88	55	("775732" | "2474407" | "3259754" | "4079304" | "4163134").pn. OR ("4272142").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 10:18 AM
L89	10831	((power NEAR2 cable) WITH (status communication)) AND	(US-PGPUB; USPAT)	OR	ON	ON	2022/08/25 10:37 AM

		@ad<"20160330"					
L90	376	((power NEAR2 cable) WITH (status communication) WITH plug) AND @ad<"20160330"	(US-PGPUB; USPAT)	OR	ON	ON	2022/08/25 10:37 AM
L91	148	plug WITH power WITH (status communication) WITH electrode	(US-PGPUB; USPAT)	OR	ON	ON	2022/08/25 10:39 AM
L92	5	("8928189" | "20050039060" | "20080150512" | "20090198841" | "20150326008").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 10:40 AM
L93	15	("5628641" | "6171129" | "6241538").pn. OR ("7798825").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 12:39 PM
L94	215	MAGSAFE	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 12:43 PM
L95	50	("3390369" | "3491326" | "3599167" | "3805216" | "4150866" | "4176898" | "4540230" | "4628392" | "4825986" | "5145356" | "5408149" | "5565714" | "5582519" | "5621256" | "5762510" | "5863221" | "6146210" | "6162082" | "6372993" | "6552888" | "6568948" | "6685493" | "6793510" | "6866529" | "6902412" | "6932636" | "7794252" | "7922529" | "8482885" | "8721355" | "8729741" | "8905795" | "9088094" | "9379472" | "9437381" | "9564277" | "20110121663" | "20130093242" | "20130093381" | "20140127926" | "20140270645" | "20140273571" | "20140285318" | "20160079749" | "20160111870" | "20160182039" | "20160370547" | "20170098908").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 12:46 PM
L96	18	("4707044" | "7264479"	(US-PGPUB; USPAT;	OR	ON	ON	2022/08/25

		| "8172580" | "8241043" | "8387466" | "8727326" | "20100240229" | "20130040470" | "20130328484" | "20140220793").pn. OR ("9209547").urpn. AND (PGPB | USPT | USOC).dbnm.	USOCR)				02:15 PM
L97	43	("7097461" | "7311526" | "7364433" | "7497693" | "7566224" | "20070072443" | "20070161262" | "20100144164").pn. OR ("8241043").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 02:23 PM
L98	53	("D256356" | "D319813" | "5127848" | "D335647" | "5378552" | "5681178" | "D389457" | "6312277" | "6372377" | "6376122" | "D475014" | "D588990" | "D589444" | "7722372" | "7879485" | "7892011" | "8038450" | "8147280" | "8221165" | "8237400" | "8241043" | "8328581" | "D675568" | "D678203" | "8460008" | "8679666" | "8808031" | "9150107" | "9321340" | "D760650" | "D765030" | "9413040" | "D774458" | "D788037" | "D817278" | "D860131" | "D867993" | "D876358" | "D877064" | "D879707" | "20070087266" | "20090136831" | "20140327444" | "20150069829" | "20150243946" | "20160043448" | "20160107530" | "20160133908" | "20160197320" | "20160226112" | "20160233632" | "20170179461" | "20180008760").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 02:23 PM
L99	64	("4370013" | "4634204" | "4708413" | "4711511"	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 02:42 PM

		| "4746306" | "4946404" | "5026298" | "5330369" | "5348493").pn. OR ("5681178").urpn. AND (PGPB | USPT | USOC).dbnm.					
L100	16	("D310995" | "D319813" | "5816829" | "6296534" | "D476955" | "7534138" | "D691089" | "D691562" | "D814418" | "D827574" | "20120184122" | "20130260586" | "20140302712" | "20150126056" | "20150372413" | "20190237895").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 02:45 PM
L101	5	("2013/0260586").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 02:57 PM
L102	1	"8992245".pn.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 03:00 PM
L103	11	("4772231" | "5021923" | "5358420" | "6152752" | "6203348" | "6210191" | "6409541" | "7029328" | "7033216" | "7104840" | "7597580").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 03:00 PM
L104	28	("4684190" | "5116236" | "5575692" | "5931699" | "6183296" | "6190203" | "6485332" | "6527586" | "6599153" | "6913494").pn. OR ("7029328").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 03:04 PM
L105	37	("3179738" | "4655527" | "4713021" | "4979910" | "5190467" | "5389007" | "5399045" | "5538437" | "5980297" | "6089898" | "6315590" | "6332800" | "6383032" | "6419515" | "6443760" | "6450830" | "6461186" | "6582243" | "6592404" | "6666727" | "6824417" | "6918783" | "7029328" | "7108534" | "7114983" | "7223114" | "7252530" | "7275951"	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 03:06 PM

		| "7297019" | "7410386" | "20050042911" | "20070270017" | "20100248553").pn. OR ("7972164").urpn. AND (PGPB | USPT | USOC).dbnm.					
L106	126	(electrical NEAR2 connector).ti. AND (power AND (data communication)).ab.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 03:13 PM
L107	5	("8928189" | "20050039060" | "20080150512" | "20090198841" | "20150326008").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 03:15 PM
L108	14	("3354454" | "3745512" | "4158473" | "5194020" | "5708705" | "6776652" | "6910911" | "7402078" | "7740501" | "8079878" | "8267723" | "20020182941" | "20090011639").pn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/25 03:24 PM
L109	26	("3354454" | "3745512" | "4158473" | "5194020" | "5708705" | "6776652" | "6910911" | "7402078" | "7740501" | "8079878" | "8267723" | "20020182941" | "20090011639").pn. OR ("8715016").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/29 02:53 PM
L110	1	"20130260586".pn.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/08/29 03:59 PM

PE2E SEARCH - Search History (Interference)

There are no Interference searches to show.

PTO/SB/08a/b
(Based on PTO 07-09 version)

Substitute for form 1449/PTO				*Complete if Known*	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT *(Use as many sheets as necessary)*				Application Number	17/112,920
				Filing Date	12/04/2020
				First Named Inventor	Yun LEI
				Art Unit	3992
				Examiner Name	Wittington, Kenneth
Sheet	1	of	5	Attorney Docket Number	240001.00005

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number Number-Kind Code (*If known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
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Substitute for form 1449/PTO				*Complete if Known*	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	17/112,920
				Filing Date	12/04/2020
				First Named Inventor	Yun LEI
				Art Unit	3992
(Use as many sheets as necessary)				Examiner Name	Wittington, Kenneth
Sheet	2	of	5	Attorney Docket Number	240001.00005

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				First Named Inventor	Yun LEI
				Art Unit	3992
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Art Unit	3992
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Attorney Docket Number	240001.00005

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Yichen Cao/	Date (YYYY-MM-DD)	2022-09-30
Name/Print	Yichen Cao	Registration Number	73,489

This collection of information is required by 37 CFR 1.97 and 1.98. 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 1 hour 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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Battery connector device for a battery jump starting device

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Applicant(s): NOCO CO [US] ± (THE NOCO COMPANY)

Classification: - international: ***F02N11/12; F02N11/14; F02N19/00; H02J7/00; H02J7/32***

- cooperative: **F02N11/12 (EP, GB); F02N11/14 (GB); F02N19/00 (GB); H01M2/30 (EP); H02J1/122 (EP); H02J7/00 (GB); H02J7/0032 (GB);** F02N11/087 (EP); F02N11/14 (EP)

Application number: AU20190201081 20190215

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Abstract of AU2019201081 (A1)

A battery device for use in a vehicle jump starter, the device comprising: a battery comprising at least one battery cell having a positive terminal tab and a negative terminal tab; a positive battery cable of the vehicle jump starter directly connected to the positive terminal tab of the at least one battery cell; and a negative terminal conductor bar directly connected to the negative terminal tab of the at least one battery cell.

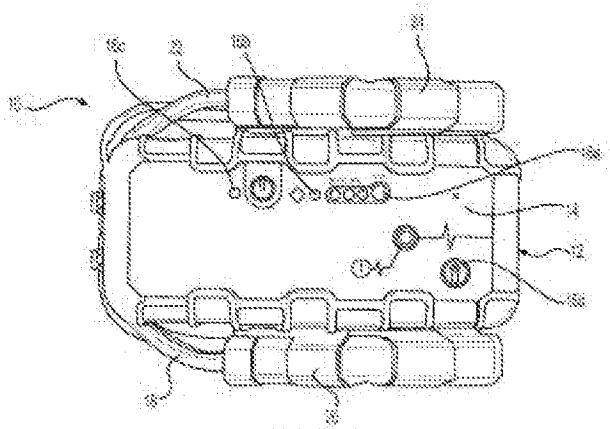

FIG. 1

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ABSTRACT

A battery device for use in a vehicle jump starter, the device comprising:

a battery comprising at least one battery cell having a positive terminal tab and a negative terminal tab;

a positive battery cable of the vehicle jump starter directly connected to the positive terminal tab of the at least one battery cell; and

a negative terminal conductor bar directly connected to the negative terminal tab of the at least one battery cell.

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TITLE

BATTERY CONNECTOR DEVICE FOR A BATTERY JUMP STARTING DEVICE

FIELD

A portable battery connector device, for example, a battery connector arrangement or assembly for a battery jump starting device, in particular a portable vehicle jump starting apparatus, configured for enhancing the conductivity between the battery of the jump starting apparatus and a battery being charged.

BACKGROUND

The exists a portable vehicle battery jump start apparatus as disclosed in U.S. Patent No. 9,007,015 to Nook et al. The apparatus utilizes a lithium ion battery pack. In this type of apparatus, there exists a need to maximize conductivity from the battery pack to the vehicle battery of the vehicle being jump started.

For successful car jump-starts, there are two main factors dictating the results. The first factor is the amount of power provided by the lithium ion battery pack, and the second factor is the maximum conductivity. You need both factors to have the best chance to jump-start big engines. One factor without the other factor is not enough.

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SUMMARY

The presently described subject matter is directed to a battery device, for example, a battery connector, battery connector arrangement, or battery conductor assembly for use in a device for jump starting a vehicle, and a device for jump starting a vehicle comprising the battery connector device.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having at least one battery conductor connected to a terminal of the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having at least one battery conductor or cable connected to a battery tab of the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive conductor and a negative conductor connected to the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive conductor plate and/or a negative conductor plate connected to the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive conductor plate and/or a negative conductor plate connected to the battery, and a positive cable connected to the positive conductor plate and/or a negative cable connected to the negative conductor plate.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal of the battery and/or a negative battery conductor connected to a negative terminal of the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and/or a negative battery conductor connected to a negative terminal contact of the battery, the battery conductors being soldered to the respective terminals of the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal of the battery and/or a negative battery conductor connected to a negative terminal contact of the battery, and a relay connected to one of the battery conductors of the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and/or a negative battery conductor connected to a negative terminal contact of the battery, and a relay connected to the negative battery conductor.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and/or a negative battery conductor connected to

a negative terminal contact of the battery, and a relay connected to the negative battery conductor.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and/or a negative battery conductor connected to a negative terminal contact of the battery, and multiple relays connected to the negative battery conductor.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and/or a negative battery conductor connected to a negative terminal contact of the battery, and a positive cable connected to the positive battery conductor.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a front view of the battery jump starting device with the clamps un-deployed.

FIG. 2 is a rear perspective view of the battery jump starting device shown in FIG. 1.

FIG. 3 is an end perspective view of the battery jump starting device shown in FIGS. 1 and 2.

FIG. 4 is a front perspective view of the battery jump starting device shown in FIG. 1, however, with the clamps deployed.

FIG. 5 is a front perspective view of a battery connector device contained within the battery jump starting device shown in FIG. 1, however, with the negative cable not yet installed.

FIG. 6 is a top planer view of the battery connector device shown in FIG. 5.

FIG. 7 is a side elevational view of the battery connector device shown in FIG. 5.

FIG. 8 is an end elevational view of the battery connector device shown in FIG. 5.

FIG. 9 is a perspective view of the battery connector device shown in FIG. 5, however, with the negative cable connected to the battery connector device.

FIG. 10 is a view perspective view of the battery connector device shown in FIG. 5, however, with a diode connector installed on the positive cable.

FIG. 11 is a perspective view of the battery connector device connected to other components or parts of the battery jump starting device.

FIG. 12 is a perspective view of the battery assembly of the battery connector device shown in FIG. 5.

FIG. 13 is a front perspective view of another battery connector device for the battery jump starting device.

FIG. 14 is a detailed view of the positive cable connection with the relay printed circuit board prior to being soldered thereto.

FIG. 15 is a detailed view of the positive cable connection with the relay printed circuit board after being soldered thereto.

FIG. 16 is a front perspective view of the battery assembly of the battery connector device shown in FIG. 13.

FIG. 17 is a partial top planar view of the battery assembly shown in FIG. 16, however, with the positive terminal conductor sheet in an unwound condition.

FIG. 18 is a partial top planer view of the positive terminal conductor of the battery assembly shown in FIG. 16.

FIG. 19 is an end perspective view of the positive terminal conductor partially wound around the end of the positive cable.

FIG. 20 is an end perspective view of the positive terminal conductor fully wound around the end of the positive cable.

FIG. 21 is a side perspective view of the positive terminal conductor fully wound around and soldered to the end of the positive cable.

FIG. 22 is an opposite end perspective view of the positive terminal conductor fully wound around and soldered to the end of the positive cable.

FIG. 23 is a perspective view of the diode connector between sections of the positive cable.

FIG. 24 is a perspective view of a Schottky Diode used in the diode connector.

FIG. 25 is a perspective view of the diode connector insulated with a shrink wrap sleeve.

FIG. 27 is a graphical illustration showing a load test of the battery connection shown in FIGS. 5-10.

FIG. 28 is a graphical illustration showing a load test of the battery connection shown in FIGS. 13-25.

FIG. 29 is a front view of a further battery connector device for the battery jump starting device.

FIG. 30 is a front view of the battery connector device comprising a plurality of battery cells, separate tab, and conductors (e.g. plate conductors) prior to assembly.

FIG. 31 is a front view of the battery connector device comprising battery cells being prepared with separate tabs for lengthening the tabs.

FIG. 32 is a front view of the battery connector device comprising the plurality of battery cells, separate tab, and conductors shown in FIG. 30, after assembly.

FIG. 33 is a perspective view showing the battery connector device comprising the battery cell assembly shown in FIG. 32, after folding the battery cells.

FIG. 34 is an end perspective view of the battery connector device showing the separate tab being wrapped or wound around an exposed end of the positive cable, and soldered together.

FIG. 35 is an opposite end perspective view of the battery connector device showing a negative battery tab wrapped around the negative terminal conductor plate and welded and/or soldered together.

FIG. 36 is a perspective view of the battery connector device showing the flat separate tab connected to the battery and extending outwardly prior to connection to the positive cable.

FIG. 37 is a side view of the temperature sensor assembly with wires and connector.

FIG. 38 is a perspective view of the diode circuit board assembled connected inline or spliced into the positive cable.

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DETAILED DESCRIPTION

A battery jump starter device 10 is shown in FIGS. 1 and 2. The battery jump starting device 10 comprises a casing 12 having a display 14 provided with an arrangement of light emitting diodes (LEDs) 16.

The battery jump starting device 10 further comprises a positive cable 18 having a positive clamp 20 and a negative cable 22 having a negative clamp 24. The positive cable 18 and negative cable 22 pass through openings 12a, 12b, respectively, in the casing 12.

The clamps 20, 24 are stowed away or docked in an un-deployed mode by clamping each to a respective side posts 26 extending outwardly on opposite sides of the casing 12, as shown in FIG. 1. The side posts 26 are shown in FIG. 2. The clamps 20, 24 are docked when the battery jump starter device 10 is in non-use, and then unclamped from the side post 26 during use.

The battery jump starting device 10 is configured to jump start a vehicle battery. For example, the battery jump starting device 10 can be the PORTABLE VEHICLE JUMP START APPARATUS WITH SAFETY PROTECTION disclosed in U.S. Patent No. 9,007,015, which is fully incorporated herein by reference, or a device or apparatus similar thereto.

The battery jump starting device 10 comprises electrical components or parts located inside the casing 12. For example, the battery jump starting device 10 comprises a battery connector device 100 shown in FIGS. 3 - 9.

The battery connector device 100 comprises a battery assembly 110 having a battery 112. For example, the battery 112 is a lithium ion rechargeable type battery. The

battery connector device 100 is configured to maximize conductivity from the battery 112 to the cables 18, 22 and clamps 20, 24 of the battery jump starter device 10. The battery 112 comprises a battery casing 112a, for example, a rectangular-shaped battery casing 112a.

The battery 112 comprises a positive tab at one end (e.g. width) of the battery 112, and a negative terminal tab at an opposite end (e.g. width) of the battery 112. For example, the battery 112 comprises one or more battery cells each having a positive and negative tab. For example, the positive tab from one battery cell is located at the one end of the battery 112 and the negative tab from one battery cell is located at the opposite end of the battery 112. A positive terminal conductor plate 114 is connected (e.g. soldered, welded, or sonically welded) at the one end of the battery 112 to the positive tab (i.e. contact) of the battery 112. The positive terminal conductor plate 114 extends along the one end (e.g. width) of the battery 112.

The positive cable 18 can be connected (e.g. directly connected by soldering) to the positive terminal conductor plate 114 and/or the positive tab of the battery 112. For example, the positive terminal conductor bar 114 can be provided with a conductive loop 116 wrapping around (e.g. entirely wrapping around) and connected (e.g. crimped and/or soldered) to an exposed end 18a of the positive cable 18. For example, the positive terminal conductor plate 114 is made from heavy gauge copper sheet (e.g. machined, cut, or stamped therefrom).

As shown in FIGS. 5 and 6, the positive terminal conductor sheet 114 can be configured (e.g. bent) to wrap around one of the square-shaped corners of the rectangular-shaped casing 112a of the battery 112 (e.g. L-shaped). The L-shaped

positive terminal conductor sheet 114 can extend along an end of the battery 112 and along at least a portion of the side of the battery 112, as shown in FIG. 5.

The positive terminal conductor plate 114 can also be mechanically coupled and/or adhered to the outer surface of the battery casing 112a to provide additional support and stability thereof (e.g. assembled to survive mechanical shock when drop testing the battery jump starter device 10). For example, the positive terminal conductor bar 114 can be mechanically connected to the battery casing 112 by adhesive (e.g. silicon adhesive), double sided tape, double sided foam tape, insulated plastic or ceramic connector with snap fit connection and/or adhesive connection, and/or the battery casing 112 can be formed (e.g. molded) to mechanically connect (e.g. snap fit or interference connection) with the positive terminal conductor plate 114.

The positive cable 18 can be a single piece of wire or a cable (e.g. twisted or braided wires) extending from the battery 110 to the positive clamp 20. Specifically, one end of the positive cable 18 is connected to the positive terminal conductor plate 114 connected to the battery 18, and the opposite end of the positive cable 18 is connected to the positive clamp 20.

More specifically, the positive cable 18 can comprise a flexible or bent cable portion 118 for changing the direction of the positive cable 18 within the casing 12. The positive cable 18 can be fitted with a flexible outer sleeve portion 120 transitioning into a flexible inner sleeve portion 122 to flexibly accommodate the positive cable 18 passing through the casing 12. The flexible outer sleeve portion 120 is externally located relative to the casing 12 of the battery jump starter device 10, and the flexible inner sleeve

portion 122 is internally located relative to the casing 12 of the battery jump starter device 10.

The flexible outer sleeve portion 120 is configured to reinforce the connection between the positive cable 18 and the casing 12 of the battery jump starter device while remaining flexible. For example, the flexible outer sleeve portion 120 is provided with one or more grooves 124 (e.g. three (3) shown in FIG. 5) exposing portions of the positive cable 18. The one or more grooves 124 act as hinges to ease bending of the positive cable 18 within the flexible outer sleeve portion 120.

The flexible sleeve 120 comprises an outer flange 124 spaced apart (e.g. a small distance equal to about a wall thickness of the casing 12 of the battery jump starter device 10) from an in inner flange 126. The flanges 124, 126 further anchor the positive cable 18 to the casing 12 of the battery jump starter device 10.

The flexible sleeve 120 comprises a sleeve portion 128 (FIG. 6) connecting together the outer flange 124 and inner flange 126. For example, the flexible outer sleeve portion 120 is molded or applied onto and around the positive cable 18 as a single unit (e.g. the flexible sleeve 120 is molded onto a portion of the positive cable 18 inserted within the mold during the molding process). Alternatively, the flexible sleeve 120 is made (e.g. molded) separately, and then installed or assembled onto a portion of the positive cable 18.

The positive cable 18 comprises an inner conductor 18b (e.g. single wire conductor, twisted wires, or braided wires) disposed within an outer insulating sheath 18c (e.g. extruded plastic sheath). The inner conductor 18b, for example, can be a solid wire conductor or a multi strand metal wire conductor comprising bundle of wires 18d.

The inner wire can be made of copper or aluminum. The flexible sleeve 120 can be applied (e.g. molded or installed or assembled) onto and surrounding the outer insulating sheath 18c of the positive cable 18.

The battery connector device 100 further comprises a negative terminal conductor plate 130 connected (e.g. soldered, welded, or sonically welded) at an opposite end of the battery 112 to the negative tab (i.e. contact) of the battery 112. The negative terminal conductor plate 130 can extend along the opposite end of the battery 112.

The other end of the negative terminal conductor plate 130 is provided with a negative terminal conductor plate connector portion 132, as shown in FIGS. 5 and 6.

The negative terminal conductor plate 130 can be configured to wrap around one of the corners of the rectangular-shaped battery 112 (e.g. L-shaped). The L-shaped negative terminal conductor plate 130 can extend along an end of the battery 112 and along at least a portion of the side of the battery 112, as shown in FIGS. 5 and 6.

The negative terminal conductor bar 130 can also be mechanically coupled and/or adhered to the outer surface of the battery casing 112a to provide additional support and stability thereof (e.g. to survive mechanical shock when drop testing the battery jump starter device 10). For example, the negative terminal conductor bar 114 can be mechanically connected to the battery casing 112a by adhesive (e.g. silicon adhesive), double sided tape, double sided foam tape, insulating plastic or ceramic connector with snap fit connection and/or adhesive connection, and/or the battery casing 112 can be formed (e.g. molded) to mechanically connect (e.g. snap fit or interference connection) with the positive terminal conductor plate 114.

The battery connector device 100 further comprises a smart switch battery interface 134. The smart switch battery interface 134 comprises a relay printed circuit board (PCB) 136 having a first circuit board conductor bar 138 spaced apart from a second circuit board conductor bar 140 located on one side of the circuit board 136, as shown in FIGS. 5 and 6.

A pair of relays 142 are mounted on an opposite side of the circuit board 136. The relays 142 include relay anchoring pins 142a located in through holes 136a in the relay printed circuit board 136 (FIGS. 5 and 7). The relays 142 further comprise relay connector pins 142b extending through the through holes 136b provided in the circuit board 136 and slots 138a provided in the first conductor bar 138. The relays 142 even further comprise relay connector pins 142c located in the through holes 136c provided in the circuit board 136 and through holes 140a provided in the second conductor bar 140. The relay anchoring pins 136a are soldered in place to mechanically connect the relays 142 to the circuit board 136. The relay connecting pins 142b and 142c are soldered in place to mechanically and electrically connect the relays 142, respectively, to the circuit board conductor plates 138, 140.

The through holes 136a in the circuit board 136 are rectangular-shaped (FIGS. 5 and 7) and accommodate the relay anchoring pins 142a. Specifically, a base portion of the relay anchoring pins 142a are rectangular-shaped with square-shaped ends. The square-shaped ends are dimensionally less wide verses the base portions creating transverse edges oriented flush with the outer surface of the circuit board 136. When solder is applied to the exposed ends of the relay anchoring pins 142a, the solder

connects to the sides of the square-shaped ends and transverse edges to anchor and lock the relay anchoring pins to the circuit board 136.

The slots 132a provided in negative terminal conductor bar connector portion 132 are rectangular-shaped and the through holes138a in the first circuit board conductor bar 138 (FIG. 3) are T-shaped to accommodate the three (3) horizontally oriented relay connector pins 142b, as shown in FIG. 3. The ends of the relay connector pins 142b are shown flush with the outer surface of the negative terminal conductor bar connector portion 132. When solder is applied to the exposed ends of the relay connector pins 142b, the solder fills in the slots 132a in the negative terminal conductor bar connector portion 132 and the through holes 138a of the first circuit board conductor bar 138, and connects the sides of the connector pins 142b with inner edges of the slots 132a and through holes 138a to anchoring the relays 142 to the circuit board 136 and negative terminal conductor bar connector portion 132. This applied solder also electrically connects the negative terminal conductor bar connector portion 132 to the first circuit board conductor bar 138.

The through holes 140a provided in the second circuit board conductor bar 140 are T-shaped to accommodate the three (3) vertically oriented relay connecting pins 142c, as shown in FIG. 3. The relay connector prongs 140a extend outwardly from the outer surface of the circuit board 136 to connect with the exposed conductor end 144a of the negative cable 144, and shown in FIG. 7. When solder is applied to the exposed conductor end 144a and the ends of the relay connector prongs 140a, the solder fills in the T-shaped slot and electrically connects the relay connector prongs 140a, second

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circuit board conductor 140, and exposed conductor end 144a of the negative cable 144.

The negative terminal conductor bar connector portion 132 of the negative terminal conductor bar 130 is connected (e.g. by soldering) to the first circuit board conductor bar 138 of the circuit board 136. The exposed conductor end 22a (i.e. with the insulating sheath removed) of the negative cable 22 is connected (e.g. by soldering) to the second circuit board conductor bar 140, as shown in FIG. 9.

The battery connector device 100 can be modified by providing the positive cable 18 with a diode connection 150, as shown in FIG. 10. For example, a diode connection is installed (e.g. spliced) into the positive cable 18. The diode connection 150 comprises a diode printed circuit board (PCB) 152 provided with a set of back-charge diodes 154 (e.g. Schottky Diodes) located on one side thereof, and a conductor bar 156 provided on an opposite side of the circuit board 152.

ASSEMBLY

The battery jump starting device 10 comprises the casing 12 having an upper casing portion 12a and a lower casing portion 12b, as shown in FIG. 11. The upper casing portion 12a and the lower casing portion 12b are configured to be connected together when assembling the battery jump starting device 10.

The battery jump starting device 10 further comprises the battery connection device 100 and controller assembly 210 both disposed within the casing 12. The

controller assembly 210 comprises a circuit board 212 located adjacent to another circuit board 214.

The positive terminal of the battery assembly 110 (FIG. 12) is connected to the circuit board 212 via a positive power wire 216. For example, the positive power wire 216 is soldered to the positive conductor bar 114 (FIG. 5). The negative terminal of the battery assembly 110 is connected to the circuit board 214 via a negative power wire 218.

The relay circuit board 136 is provided with a wire set 220 having a connector 222. The connector 222 is configured to connect with the relay board connector 224 located on the circuit board 212 of the controller assembly 210 during assembly of the battery jump starting device 10.

The battery assembly 110 further comprises a wire set 226 having a connector 228. The connector 228 is configured to connect with the battery cell charging/monitoring connector 230 located on the circuit board 212 of the controller assembly 220.

The battery assembly 110 also comprises a battery temperature sensor having a wire set 232 having a connector 234. The connector 234 is configured to connect with the temperature sensor connector 236 located on the circuit board 212 of the controller assembly 220.

The circuit board 212 is provided with in charge power resistors 240 and an out relay 242, as shown in FIG. 11. Further, the lower casing portion 12a is provided with a main user out connector 244 having a wire set 246 connected to the circuit board 214,

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and a main user in connector 248 having a wire set 250 connected to the circuit board 214.

The battery assembly 110 is connected to battery jump starting device 10, as shown in FIG. 11. The battery connector device 110 is installed within the casing 12 of the battery jump starting device 10 when assembled.

ENHANCED CONDUCTIVITY

An enhanced conductivity battery connector device 400 is shown in FIGS. 13 – 25. The enhanced conductivity battery connector device 400 provides a significantly increased conductivity compared to the battery connector device 100, as shown in FIGS. 5 – 10.

The amount of power to be conducted from the battery 412 to the clamps can be enhanced as follows:

1) Increase Wire Gauge

e.g. change 4AWG (American Wire Gage) positive cable 18 and negative cable 22 (FIG. 9) to a 2AWG positive cable 318 and negative cable 322 (FIGS. 13 and 15).

2) Increase Conductivity of Negative Cable Connection

e.g. negative cable end 322a (FIG. 15) connection to the relays will extend all the way across the connector pins 422c of the relays 422.

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3) Increase Conductivity of Positive Cable Connection

e.g. the positive battery tab 414 is lengthened so that the positive cable 318 can be rolled up (FIGS. 17-22) in the positive battery tab 414 and soldered together thoroughly;

4) Increase Conductivity of Diode Connection

e.g. replace the diode connection 150 (FIG. 5) with the diode connection 450 (FIG. 23).

5) Redesign Resistor/Diode Printed Circuit Board (PCB)

e.g. replace the diode printed circuit board (PCB) 152 (FIG. 10) with the diode printed circuit board (PCB) 452 (FIG. 23).

6) Reconnect Resistors

e.g. reconnect resistors R134A&B, R135A&B located on the diode printed circuit board (PCB) 152 (FIG. 10) to be connected again.

A detailed description of each of these enhanced conductivity features or arrangement is set forth below.

1) Increase Wire Gauge

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The gauge of the positive cable 18 and negative cable 22 (FIG. 9), for example, can be increased from 4AWG (American Wire Gage) cable to a 2AWG cable for positive cable 318 and negative cable 322 (FIGS. 13 and 15). The comparative specifications of the 4AWG cable and 2AWG cable are as follows:

	2AWG	4AWG
Diameter	0.2576 in	0.2294 in
	(6.544 mm)	(5.189 mm)
Turns of wire	3.88/in	4.89/in
	(1.53/cm)	(1.93/cm)
Area	66.4 kcmil	41.7 kcmil
	(33.6 mm^2)	(21.2 mm^2)
Resistance/length	0.5127 mΩ/m	0.8152 mΩ/m
	(0.1563 mΩ/ft)	(0.2485 mΩ/m)
Ampacity	95 (60° C)	70 (60° C)
	115 (75° C)	85 (75° C)
	130 (90° C)	95 (90° C)
Fusing current	1.3 kA (10 s)	946 A (10 s)
	10.2 kA (1s)	6.4 kA (1 s)
	57kA (32 ms)	36 kA (32 ms)

The 2AWG cable provides a significant increase of conductivity (i.e. ampacity) compared to the 4AWG cable (i.e. approximately 36%).

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2) Increase Conductivity of Negative Cable Connection

The negative cable 322 (FIG. 15) can be connected to the battery 412 (FIG. 13) in a manner to increase the conductivity (i.e. ampacity) between the battery 412 and negative cable 322. For example, the negative cable end 322a can be directly connected (e.g. soldered) to the connector prongs 442c (FIG. 15) of the relays 442. Specifically, the negative cable end 322a can extend across and directly connect to all relays 342 of the smart switch battery interface 434, as shown in FIGS. 14 and 15. Further, the negative cable end 322a can be connected to a conductor loop 441 of the circuit board conductor bar 440.

The negative cable 322, for example, can be stranded wire comprising an inner electrical wire conductor 322b composed of an untwisted or twisted bundle of wires 322d disposed within an outer electrical insulating sheath 322c. The electrical insulating sheath 322c of the negative cable 322 can be removed from the negative cable end 322a exposing the inner electrical conductor 322b at the negative cable end 322a.

The exposed bundle of wires 322d of the electrical conductor 322b can be forced over the ends of the exposed connector pins 442c of the relays 442 so that strands of wires 322d are captured between the adjacent connector pins 442c. The exposed bundles of wires 332d can be further forced into contact with the conductor bar 440 (e.g. made of copper). Solder 423 is applied to this assembly so that the solder flows between the exposed bundles of wires 422d to the connector pins 442c and the conductor bar 440 to complete the electrical connection between the negative cable 322 and the smart switch battery interface 434 connected to the battery 412.

The length of the exposed bundle of wires 322d is selected so that exposed bundle of wires 322d directly connects with each set of connector pins 442c of each and every relay 442 to provide the maximum electrical conductivity (i.e. maximum ampacity) between the negative cable 322 and the battery 412.

3) Increase Conductivity of Positive Cable Connection

The positive cable 318 can be connected to the battery 412 in a manner to increase the conductivity (i.e. ampacity) between the battery 412 and positive cable 318. For example, the positive cable 318 can be rolled up in the positive battery tab 414 and soldered together thoroughly. The connection between the positive cable 318 and battery 412 is shown in FIGS. 16-22.

The positive cable 318, for example, can be stranded wire comprising an inner electrical wire conductor 318b composed of an untwisted or twisted bundle of wires 318d disposed within an outer electrical insulating sheath 318c. The electrical insulating sheath 318c of the positive cable 318 can be removed from the positive cable end 318a exposing the inner electrical conductor 318b at the positive cable end 318a.

The battery 412 is provided with a positive battery tab 414. The positive battery tab 414 is a metal sheet (e.g. copper sheet) connected to the positive terminal tab 414 of the battery 412.

The exposed bundle of wires 318d of the inner electrical conductor 318b can be soldered with tin, and then rolled up within the positive battery tab 312a. Solder 415 (FIG. 21) is applied to the exposed bundle of wires 318d and the positive battery tab 312a.

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The length of the exposed bundle of wires 318d is selected so that exposed bundle of wires 318d directly connects with the full width of the positive battery tab 414 to provide the maximum electrical conductivity (i.e. maximum ampacity) between the battery 312 and the positive cable 318.

4) Increase Conductivity of Diode Connection

The positive cable 318 can be provided with a diode connection 450 configured to increase the conductivity along the positive cable 318, as shown in FIGS. 23 – 25.

The diode connection 450 comprises a plurality of diodes 454 connected between positive cable sections 318e and 318f (FIG. 25). For example, the diode connection 450 comprises six (6) back-charge type diodes (e.g. Schottky barrier diodes).

The diodes 454 are soldered between the positive cable sections 318e and 318f. Specifically, the diode conductor tabs 454a are soldered to the positive cable section 318e and the diode conductor prongs 454b are soldered to the positive cable section 318f. More specifically, the diode conductor prongs 454b of the diodes 354 extend through the diode circuit board 452, extend into the bundle of wires 318b, and then are soldered in place completing assembly of the diode connection 450.

The diode connection 450 is then insulated, for example, using a shrink wrap insulator 455 (FIG. 25), which is applied around the diode connection 450, and then shrunk by applying heat (e.g. using heat gun).

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5) Redesign Resistor/Diode Printed Circuit Board (PCB)

e.g. redesign of resistor/diode PCB to eliminate the diodes extending therefrom;

6) Reconnect Resistors

e.g. reconnect resistors R134A&B, R135A&B that are on the Resistor/Diode PCB to be connected again.

TEST #1

The battery connection device 100 shown in FIG. 5 was subjected to a 1250A Load Test. The results are shown in FIG. 27, and as follows:

Pulse #1 Average Power of 4799.01W

Pulse #2 Average Power of 5528.99W

Pulse #3 Average Power of 6101.63W

TEST #2

The battery connection device 400 shown in FIG. 13 was subjected to a 1250A Load Test. The results are shown in FIG. 28, and as follows:

Pulse #1 Average Power of 6584.61W

Pulse #2 Average Power of 7149.60W

Pulse #3 Average Power of 7325.91W

This results in a significant increase of approximately twenty percent (20%) for peak power compared to the results of TEST #1.

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Another enhanced conductivity battery conductor device 500 is shown in FIGS. 29 - 37. The enhanced conductivity battery connector device 500 provides a significantly increased conductivity compared to the battery connector device 100, as shown in FIGS. 5 – 10.

The battery conductor device 500 comprises the battery assembly 410, including the battery 512 connected to the positive cable 518 and the negative terminal conductor plate 530. A positive wire 519 is connected directly or indirectly to the positive tab or positive cable 518 of the battery 530, and a negative wire 523 is connected directly or indirectly to the negative tab or negative terminal conductor plate 530. The battery conductor device 500 can further include a bundle of wires 570 connected to or associated with the operation of the battery 512 (e.g. battery temperature sensor, power supply, etc.).

The battery 512 can comprise a single battery cell 512c (FIG. 30), or multiple battery cells 512C connected end-to-end in series. Three (3) separate battery cells 512c are shown in FIG. 30.

The battery cells 512c each have positive and negative tabs 512d located at opposite ends of each battery cell 512c. The battery cells 512c are connected together in series by welding (e.g. sonically and/or thermally welding) and/or soldering respective positive and negative tabs 512d together. For example, the tabs 512d are positioned so as to overlap each other (e.g. edges overlapping opposite tab 512d, or edge-to-edge).

The tabs 512d are metal plates (e.g. relative thin metal foils) extending outwardly from the body and opposite edges of each battery cell 512c. As shown in FIG. 30, the tabs 512d extend along opposite edges at the width of each battery cell 512c. The tabs

512d are each centered and extend most of the width of each opposite edge of each battery cell 512c.

As shown in FIGS. 30 and 31, a separate tab 512e is added or connected to the right side of the battery cell 512c to extend the length of the tab 512d. The separate tab 512e is shown as having the same width as the tab 512d; however, this width can be different. To assemble the separate tab 512e to the tab 512d, for example, the separate tab 512e is positioned to overlap over the tab 512d, and then welded (e.g. sonically and/or thermally welded) and/or soldered together. The exposed end of the positive cable 518 is then wound up inside the separate tab, as shown in FIGS. 32 and 34. For example, the initially flat separate tab 512e is wrapped around the exposed end of the positive cable 518, and then connected to the exposed end by welding (e.g. sonically and/or thermally welding) and/or soldering. For example, a layer of solder is applied to one or both sides of the separate tab 512e, and then after wrapping the separate tab 512e around the exposed end of the positive wire 518, the assembly is heated to melt the layered solder and solder the assembly together.

The three (3) battery cells 512c once connected together, as shown in FIG. 32, are then folded over each other into the layered battery cell arrangement shown in FIG. 33. The layered battery cell arrangement can be packaged (e.g. the three (3) battery cells can be taped or shrink wrapped together), or placed within a battery cover or casing, as shown in FIG. 34.

As shown in FIG. 35, the negative tab 512d can be attached to the negative terminal conductor plate 530. For example, the negative tab 512d can be wrapped partially or fully, as shown, around the negative terminal conductor plate 530. The

negative tab 512d can be provided with a plurality of through holes 512f to facilitate welding and/or soldering the negative tab 512d to the negative terminal conductor plate 530. For example, the through holes 512f can be square-shaped through holes arranged into a matrix, as shown in FIG. 35. The negative wire 523 is shown connected (e.g. soldered) to the negative tab 512d.

A separate tab 512e (see FIG. 30) can be connected to the negative tab 512d to lengthen same, so that the lengthened negative tab can be wrapped or wound around the negative terminal conductor plate 530 more than one time (e.g. 2, 3, 4, or more times). In this manner, the electrical connection between the negative tab 512d and the negative terminal conductor plate 530 can be enhanced. The separate tab 512e can be provided with a layer of solder on one or both sides, so that after the separate tab 512e is wrapped or wound around the negative terminal conductor plate 530, this assembly can be heated up to solder the separate tab 512e onto the negative terminal conductor plate 530.

The completed assembly of the battery conductor device 500 with the connected separate positive tab 512d ready to be wrapped or wound an exposed end of the positive cable 518 (FIG. 29) can be seen in FIG. 36. The bundle of wires 570 shown in FIG. 36, includes wires 572 for a temperature sensor embedded within the battery 512 (e.g. temperature sensor located near battery tab or between battery cells. The temperature sensor 574 having two (2) wires 572a, 572b is shown in FIG. 37.

The battery conductor device 500 can comprise a diode connector 550 connected inline or splice into the positive cable 518, as shown in FIG. 38.

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The battery conductor device 500 comprises a diode circuit board 552 having a plurality of diodes 454 assembled thereon. The diodes 454 each have a diode conductor tab 454a connected (e.g. soldered) to an exposed end of the positive cable 518. The prongs of the diodes 454 extend through holes in the diode circuit board 552, and are soldered to both the conductive traces and exposed end of the positive cable 518 along with a resistor 576 to complete the assembly.

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CLAIMS

1. A battery connector device for a battery jump starting device having a smart switch, the device comprising:

a battery comprising a positive terminal tab and a negative terminal tab;

a positive terminal conductor sheet connected to the positive terminal tab of the battery;

a negative terminal conductor bar connected to the negative terminal tab of the battery;

a positive cable connected to the positive terminal conductor sheet of the battery;

a smart switch interface connectable to the smart switch of the jump starting device, the smart switch interface comprising a circuit board having a first circuit board conductor bar spaced apart from a second circuit board conductor bar, the first circuit board conductor bar electrically connected to the negative terminal conductor bar of the battery, the smart switch interface further comprising one or more relays connected between the first circuit board conductor bar and the second circuit board conductor bar for providing isolation between the negative terminal tab of the battery and a battery being jump started; and

a negative cable connected to the second circuit board conductor bar.

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2. A battery connector device for a battery jump starting device having a smart switch, the device comprising:

a rechargeable battery comprising a positive terminal tab and a negative terminal tab;

a positive terminal conductor sheet connected to the positive terminal tab of the battery;

a negative terminal conductor bar connected to the negative terminal tab of the battery;

a positive cable connected to the positive terminal conductor sheet of the battery;

a smart switch interface connectable to the smart switch of the jump starting device, the smart switch interface comprising a circuit board having a first circuit board conductor bar spaced apart from a second circuit board conductor bar, the first circuit board conductor bar electrically connected to the negative terminal conductor bar of the battery, the smart switch interface further comprising a plurality of relays each connected between the first circuit board conductor bar and the second circuit board conductor bar for providing isolation between the negative terminal tab of the battery and a battery being jump started; and

a negative cable connected to the second circuit board conductor bar, the negative cable directly electrically connecting to each of the plurality of relays.

3. A battery connector device for a battery jump starting device having a smart switch, the device comprising:

a rechargeable battery comprising a positive terminal tab and a negative terminal tab;

a positive terminal conductor sheet connected to the positive terminal tab of the battery;

a negative terminal conductor bar connected to the negative terminal tab of the battery;

a positive cable connected to the positive terminal conductor sheet of the battery;

a smart switch interface connectable to the smart switch of the jump starting device, the smart switch interface comprising a circuit board having a first circuit board conductor bar spaced apart from a second circuit board conductor bar, the first circuit board conductor bar electrically connected to the negative terminal conductor bar of the battery, the smart switch interface further comprising multiple relays each connected between the first circuit board conductor bar and the second circuit board conductor bar for providing isolation between the negative terminal tab of the battery and a battery being jump started;

a negative cable connected to the second circuit board conductor bar, the negative cable directly electrically connecting to each of the plurality of relays; and

a diode connection provided between a first section of the positive cable and a second section of the positive cable.

4. The device according to claim 1, wherein the one or more relays is multiple relays connected in parallel between the first circuit board conductor bar and the second circuit board conductor bar.

5. The device according to claim 1, wherein the negative terminal conductor bar is configured to mechanically and electrically connect the battery to the smart switch battery interface.

6. The device according to claim 5, wherein the negative terminal conductor bar is configured to position the smart switch battery above and adjacent to the battery.

7. The device according to claim 1, wherein the positive terminal conductor sheet wraps around one end of the positive cable to electrically connect the battery to the positive cable.

8. The device according to claim 1, wherein the positive terminal conductor bar is ultrasonically welded to the positive terminal tab of the battery and the negative terminal conductor bar is ultrasonically welded to the negative terminal tab of the battery.

9. The device according to claim 1, wherein the battery is rectangular-shaped and a width of the positive terminal conductor sheet of the battery is equal to the width of the battery, and the negative terminal conductor bar is L-shaped and configured to wrap around a respective corner of the battery.

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10. The device according to claim 9, wherein the battery tabs are mounted flush with a casing of the battery.

11. The device according to claim 1, wherein a diode connection is provided between a first section of the positive cable and a second section of the positive cable.

12. The device according to claim 11, wherein the diode connection comprises one or more diodes connected between the first section of the positive cable and the second section of the positive cable.

13. The device according to claim 12, wherein the diode connection comprises multiple diodes each connected between the first section of the positive cable and the second section of the positive cable.

14. The device according to claim 13, wherein conductor tabs of the multiple diodes are connected to the first section of the positive cable and the conductor prongs of the multiple diodes are connected to the second section of the positive cable.

15. The device according to claim 14, wherein the multiple diodes are connected to a printed circuit board.

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16. The device according to claim 15, wherein the conductor prongs of the multiple diodes extend through the printed circuit board and electrically connect with the second section of the conductor prongs.

17. The device according to claim 16, wherein the multiple diodes are arranged abutting each other along a single axis.

18. The device according to claim 13, wherein the diode connector is insulated with a heat shrink insulator.

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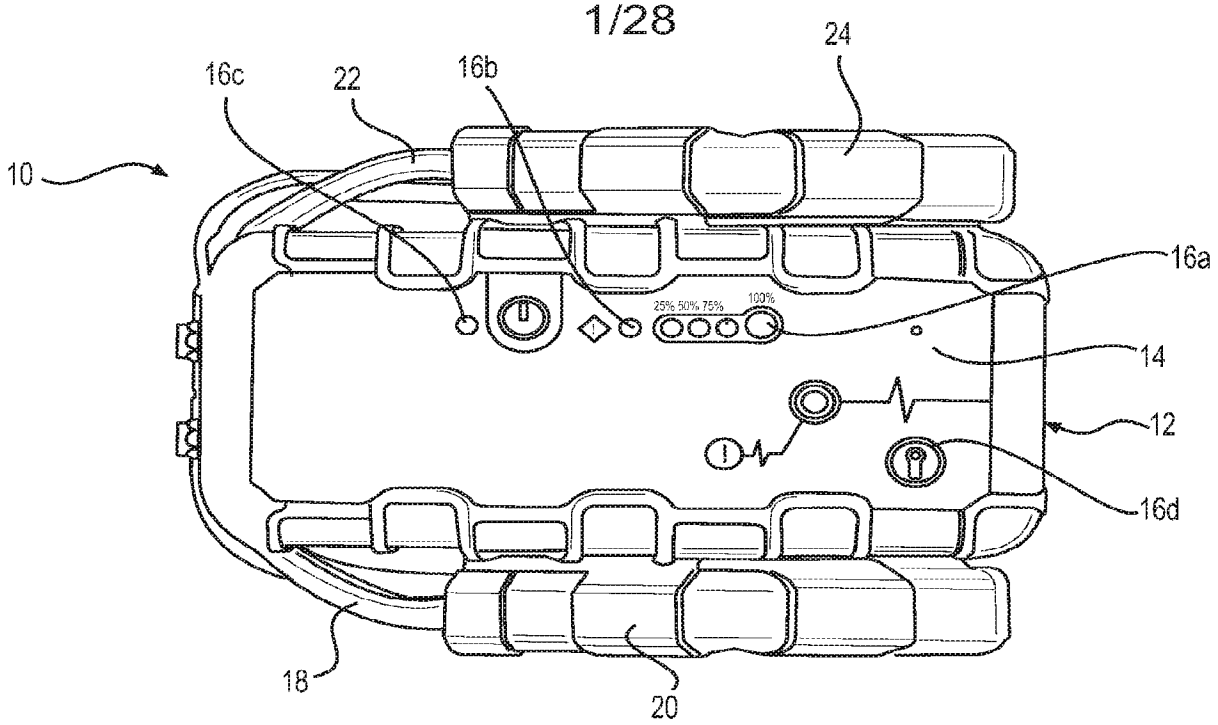

FIG. 1

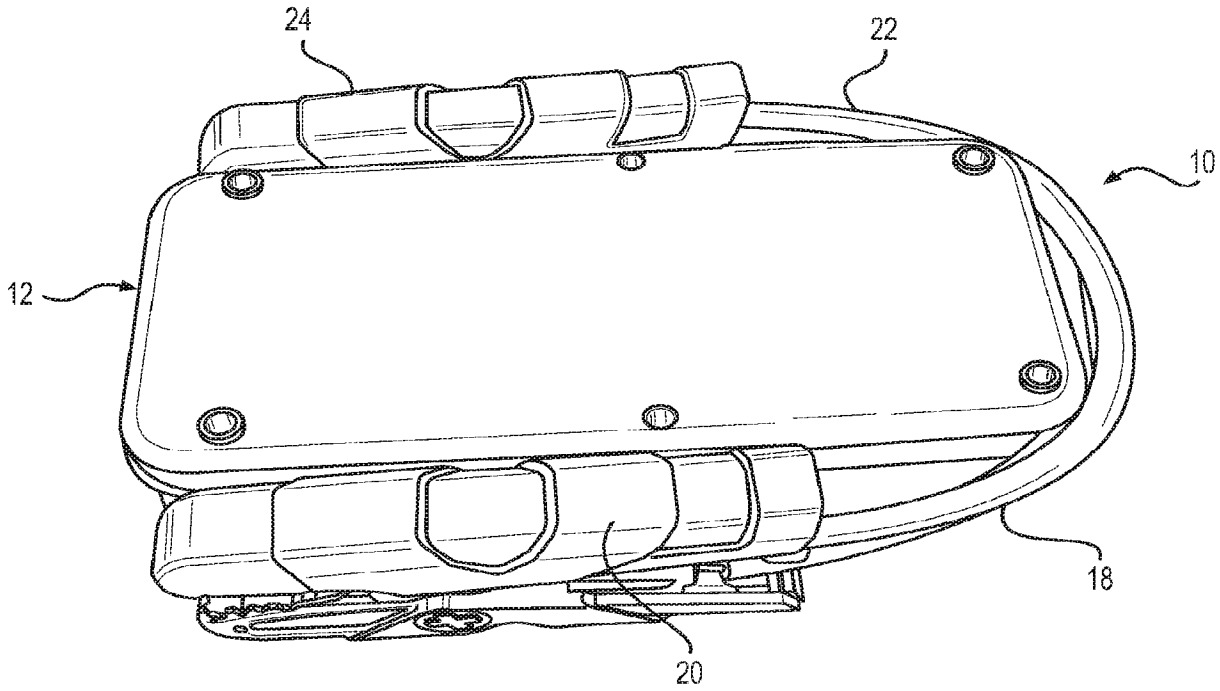

FIG. 2

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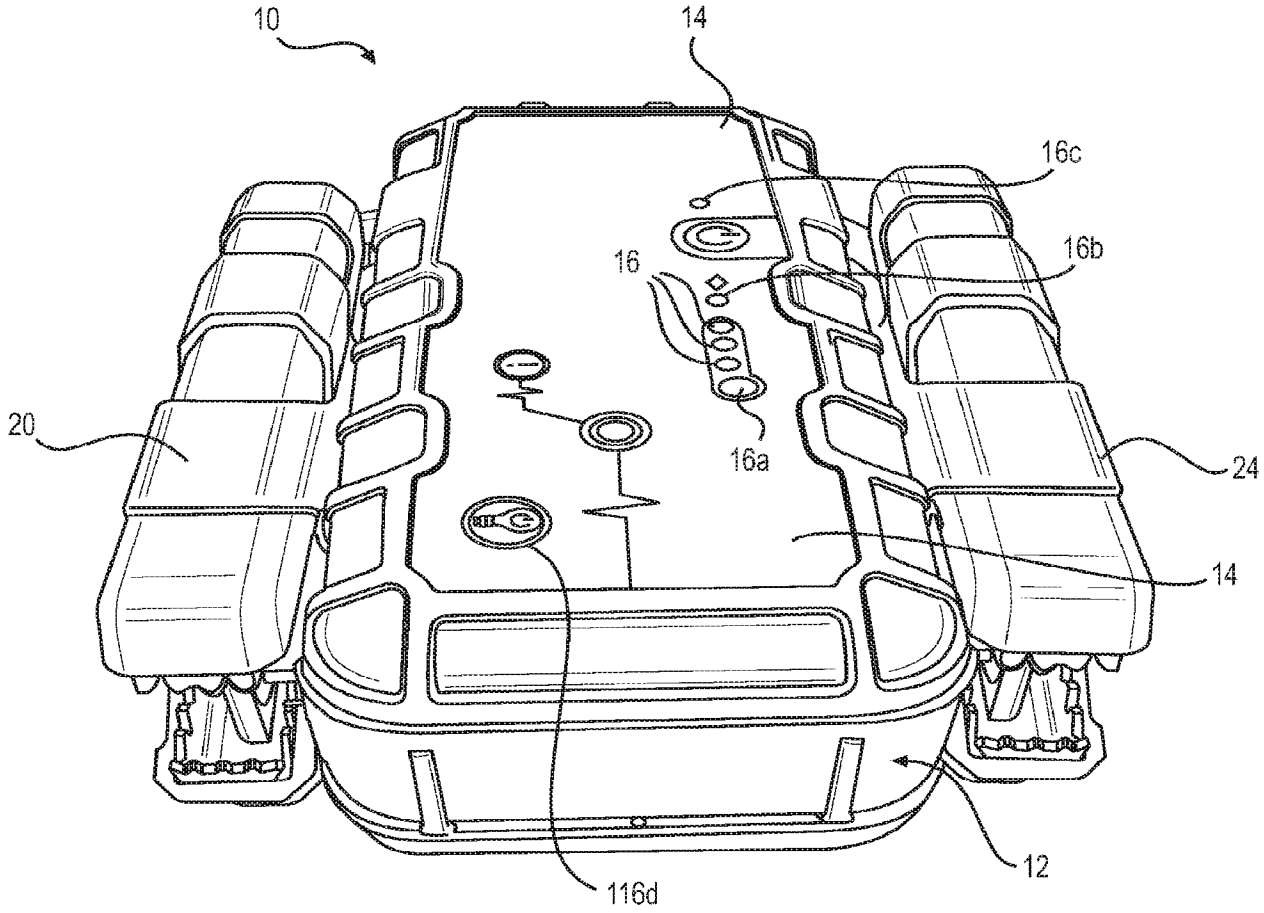

FIG. 3

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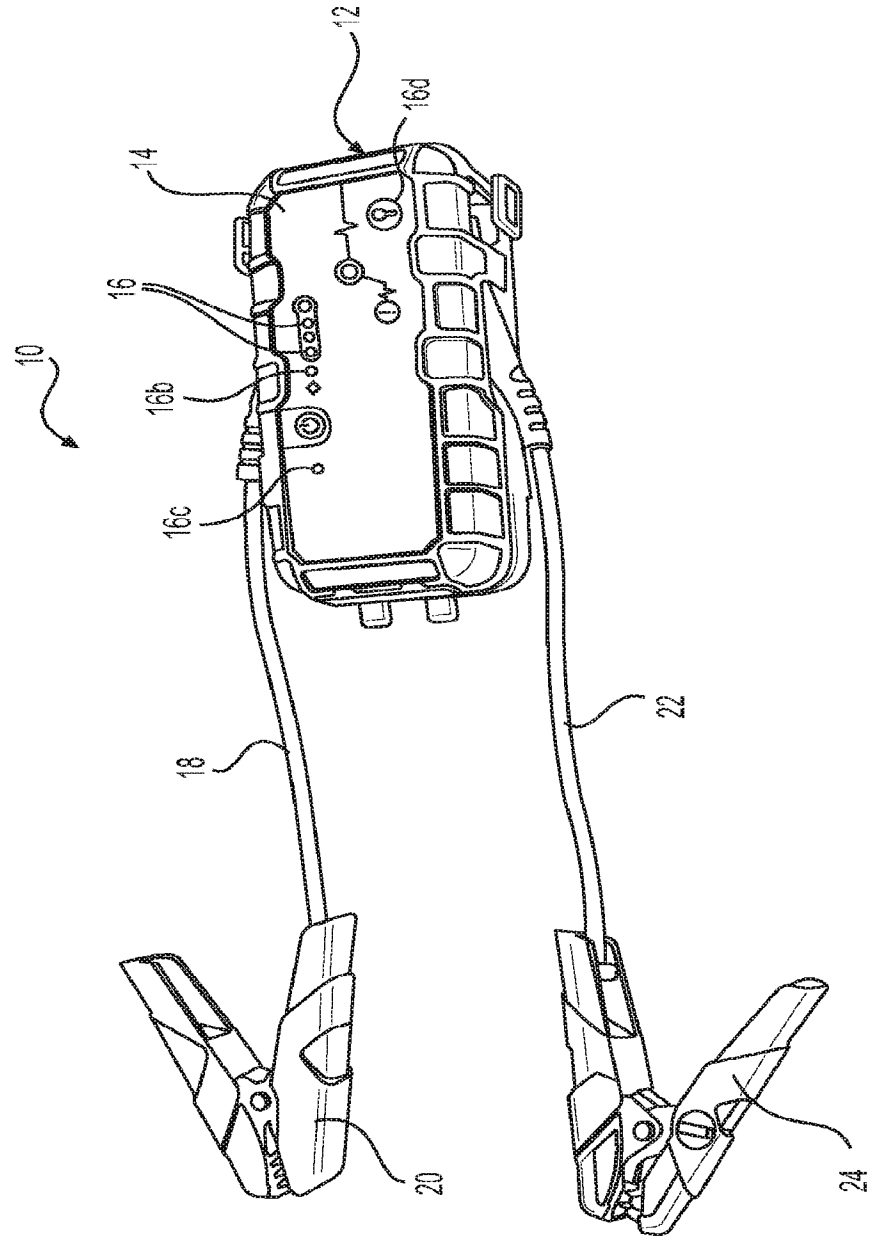


FIG. 4

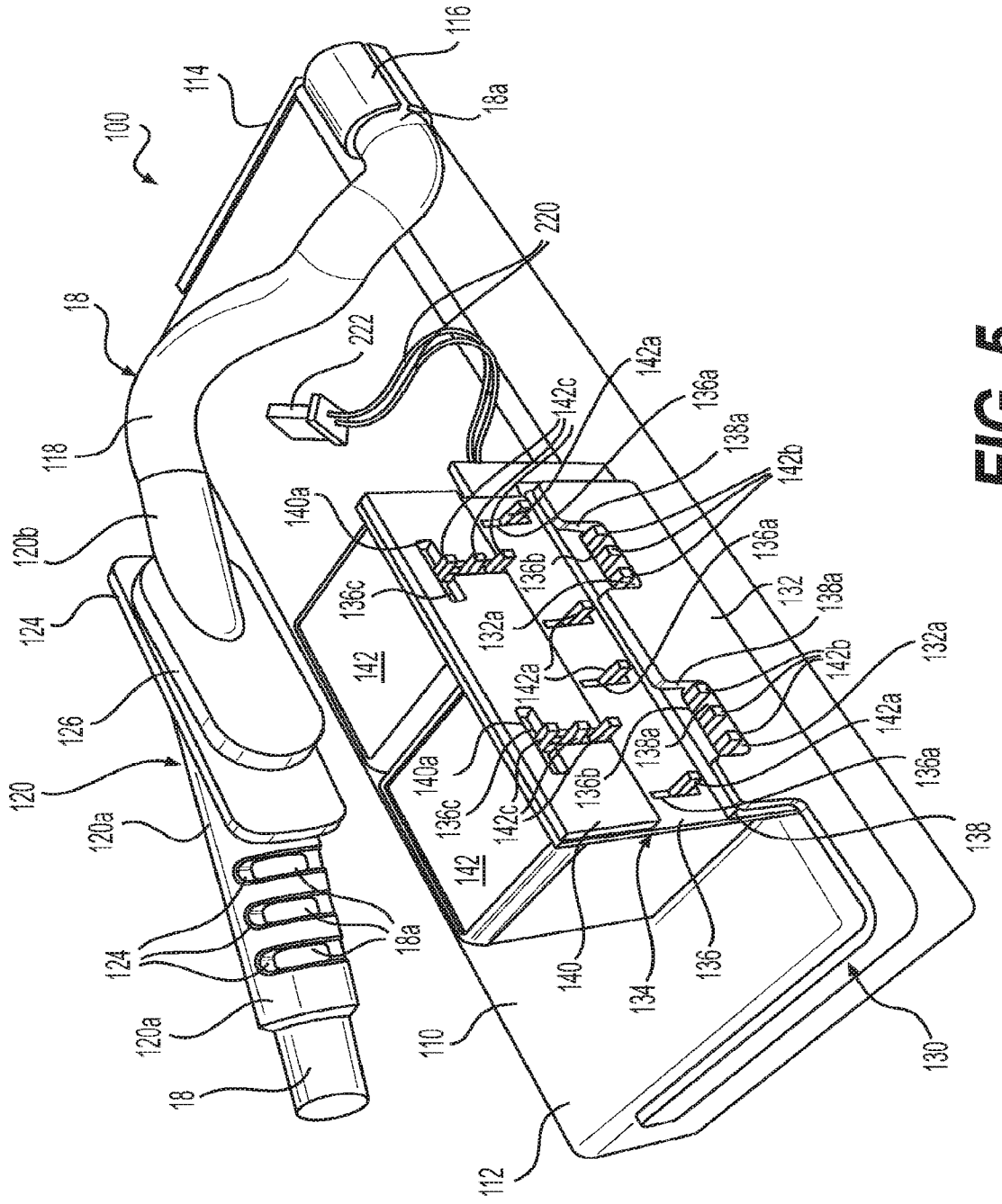
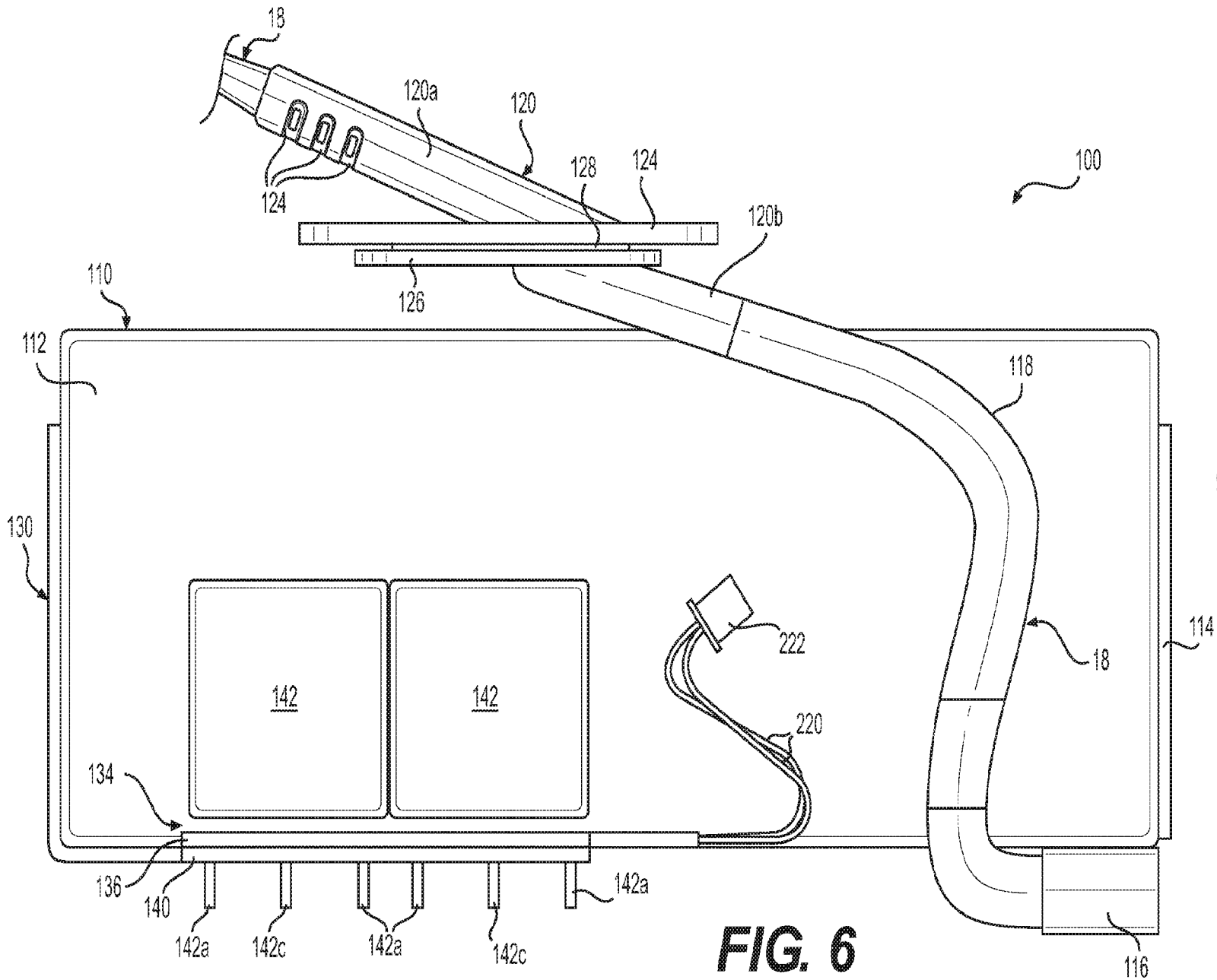

100
114
116
18a
18
220
222
118
120b
124
126
120
120a
142a
142c
136a
138a
142b
140a
136c
136b
132a
132
142
138
140
134
136
110
112
130

FIG. 5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120a
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124
128
124
100
120b
126
110
112
118
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114
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222
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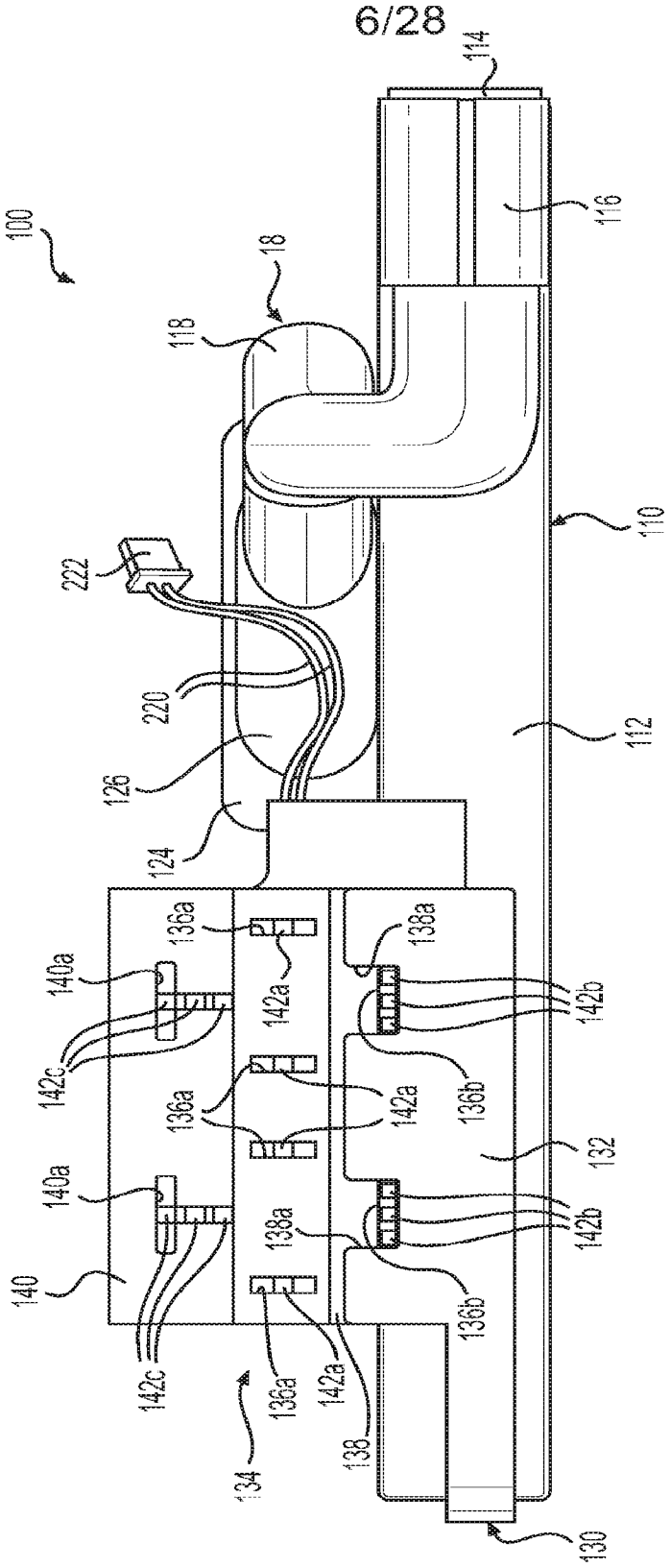
134
136
140
142a
142a
142c
142a
142c
116

FIG. 6


100
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114
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118
110
222
220
112
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142c
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136b
132
138a
140
138
134
130

FIG. 7

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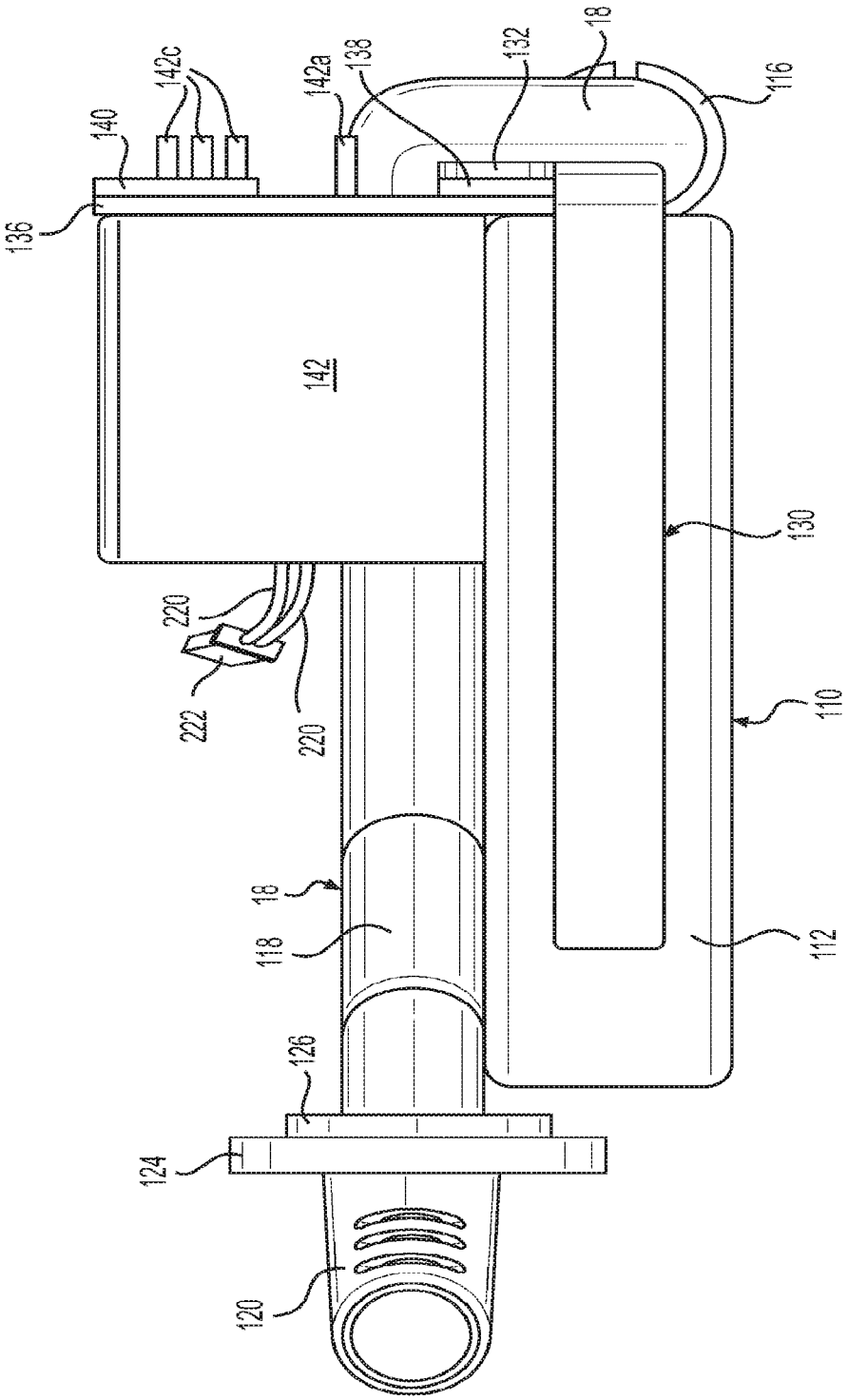

FIG. 8

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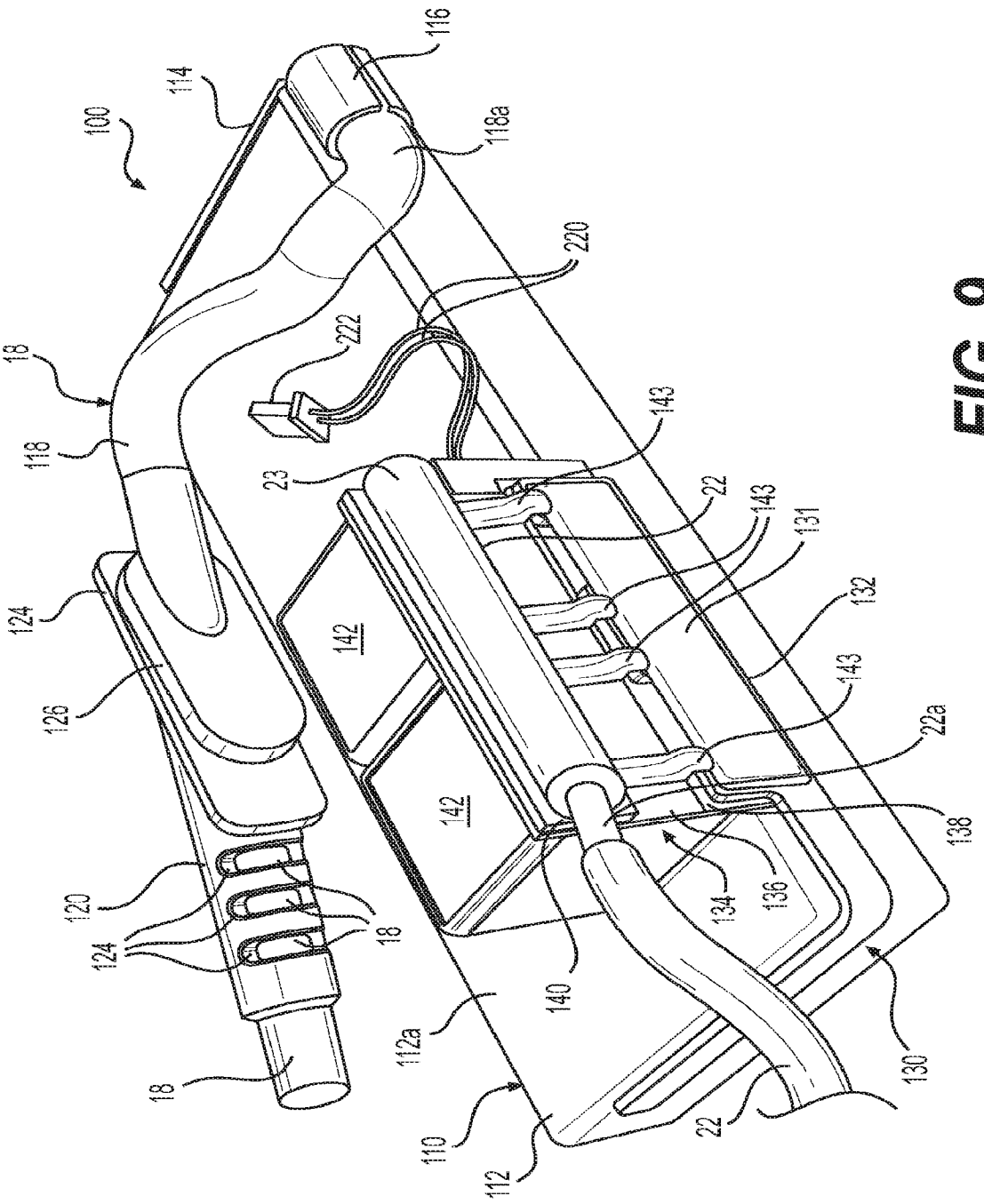


FIG. 9

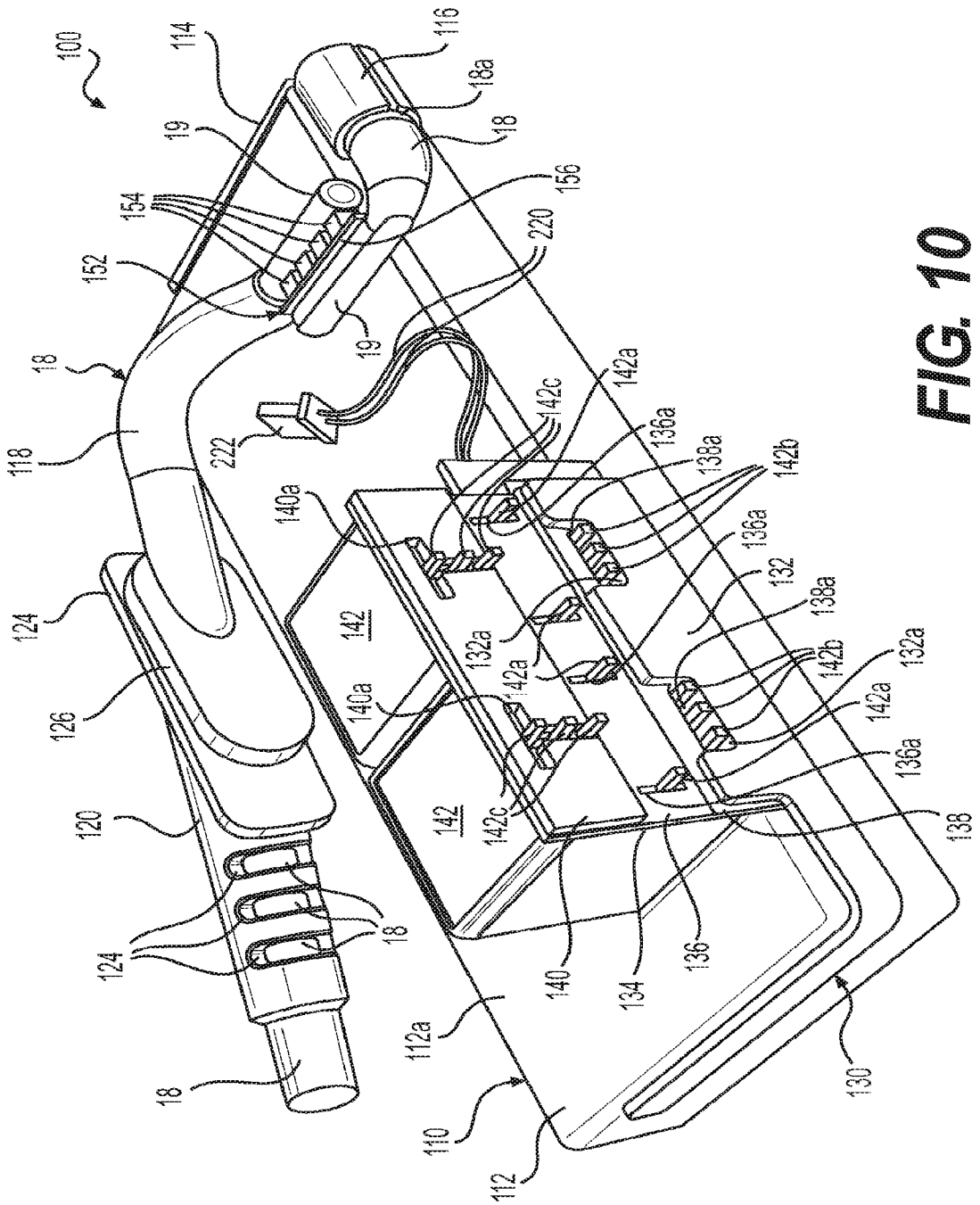
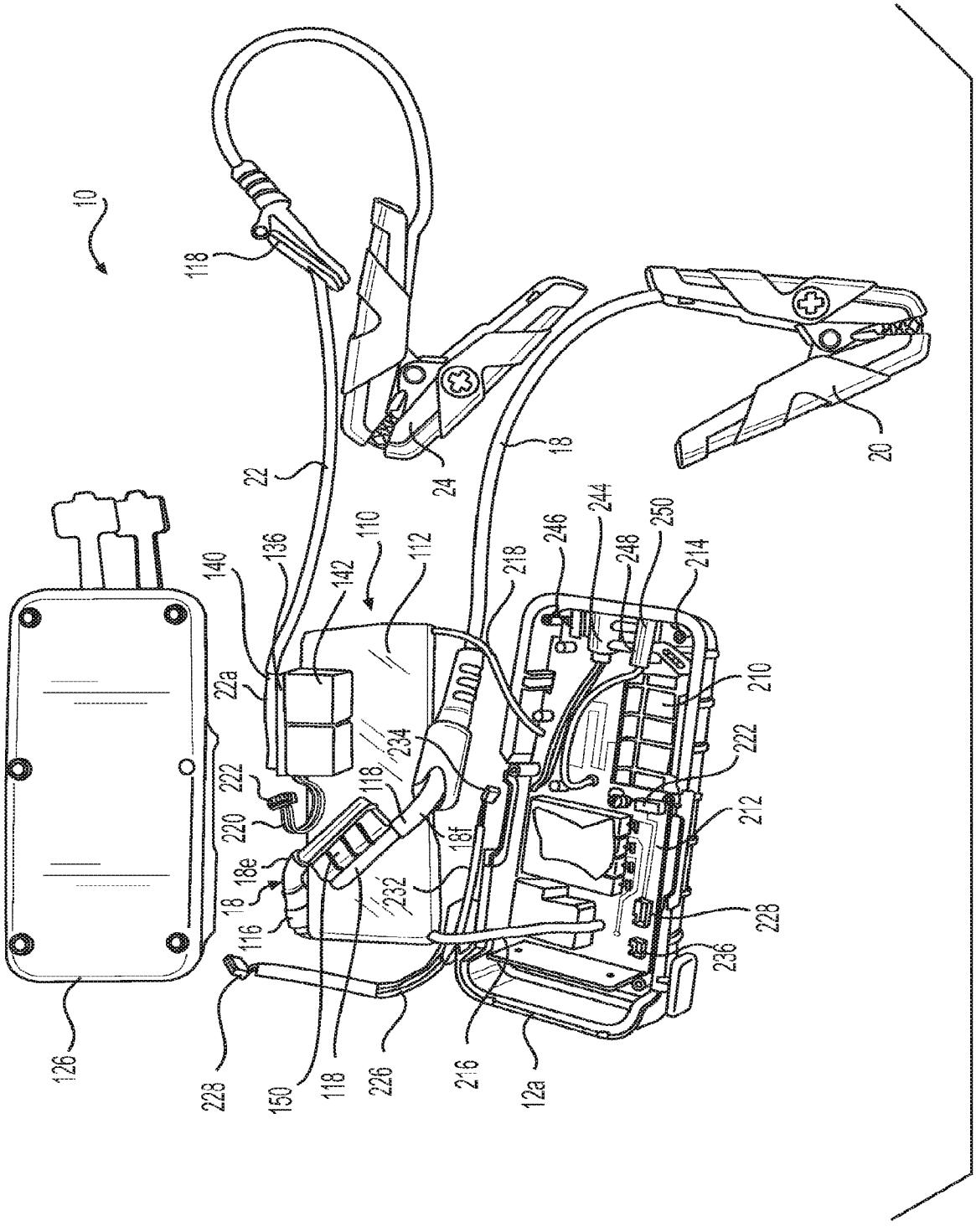

100
114
116
18a
19
18
154
156
152
220
18
19
118
222
142a
142c
136a
138a
142b
140a
142
132
132a
124
126
120
138
140
134
136
112a
110
112
130

FIG. 10


10
118
22
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112
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212
228
236
22a
234
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18e
18
116
18f
232
126
228
150
118
226
216
12a

FIG. 11

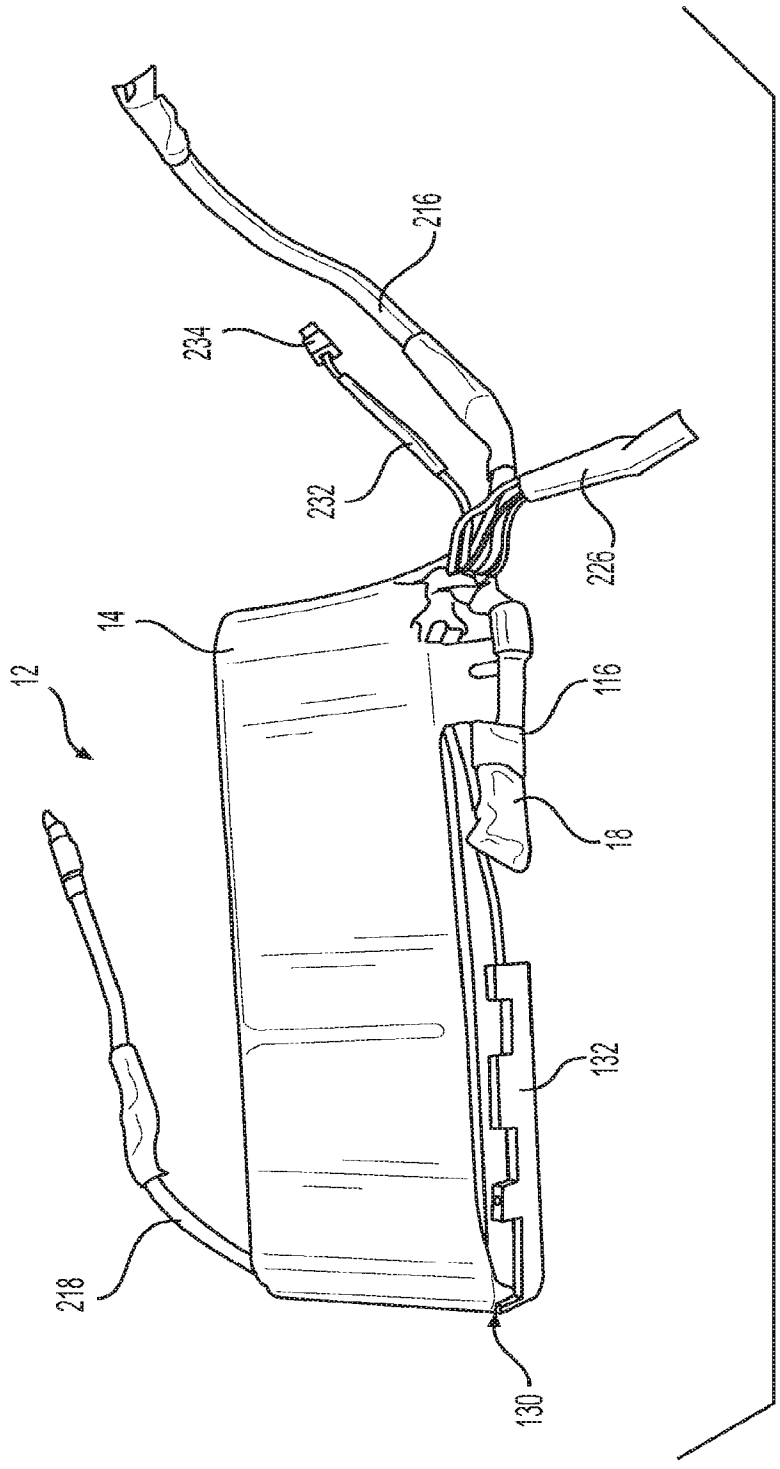

FIG. 12

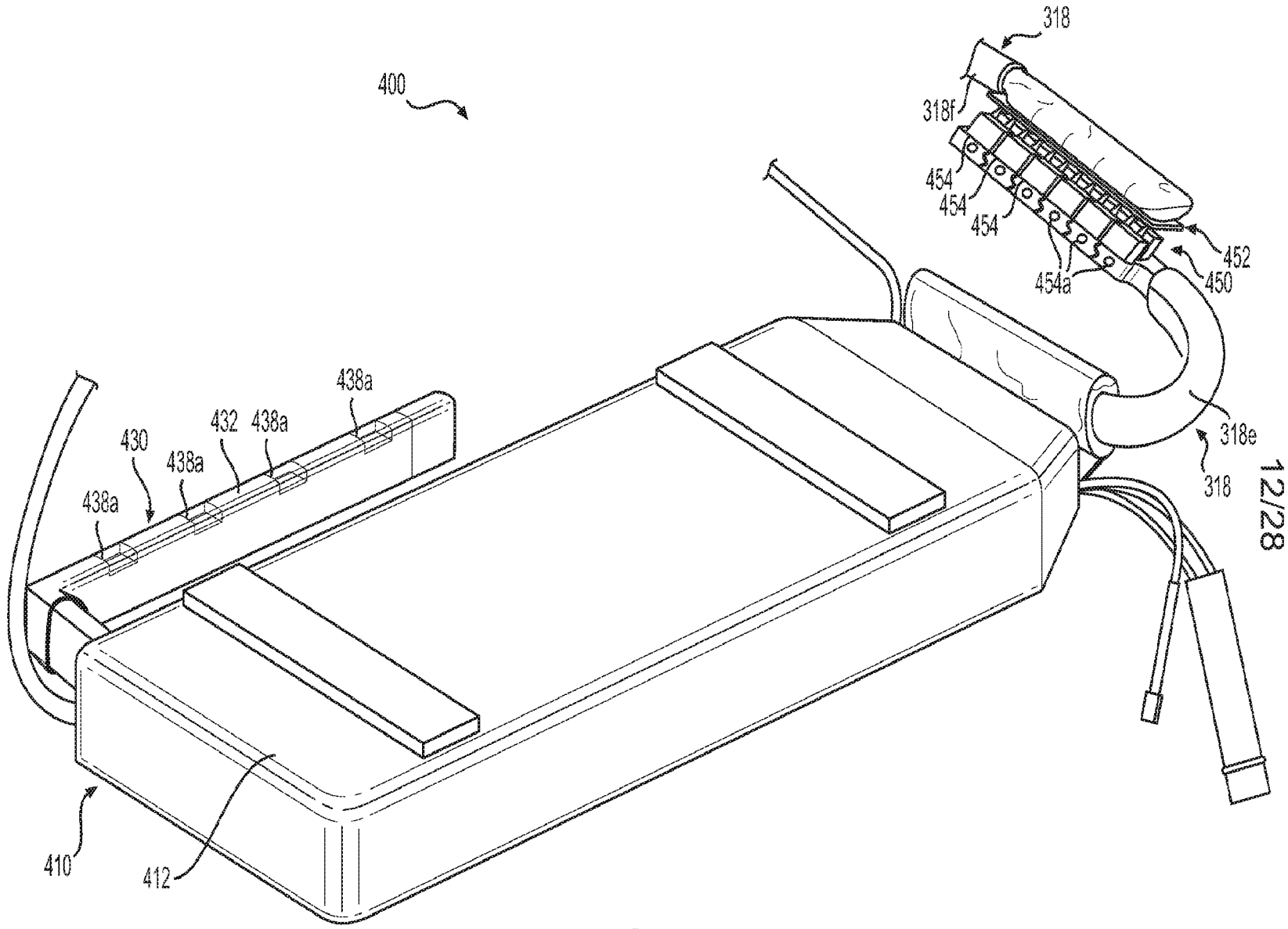

FIG. 13

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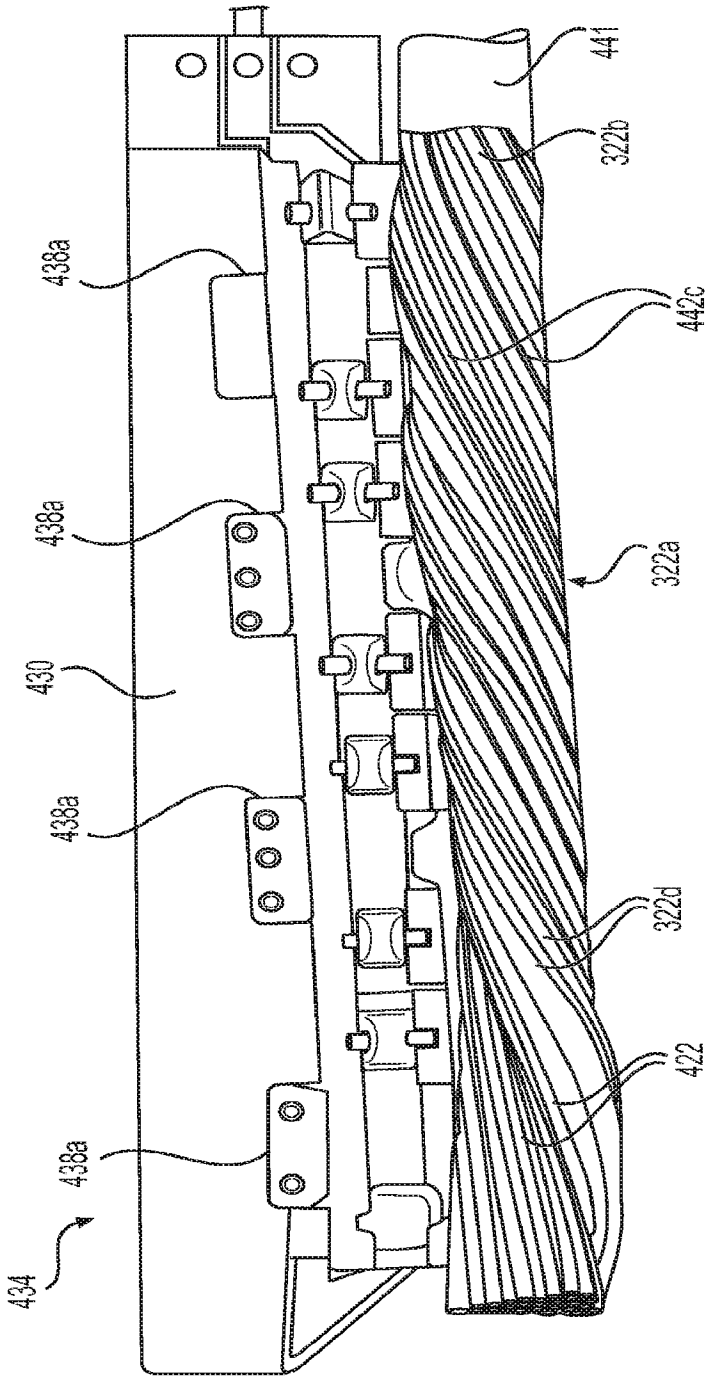

FIG. 14

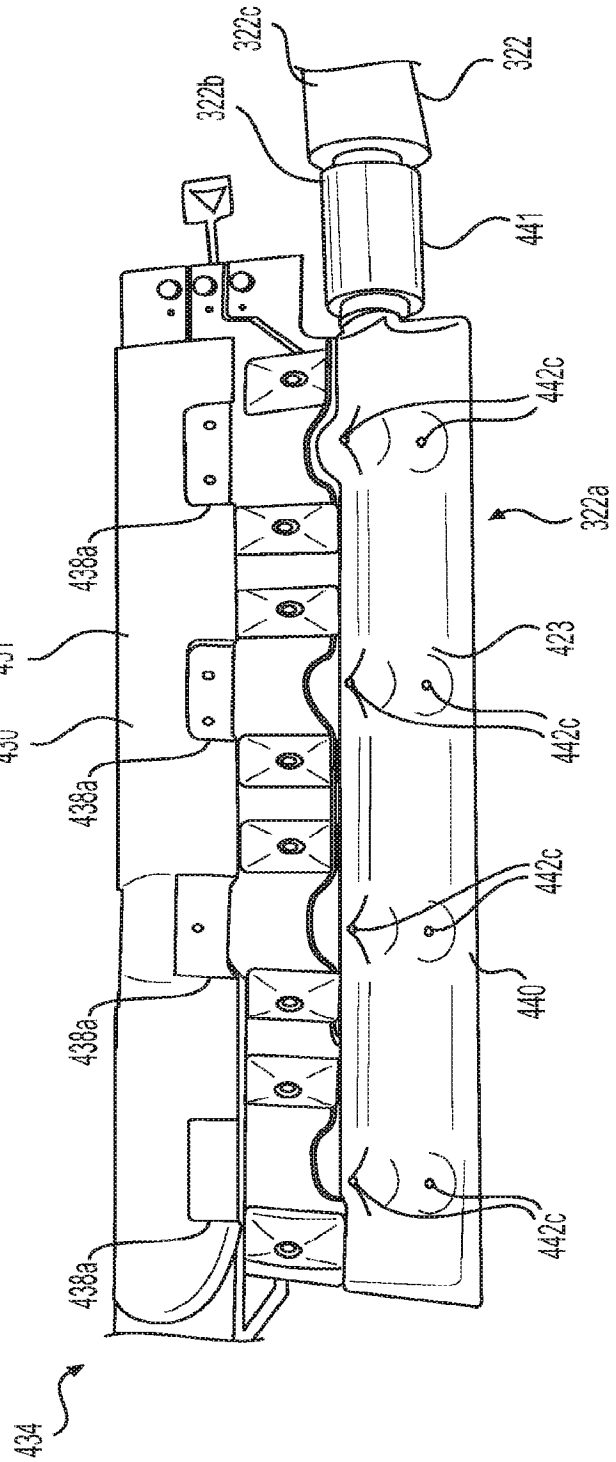
322c
322
322b
441
442c
322a
438a
423
431
430
442c
438a
442c
440
438a
442c
438a
434

FIG. 15

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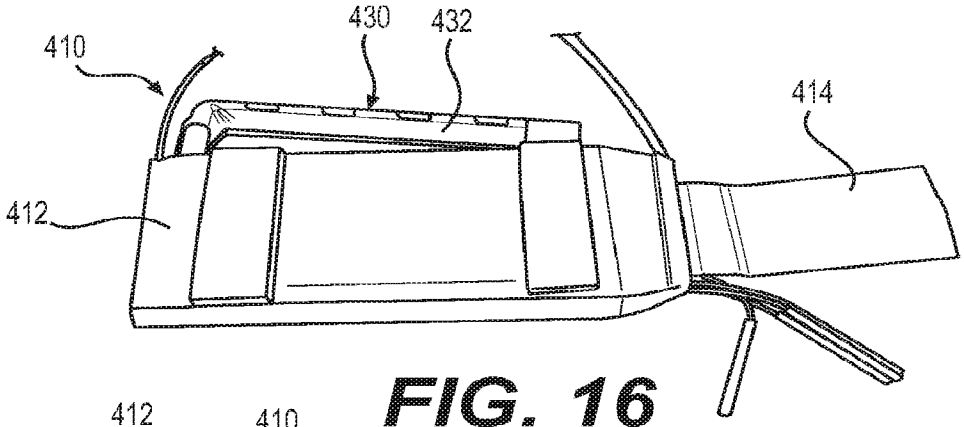

FIG. 16

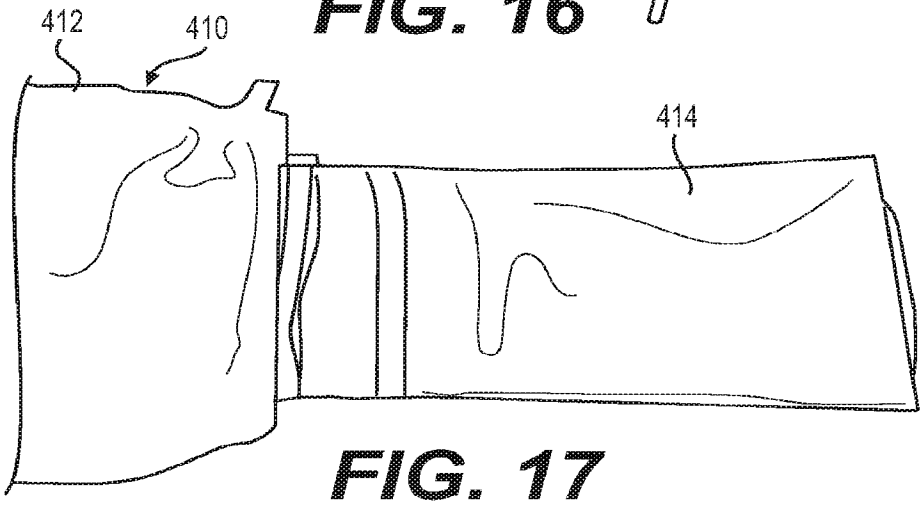

FIG. 17

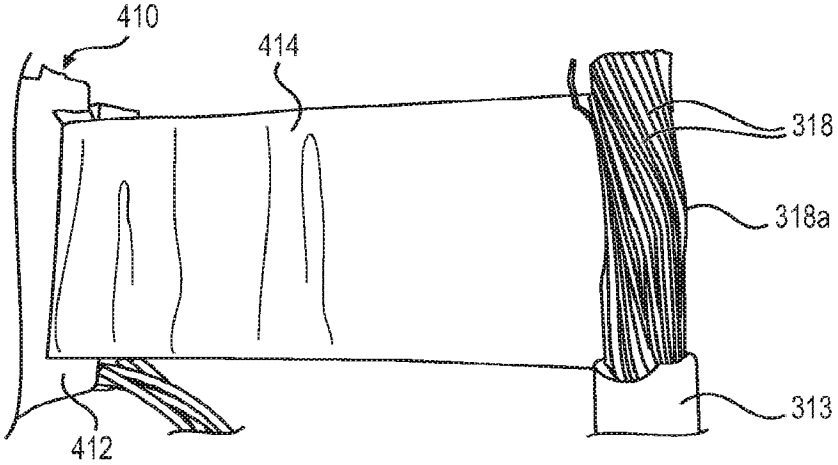

FIG. 18

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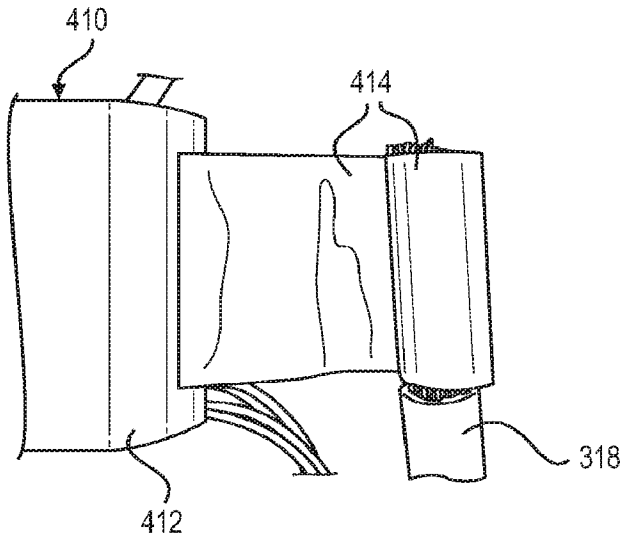

FIG. 19

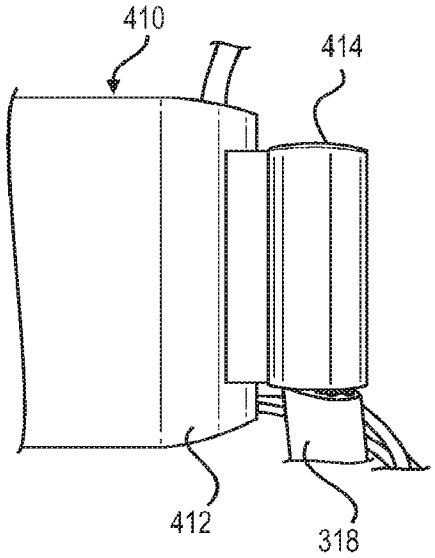

FIG. 20

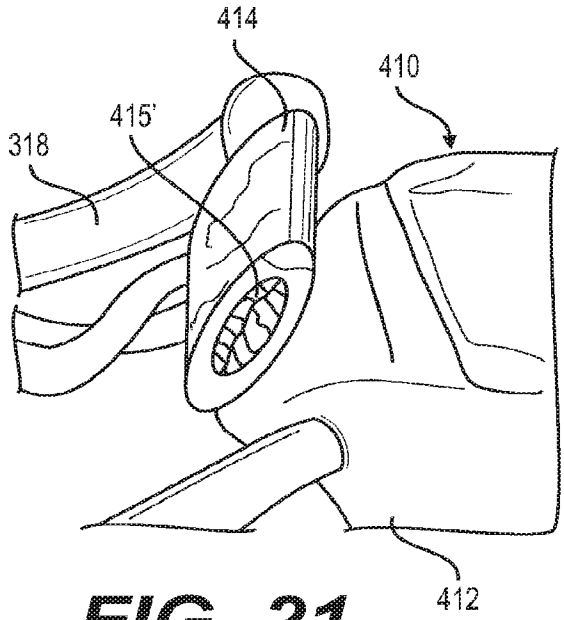

FIG. 21

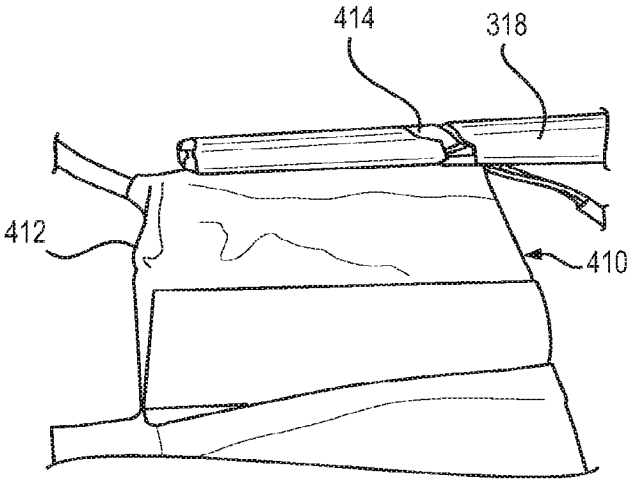

FIG. 22

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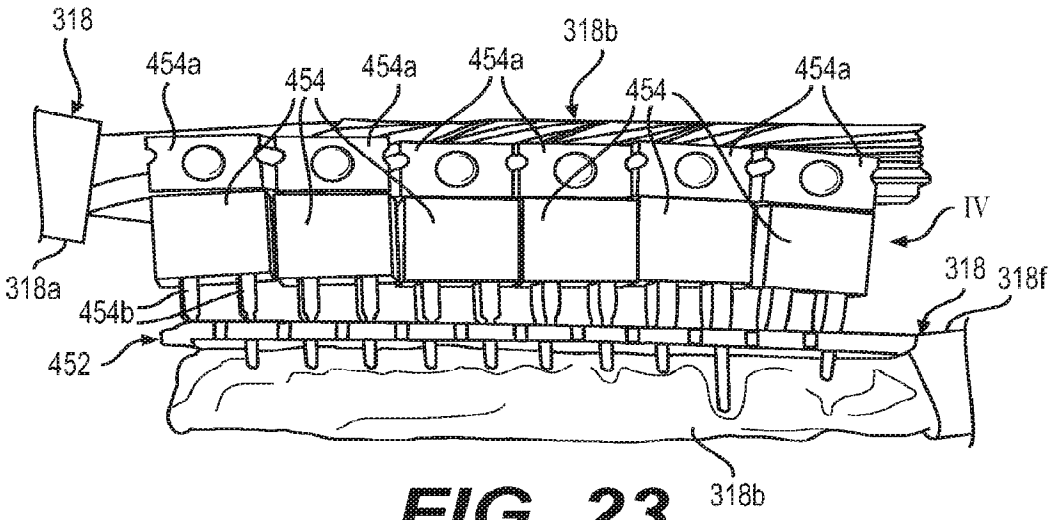

FIG. 23

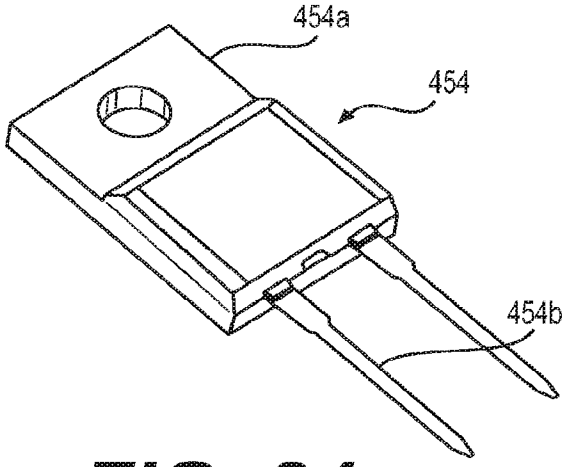

FIG. 24

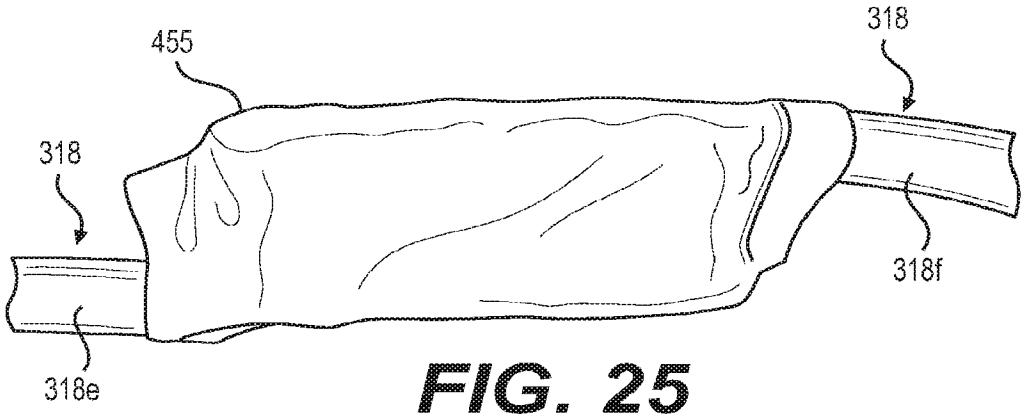

FIG. 25

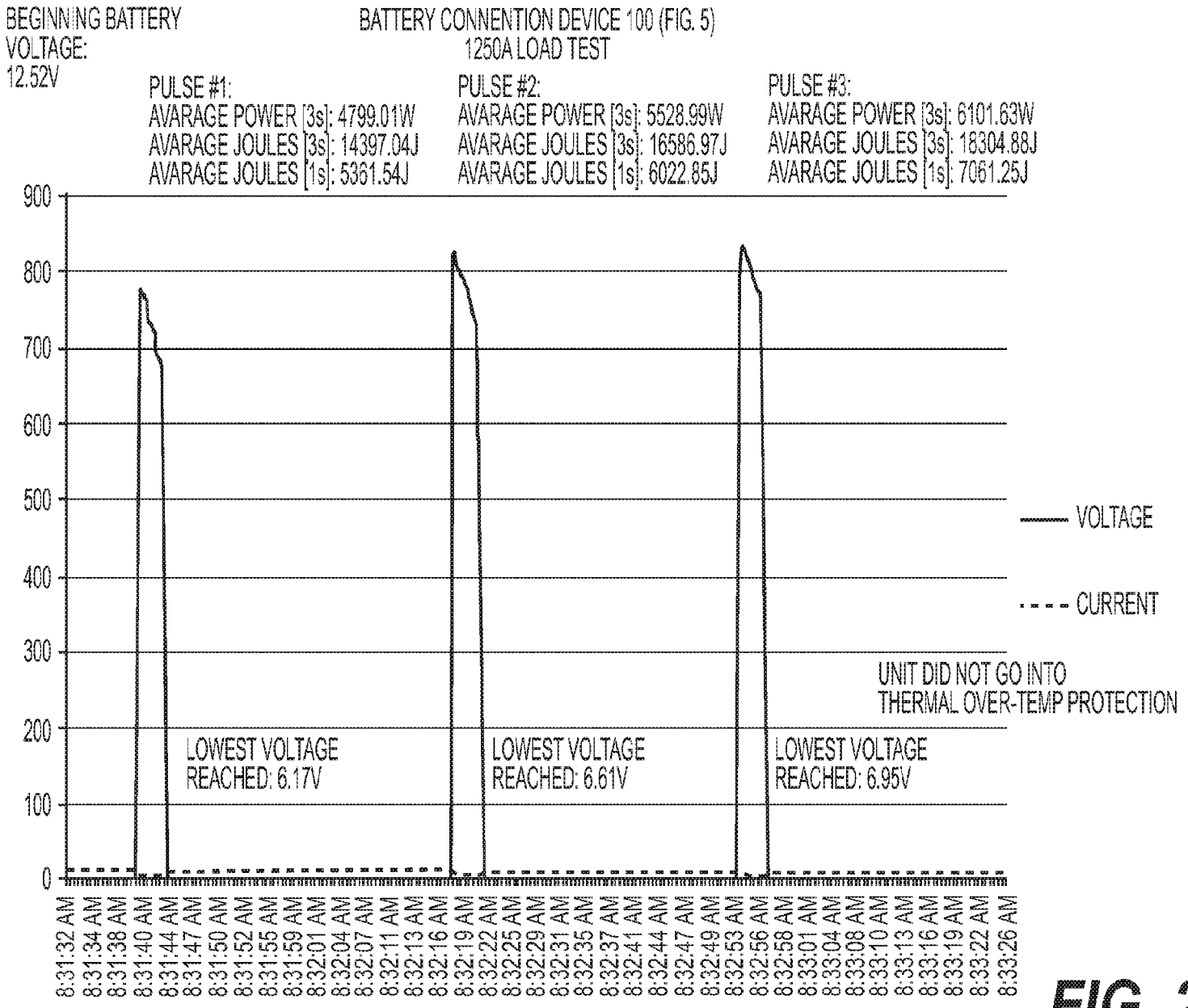

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FIG. 27

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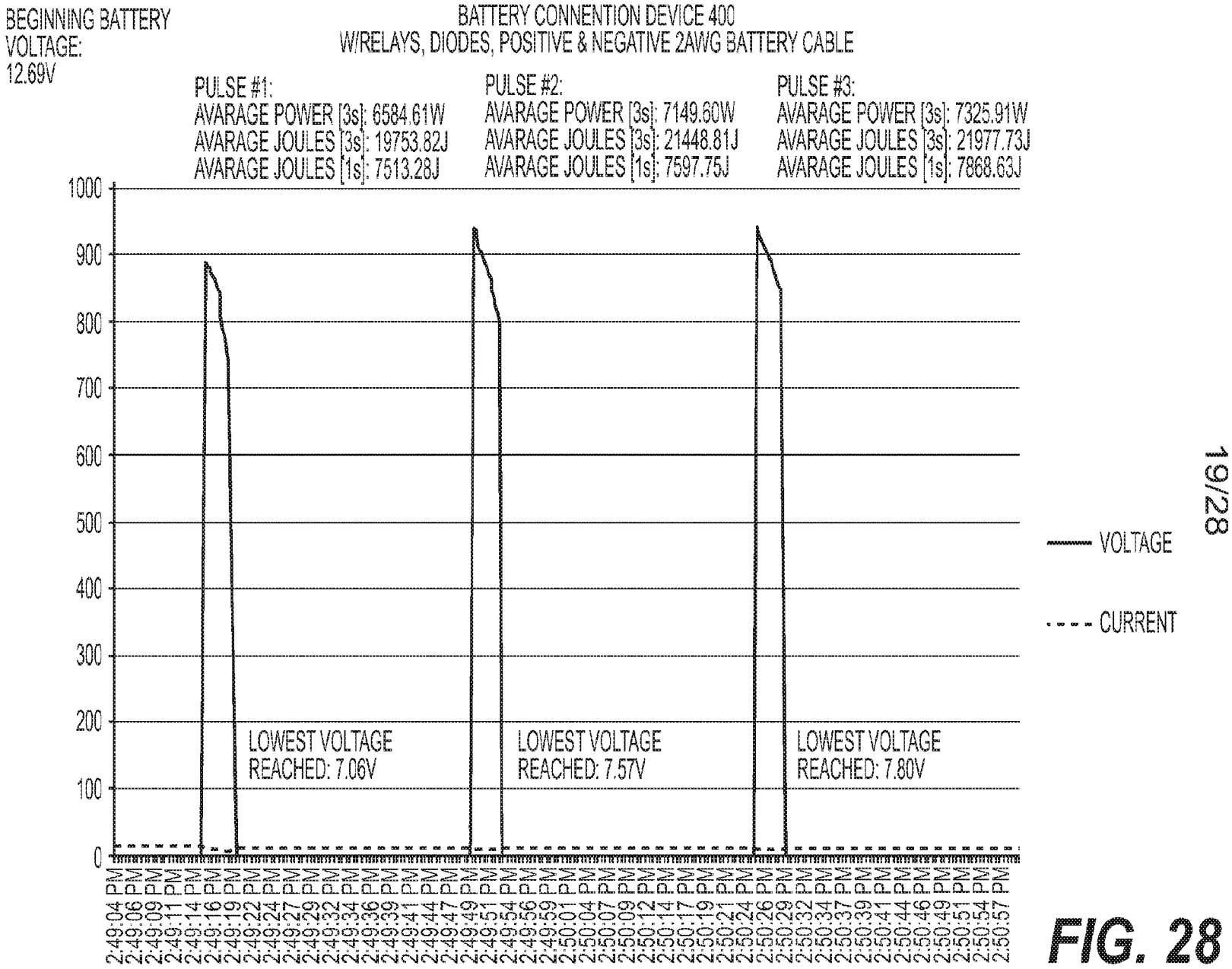

FIG. 28

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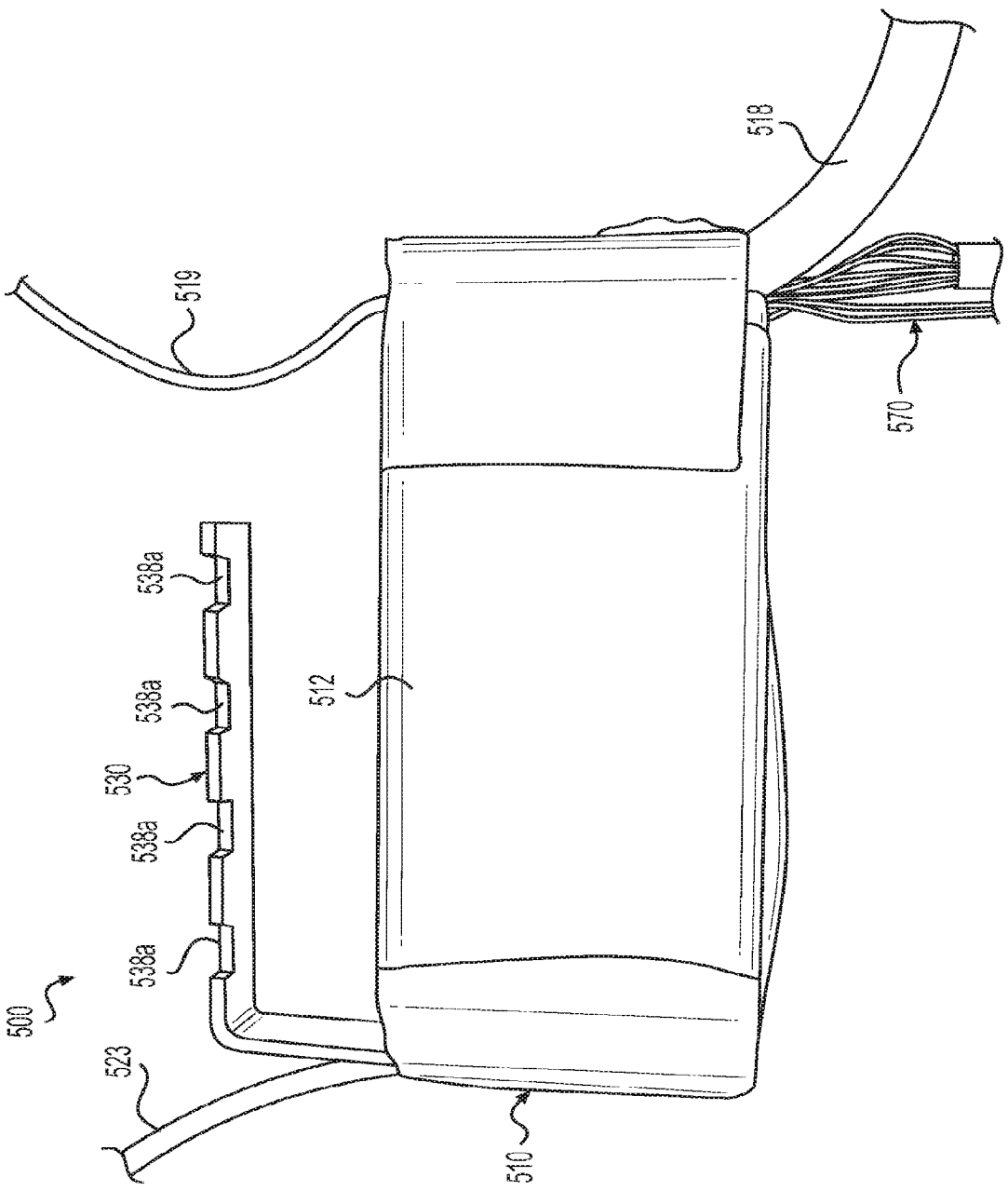
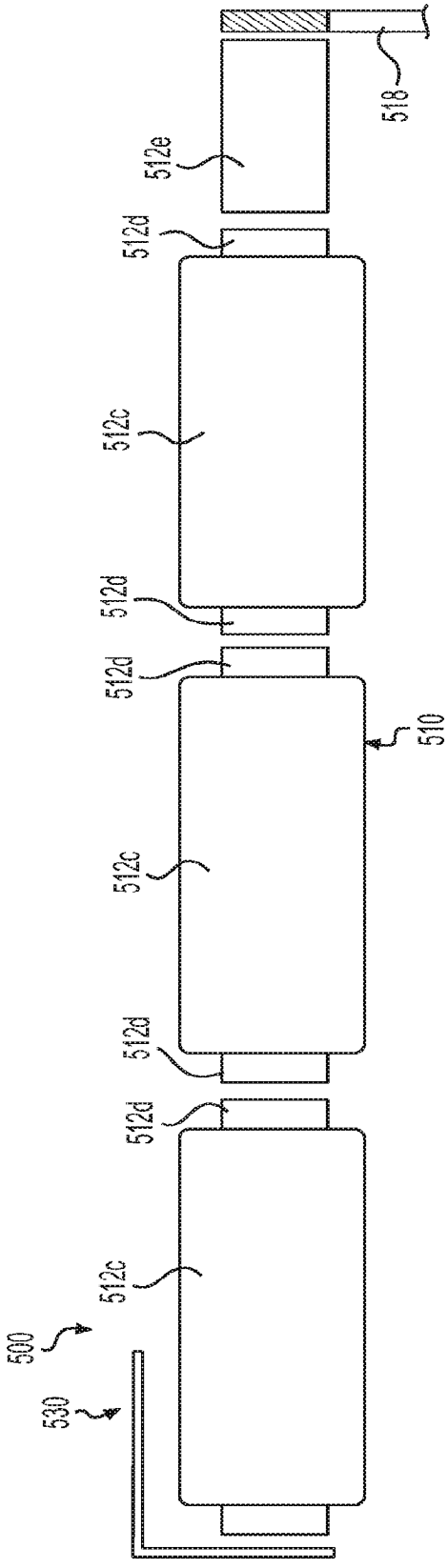


FIG. 29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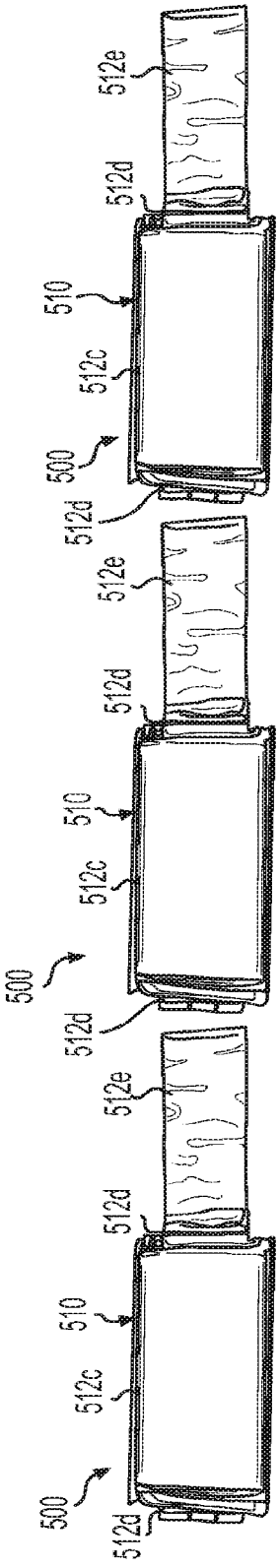
530

FIG. 30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512d

FIG. 31

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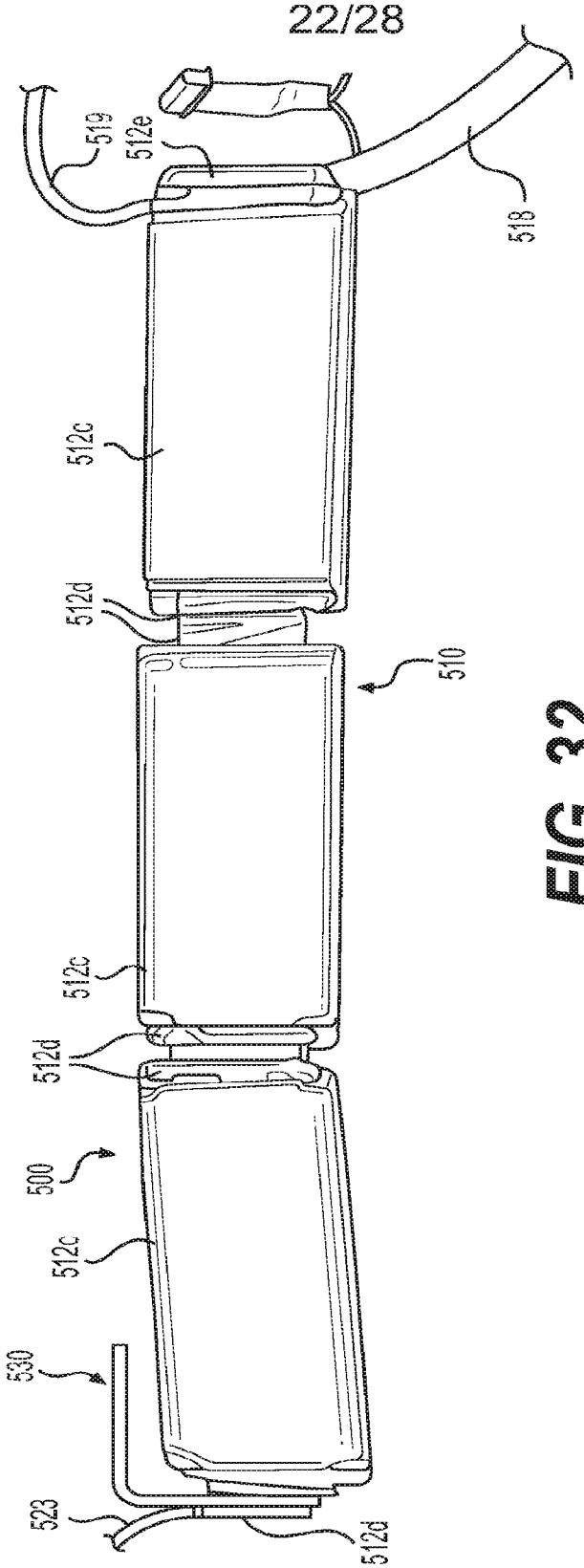

FIG. 32

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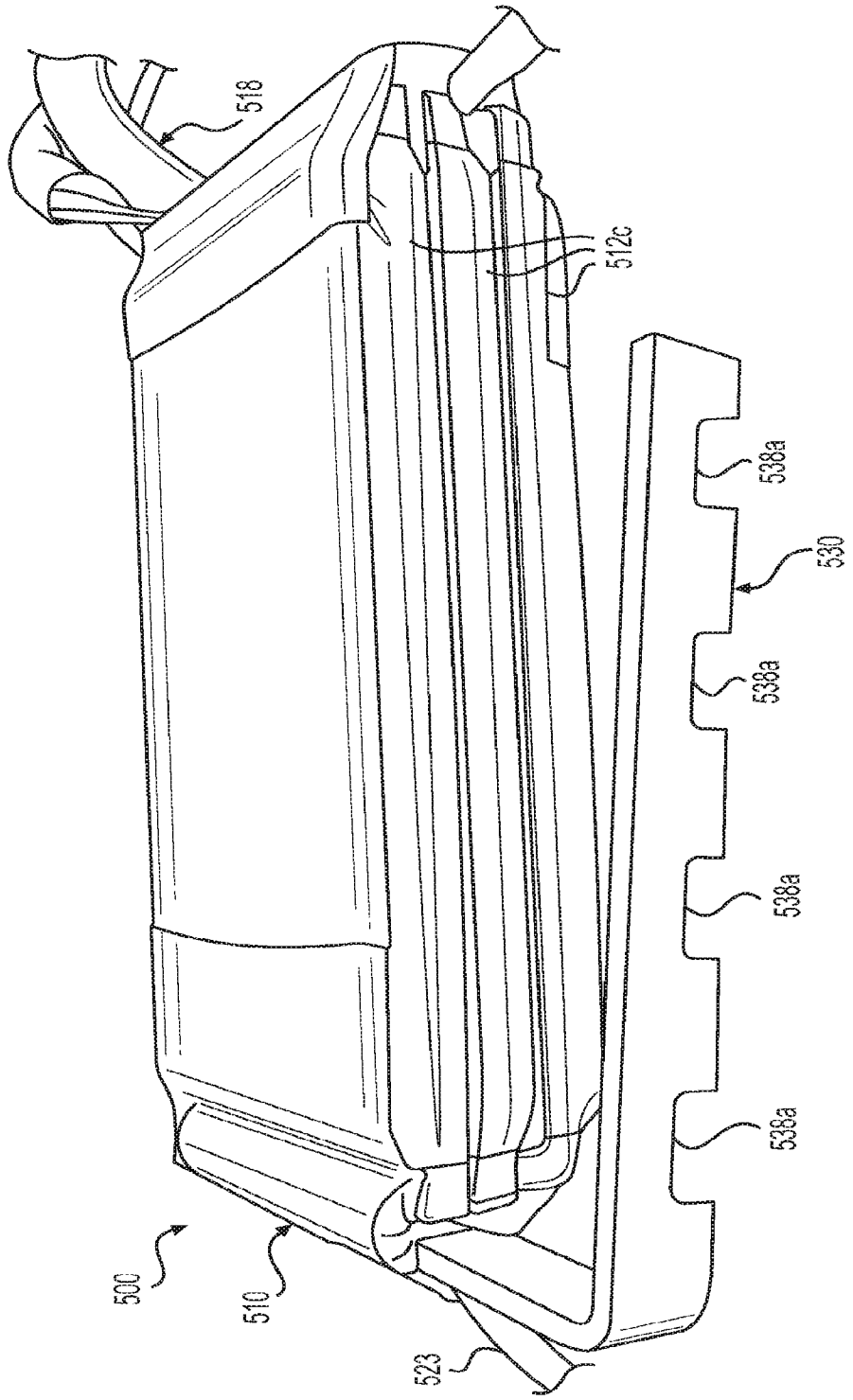

FIG. 33

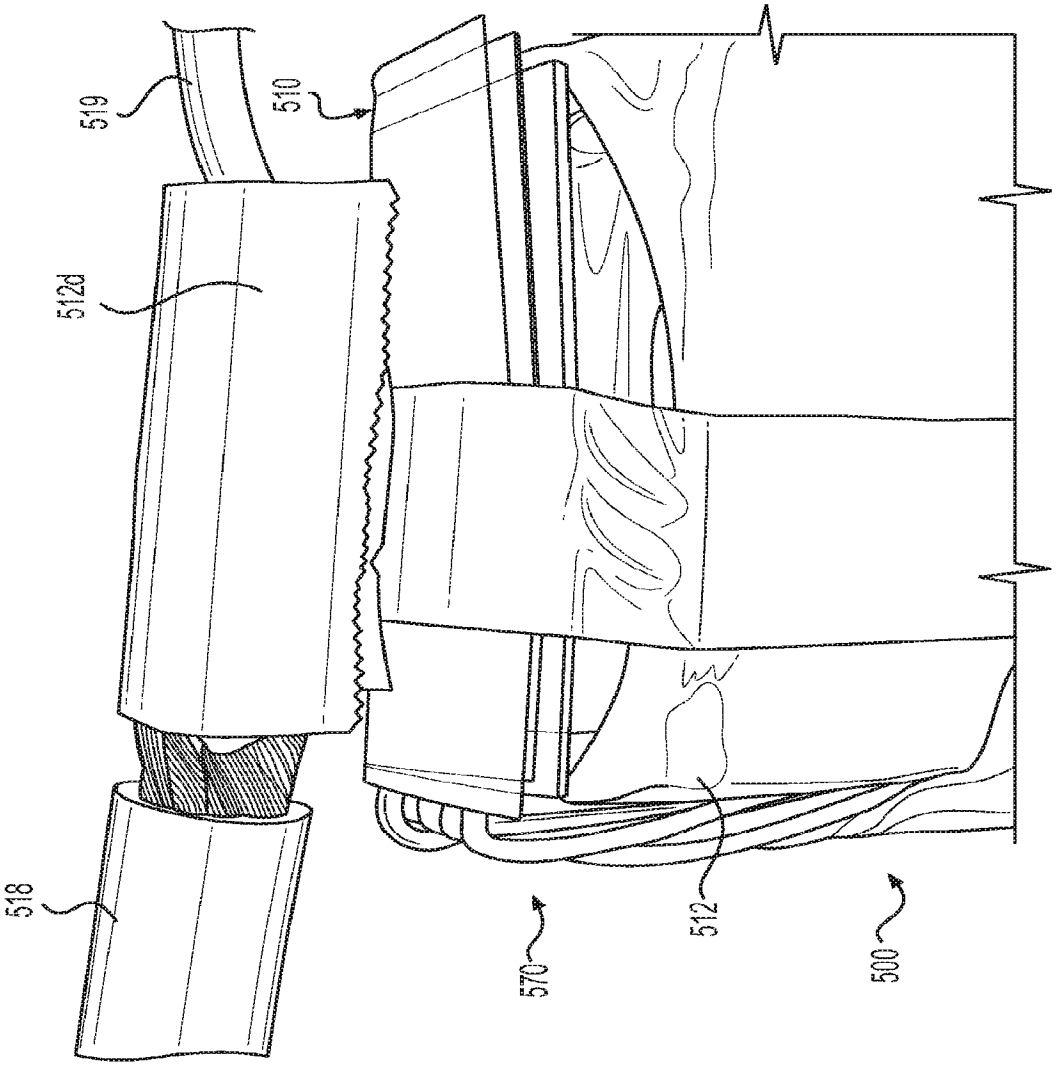

FIG. 34

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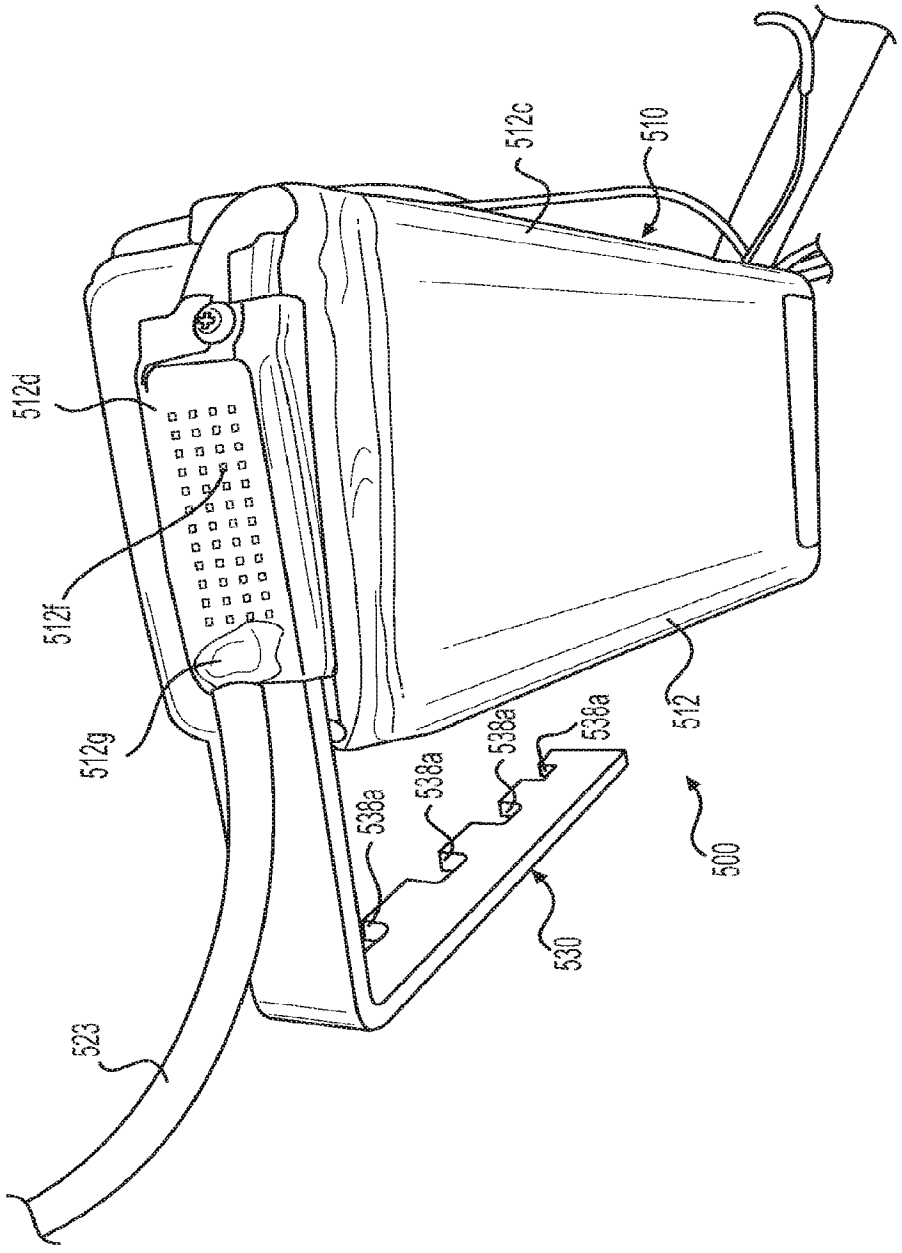

FIG. 35

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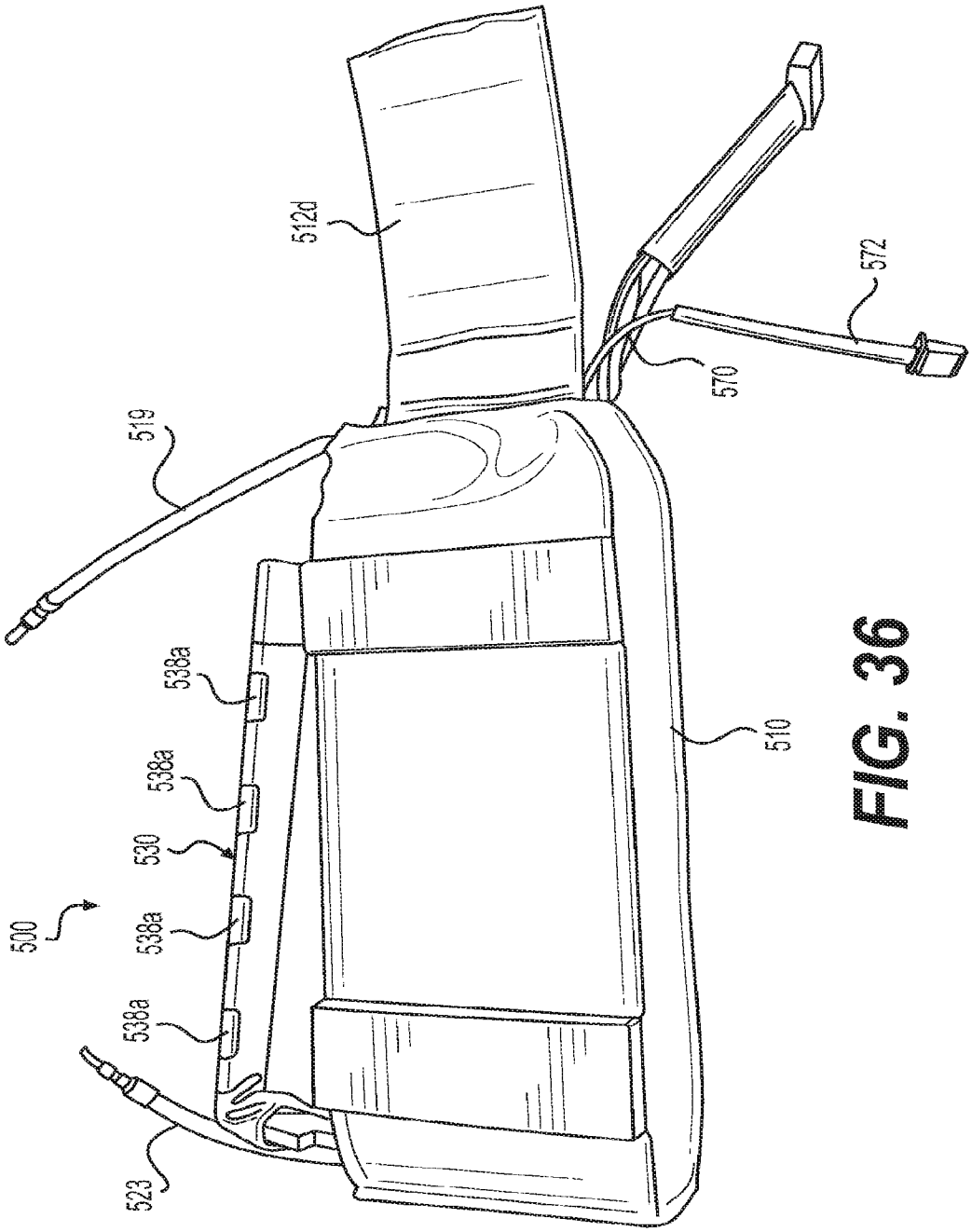

FIG. 36

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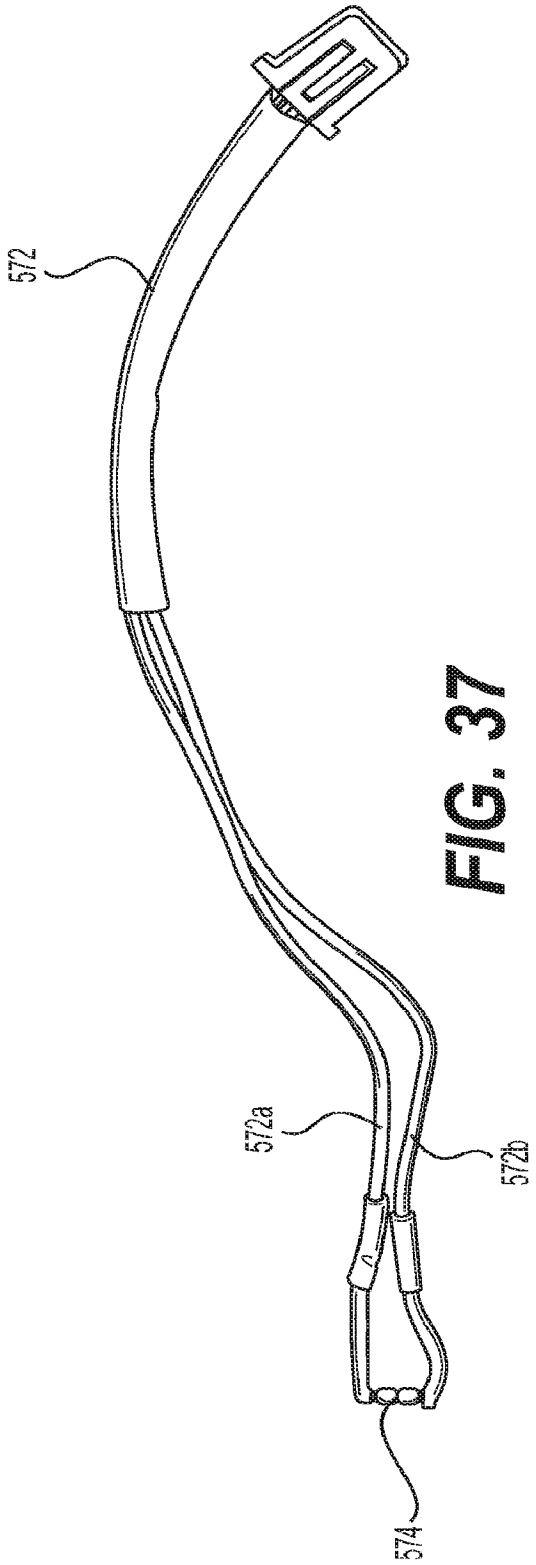

FIG. 37

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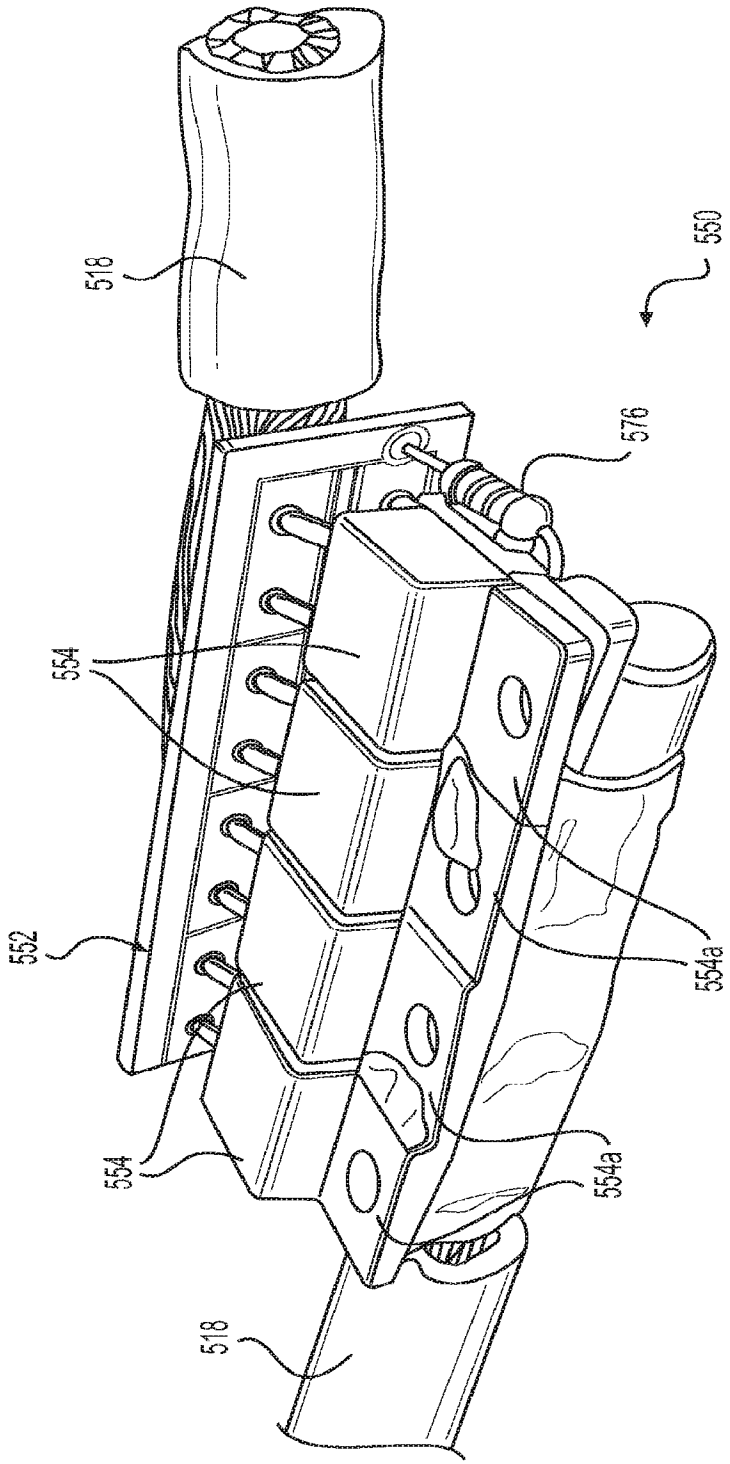

FIG. 38

Espacenet

Bibliographic data: AU2015258299 (A1) — 2015-12-10

DIKETONES AND HYDROXYKETONES AS CATENIN SIGNALING PATHWAY ACTIVATORS

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Applicant(s): SAMUMED LLC ± (SAMUMED, LLC, ; Samumed, LLC)

Classification: **- international:** ***A01N35/00; A61K31/12***
- cooperative:

Application number: AU20150258299 20151120

Priority number(s): AU20150258299 20151120 ; AU20110291989 20110817 ; US20100374687P 20100818 ; US201061427974P 20101229 ; WO2011US48086 20110817

Also published as: AU2015258299 (B2) AU2018200333 (A1) AU2018200333 (B2)

Abstract of AU2015258299 (A1)

[0279] The present invention discloses -diketones, y-diketones or 7 hydroxyketones or analogs thereof, that activate Wnt/p-catenin signalling and thus treat or prevent diseases related to signal transduction, such as osteoporosis and osteoarthropathy; osteogenesis imperfecta, bone defects, bone fractures, periodontal disease, otosclerosis, wound healing, craniofacial defects, oncolytic bone disease, traumatic brain injuries related to the differentiation and development of the central nervous system, comprising Parkinson's disease, strokes, ischemic cerebral disease, epilepsy, Alzheimer's disease, depression, bipolar disorder, schizophrenia; eye diseases such as age related macular degeneration, diabetic macular edema or retinitis pigmentosa and diseases related to differentiation and growth of stem cell, comprising hair loss, hematopoiesis related diseases and tissue regeneration related diseases.

(12) STANDARD PATENT APPLICATION (11) Application No. **AU 2015258299 A1**
(19) AUSTRALIAN PATENT OFFICE

(54) Title
DIKETONES AND HYDROXYKETONES AS CATENIN SIGNALING PATHWAY ACTIVATORS

(51) International Patent Classification(s)
A01N 35/00 (2006.01) ***A61K 31/12*** (2006.01)

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(43) Publication Date: **2015.12.10**
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(62) Divisional of:
2011291989

(71) Applicant(s)
Samumed, LLC

(72) Inventor(s)
KC, Sunil Kumar;Wallace, David Mark;Hood, John;Barroga, Charlene F.

(74) Agent / Attorney
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20 Nov 2015 2015258299

ABSTRACT

[0279] The present invention discloses β-diketones, γ-diketones or γ-hydroxyketones or analogs thereof, that activate Wnt/p-catenin signalling and thus treat or prevent diseases related to signal transduction, such as osteoporosis and osteoarthropathy; osteogenesis imperfecta, bone defects, bone fractures, periodontal disease, otosclerosis, wound healing, craniofacial defects, oncolytic bone disease, traumatic brain injuries related to the differentiation and development of the central nervous system, comprising Parkinson's disease, strokes, ischemic cerebral disease, epilepsy, Alzheimer's disease, depression, bipolar disorder, schizophrenia; eye diseases such as age related macular degeneration, diabetic macular edema or retinitis pigmentosa and diseases related to differentiation and growth of stem cell, comprising hair loss, hematopoiesis related diseases and tissue regeneration related diseases.

2015258299 20 Nov 2015

DIKETONES AND HYDROXYKETONES AS CATENIN SIGNALING PATHWAY ACTIVATORS

RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 61/374,687, filed August 18, 2010 and U.S. Provisional Application No. 61/427,974, filed December 29, 2010, which are incorporated herein by reference in their entirety.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] This invention relates to activators of one or more proteins in the Wnt pathway, including activators of one or more Wnt proteins, and compositions comprising the same. More particularly, it concerns the use of a β-diketone, γ-diketone or γ-hydroxyketone or salts or analogs thereof, in the treatment of osteoporosis and osteoarthropathy; osteogenesis imperfecta, bone defects, bone fractures, periodontal disease, otosclerosis, wound healing, craniofacial defects, oncolytic bone disease, traumatic brain injuries related to the differentiation and development of the central nervous system, comprising Parkinson's disease, strokes, ischemic cerebral disease, epilepsy, Alzheimer's disease, depression, bipolar disorder, schizophrenia; eye diseases such as age related macular degeneration, diabetic macular edema or retinitis pigmentosa and diseases related to differentiation and growth of stem cell, comprising hair loss, hematopoiesis related diseases and tissue regeneration related diseases.

Description of the Related Art

[0003] The *Wnt*/β-catenin signaling pathway is essential in many biological processes. It regulates the fate of as-yet undeveloped cells in embryo form. The *Wnt*/β-catenin signaling pathway is essential to stem cell self-renewal and proliferation as well as the development of stem cells in adult organisms (e.g. skin cell, bone cell, liver cell, etc.) [*Science* (**2002**), *296(5573)*, 1644–1646]. The *Wnt*/β-catenin signaling pathway

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regulates development, morphology, proliferation, motility and cell fate [*Annual Review of Cell and Developmental Biology* (**2004**), 20, 781-810]. The *Wnt*/β-catenin signaling pathway has a central role in tumorigenesis and inappropriate activation of this system is observed in several human cancers ["Wnt Signaling in Human Cancer", in *Signal Transduction in Cancer* (pp. 169-187). (2006) Springer]. *Wnt*/β-catenin was first described in humans as a protein which interacts with the cytoplasmic domain of E-cadherin and with *Wnt*/β-catenin, anchoring the cadherin complex to the actin cytoskeleton [*Science* (**1991**), 254(*5036*), 1359-1361]. Then, an additional role for mammalian *Wnt*/β-catenin was discovered; namely, as the key mediator of *Wnt*/β-catenin messaging.

[0004] In the presence of a Wnt ligand, if not inhibited by secreted antagonists, the Wnt ligand binds a frizzled (Fzd)/low density lipoprotein receptor related protein (LRP) complex, activating the cytoplasmic protein dishevelled (Dsh in Drosophila and Dvl in vertebrates). Precisely how Dsh/Dvl is activated is not fully understood, but phosphorylation by casein kinase 1 (CK1) and casein kinase 2 (CK2) have been suggested to be partly responsible [*Proceedings of the National Academy of Sciences of the USA* (**1999**), 96(*22*), 12548-12552]. Dsh/Dvl then inhibits the activity of the multiprotein complex (β-catenin-Axin-adenomatous polyposis coli (APC)-glycogen synthase kinase (GSK)-3β), which targets β-catenin by phosphorylation for degradation by the proteasome. Dsh/Dvl is suggested to bind CK1 and thereby inhibiting priming of β-catenin and indirectly preventing GSK-3β phosphorylation of β-catenin [*Genes & Development* (**2002**), 16(*9*), 1066–1076]. Upon Wnt stimulation, Dvl has also been shown to recruit GSK-3 binding protein (GBP) to the multiprotein complex. GBP might titrate GSK-3β from Axin and in this way inhibits phosphorylation of β-catenin. Finally, sequestration of Axin at the cell membrane by LRP has been described [*Molecular cell* (**2001**), 7(*4*), 801-809]. The overall result is accumulation of cytosolic β-catenin. Stabilized β-catenin will then translocate into the nucleus and bind to members of the T-cell factor (Tcf)/Lymphoid enhancing factor (Lef) family of DNA binding proteins leading to transcription of Wnt target genes.

[0005] In the absence of a Wnt ligand, Axin recruits CK1 to the multiprotein complex causing priming of β-catenin and initiation of the β-catenin phosphorylation

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cascade performed by GSK-3β. Phosphorylated β-catenin is then recognized by β-transducin repeat-containing protein (β-TrCP) and degraded by the proteasome, reducing the level of cytosolic β-catenin.

[0006] Aberrant activation of the *Wnt*/β-catenin pathway has led to several phenotypes, including the development of a variety of human cancers, and diseases leading to abnormal development and functioning of the stem cells [*Oncogene* (**2009**), 28(*21*), 2163–2172; *Cancer Cell* (**2008**), 14(*6*), 471-484; *American Journal of Pathology* (**2003**), 162(*5*), 1495-1502]. Chronic activation of the *Wnt*/β-catenin signaling pathway has been implicated in the development of a variety of human malignancies, including high bone mass syndrome, sclerosteosis, colorectal carcinomas, hepatocellular carcinomas (HCCs), ovarian, uterine, pancreatic carcinomas, and melanomas [*BioEssays* (**1999**) 21(*12*), 1021–1030; *Cell* (**2000**), 103(*2*), 311–320; *Genes Dev.* (**2000**), 14(*15*), 1837–1851]. Since the *Wnt*/β-catenin pathway is involved in myriad growth and development processes, mutation of the proteins involved in the *Wnt*/β-catenin signal transduction system is closely correlated with various human diseases such as abnormalities in development, hair follicle morphogenesis, stem cell differentiation, bone formation and cell proliferation.

Hair Loss

[0007] Hair forms in a pouch-like structure below the skin called a hair follicle. Visible hair, for example that seen on a human scalp, is actually the hair shaft, which is keratinized, hardened tissue that grows from the hair follicle. In particular, the hair shaft is composed largely of keratin, which is produced by keratinocytes.

[0008] Normal hair follicles cycle between a growth stage (anagen), a degenerative stage (catagen), and a resting stage (telogen). Scalp hairs have a relatively long life cycle: the anagen stage ranges from 2 to 6 years, the catagen stage ranges from a few days to a few weeks, and the telogen stage is approximately three months. Shorter hairs found elsewhere on the human body have corresponding shorter anagen durations. The morphology of the hair and the hair follicle change dramatically over the course of the life cycle of the hair [Dermatology in General Medicine (Vol. I), McGraw-Hill, Inc., 1993, pp. 290-91; Sperling, L. C.; *J. Amer. Acad. Dermatology* (1991), 25(1, Part 1), 1-17].

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[0009] During anagen, the hair follicle is highly active metabolically. The follicle comprises a dermal papilla at the base of the follicle; and epidermal matrix cells surrounding the dermal papilla form the base of the hair shaft, which extends upwards from the papilla through the hair canal. The matrix cells are the actively growing portion of the hair.

[0010] At catagen, the matrix cells retract from the papilla, and other degenerative changes occur. For example, the vessels and capillaries supplying blood and nutrients to the hair follicle shrivel and stop functioning. A column of epithelial cells pushes the keratinized proximal shaft of the hair upwards, and cell death occurs within the follicle. The hair shaft is then shed from the scalp or other part of the body and the hair follicle enters telogen, the resting stage of the hair growth cycle.

[0011] Although hair follicle regulation and growth are not well understood, they represent dynamic processes of proliferation, differentiation, and cellular interactions during tissue morphogenesis. It is believed that hair follicles are formed only in the early stages of development and are not replaced. Thus, an increase in damaged or non-functioning hair follicles is generally associated with hair loss.

[0012] Male or female pattern baldness requires the presence of male or female hormones, e.g. androgens, but the cause is unknown. The extent of hair loss in any male greatly depends on the genes he inherits from his father, mother, or both. Hair loss begins at the temples or at the top of the head. If male pattern hair loss begins in the mid-teens, subsequent hair loss is usually fairly extensive. Male balding goes in waves. Hair loss may begin in the early 20's, then stop, only to start again in a few years. By the age of 20 to 30 years, 30% of men have bald spots. This continues to rise until age 50-60, when 50% of men are completely bald.

[0013] The rate of hair loss is affected by advancing age, the tendency to bald early due to inherited genes, and an overabundance of the male hormone dihydrotestosterone (DHT) within the hair follicle. DHT acts on a hormone receptor within the hair follicle, and thereby slows hair production and produces weak, shorter hair. Sometimes DHT production even stops hair growth completely. Although balding men have above average amounts of DHT in their hair follicles, they usually do not have above average circulating testosterone levels.

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[0014] Female pattern baldness is not as common as male pattern baldness, but is on the rise. It is confined to the hair predominantly at the top of the head and complete baldness is rare in females.

[0015] Toxic alopecia is temporary but typically lasts three to four months, and often is caused by an infectious disease. For example, toxic alopecia may occur as a result of hypothyroidism, diabetes, hormonal problems, vitamin deficiencies, hypopituitarism, parasites, poor digestion, early stage of syphilis, vitamin A or retinoid overdoses, or other cytotoxic drugs.

[0016] Alopecia areata is a sudden hair loss in demarcated areas. It can affect any hairy area, but most frequently affects the scalp and beard. Hair loss confined to a few areas is often reversed in a few months even without treatment but recurrence is a possibility. Alopecia areata usually occurs in people with no obvious skin disease or systemic disease, but in rare cases lab tests may show anti-microsomal antibodies to thyroglobulin, gastric parietal cells and adrenal cells.

[0017] Scarring alopecia results from inflammation and tissue destruction. It may be due to injuries such as burns, physical trauma, or destruction after x-rays. In these cases, little regrowth is expected. Other causes are cutaneous lupus erythematosus, lichen planus, chronic deep bacterial or fungal infections, deep ulcers, sarcoidosis, syphilis, or tuberculosis. Slow growing tumors of the scalp are a rare cause of hair loss.

[0018] While none of these conditions is very well understood, each condition is distressing because hair is often considered an important factor in human social communications and interactions.

[0019] Numerous approaches have been suggested for treating hair loss. Two of the most commonly used and accepted compounds for preventing hair loss are minoxidil, the active ingredient in Rogaine® and the 5α-reductase inhibitor, finasteride, the active ingredient in Propecia®. However, cosmetic treatment of age-related hair loss in patients with topical solution of minoxidil or finasteride has resulted in only moderate regrowth of hair in less than 40% of such patients. Indeed, less than ten percent of the men who use Rogaine® achieve satisfactory results. Thus, there is a need in the art for more effective methods of, and compositions for treating hair loss. Preferably, new methods and compositions will require fewer applications of active ingredients; provide

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hair regrowth sooner, in more abundance, and thicker, than presently observed with minoxidil or finasteride treatment.

[0020] It has been found that hair follicle development and regeneration are regulated by the canonical *Wnt*/β-catenin signaling pathway [*Investigative Dermatology* (**2008**), 128(*5*), 1081–1087]. In the epidermis, hair follicle development is initiated when mesenchymal cells populate the skin. During this process, signals emanating from the dermis induce epithelium thickening, elongation of the epithelial cells, and the formation of placodes containing *Wnt*-responsive cells. In response, placodes signal dermal cells to condense, thereby forming the dermal papilla component of the hair follicle, which is also responsive to *Wnt* signaling. *Wnt3a* is secreted from hair epithelium and acts in an autocrine and paracrine fashion, and it has been demonstrated that *Wnt-3a* maintains anagen gene expression in dermal papilla cells and mediates hair-inductive activity in an organ culture. This *Wnt-3a*-mediated hair growth might depend on the canonical *Wnt*/β-catenin signaling pathway because deletion of β-catenin or the *Lef1* gene resulted in hair loss in mice. Therefore, activation of β-catenin by *Wnt* contributes to the inhibition of keratinocytes differentiation, induction of hair follicle formation, and maintenance of proliferation of neuronal progenitors.

Neurodegenerative Diseases

[0021] Neurodegenerative diseases result from deterioration of neurons or their myelin sheath which over time will lead to dysfunction and disabilities resulting from this. Adult mammalian brain has limited capacity for regeneration. This makes the repair of any injuries hazardous and, consequently, CNS traumas are devastating.

[0022] New neurons are generated from neural stem cells, in two regions of the adult mammalian central nervous system: the subventricular zone of the lateral ventricle, and the subgranular zone of the hippocampal dentate gyrus [*Current Opinion in Cell Biology* (**2001**), 13, 666–672]. Signals provided by the microenvironment contribute to the regulation of the maintenance, proliferation and neuronal fate commitment of the local stem cells. Many of these signals and signaling pathways are unknown.

[0023] Alzheimer's disease (AD) is the most common cause of dementia that gradually destroys neurons and affects more than 24 million people worldwide. It occurs mostly in older adults and patients afflicted with AD lose their ability to learn, remember,

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make decisions, communicate and carry out daily activities. The etiology and progression of AD is not well understood, but is associated with amyloid beta (Aβ) plaques and neurofibrillary tangles in the brain.

[0024] Parkinson's disease (PD) is a degenerative disorder of the central nervous system affecting more than 6 million people worldwide and that often impairs the sufferer's motor skills and speech. The symptoms of Parkinson's disease result from the loss of dopamine-secreting cells in the region of the substantia nigra (literally "black substance"). These neurons project to the striatum and their loss leads to alterations in the activity of the neural circuits within the basal ganglia that regulate movement.

[0025] Amyotrophic Lateral Sclerosis (ALS) is a fatal neurodegenerative disease that results from the death of motor neurons. A progressive loss of muscle control impairs the individual's capacity for independent function. ALS strikes the cells in the brain and spinal cord (motor neurons), which send signals to move muscles. In some cases, a mutation in the SOD1 gene results in a dysfunctional protein, the superoxide dismutase protein (called SOD1), which normally "cleans" up toxic particles inside a cell. When SOD1 is mutated, toxic particles accumulate inside motor neurons causing them to malfunction. But this mutation only explains a few percent of cases of ALS. The primary cause of ALS, which afflicts about 350,000 adults worldwide, is unknown.

[0026] Stroke and traumatic brain injury can also cause neuronal loss and lead to cognitive decline. Stroke can be classified into two major categories: ischemic and hemorrhagic. Ischemia is due to interruption of the blood supply, while hemorrhage is due to rupture of a blood vessel or an abnormal vascular structure. Stroke can cause permanent neurological damage, complications and death if not promptly diagnosed and treated. It is the third leading cause of death and the leading cause of adult disability in the United States and Europe.

[0027] Frontotemporal Dementia (FTD) accounts for 18% of dementias in people under 65 years old. It frequently manifests itself as a behavioral disturbance, and can progress to impair an individual's capacity for independent thought and function. Recent studies have uncovered genetic factors that contribute to this dementia; however no treatment yet exists to block the brain deterioration it causes.

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[0028] *Wnt*/β-catenin signal transduction system plays a crucial role in the differentiation and development of nerve cells for the central nervous system, suggesting a relationship between *Wnt*/β-catenin proteins and the incidence of various diseases of the central nervous system, including neurodegenerative diseases [*Nature* **(2005)**, 437(*7063*), 1370-1375]. Particularly, it is also found that *Wnt*/β-catenin signaling is related to diseases resulting from the abnormality of nerve cells, such as brain damage, Parkinson's disease, Amyotrophic Lateral Sclerosis (Lou Gehrig's disease), stroke, epilepsy, Alzheimer's disease (AD), depression, bipolar disorder, and schizophrenia.

[0029] Alzheimer's disease is the most common age-related neurodegenerative disorder. In fact, a relationship between amyloid-β-peptide (Aβ)-induced neurotoxicity and a decrease in the cytoplasmic levels of β-catenin has been observed. Apparently Aβ binds to the extracellular cysteine-rich domain of the Frizzled receptor (Fz) inhibiting *Wnt*/β-catenin signaling. Cross-talk with other signaling cascades that regulate *Wnt*/β-catenin signaling, including the activation of M1 muscarinic receptor and PKC, the use of Ibuprofen-ChE bi-functional compounds, PPAR α, γ agonists, nicotine and some antioxidants, results in neuroprotection against Aβ. These studies indicate that a sustained loss of *Wnt* signaling function may be involved in the Aβ-dependent neurodegeneration observed in Alzheimer's brain. Thus, the activation of the *Wnt*/β-catenin signaling pathway could be proposed as a therapeutic target for the treatment of AD.

Eye Diseases

[0030] Age related macular degeneration (AMD) is a medical condition which usually affects older adults that results in a loss of vision in the center of the visual field (the macula) because of damage to the retina. It occurs in "dry" and "wet" forms. It is a major cause of visual impairment in older adults (>50 years). The inner layer of the eye is the retina, which contains nerves that communicate sight, and behind the retina is the choroid, which contains the blood supply to the macula (the central part of the retina). In the dry (nonexudative) form, cellular debris called drusen accumulate between the retina and the choroid, and the retina can become detached. In the wet (exudative) form, which is more severe, blood vessels grow up from the choroid behind the retina, and the

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retina can also become detached. It can be treated with laser coagulation, and with medication that stops and sometimes reverses the growth of blood vessels.

[0031] Diabetic retinopathy is retinopathy (damage to the retina) caused by complications of diabetes mellitus, which can eventually lead to blindness. It is an ocular manifestation of systemic disease which affects up to 80% of all patients who have had diabetes for 10 years or more. As new blood vessels form at the back of the eye as a part of proliferative diabetic retinopathy (PDR), they can bleed (hemorrhage) and blur vision. Some people develop a condition called macular edema. It occurs when the damaged blood vessels leak fluid and lipids onto the macula, the part of the retina that lets us see detail. As the disease progresses, severe nonproliferative diabetic retinopathy enters an advanced, or proliferative, stage. The lack of oxygen in the retina causes fragile, new, blood vessels to grow along the retina and in the clear, gel-like vitreous humour that fills the inside of the eye. Without timely treatment, these new blood vessels can bleed, cloud vision, and destroy the retina.

[0032] Retinitis pigmentosa (RP) is a group of genetic eye conditions. In the progression of symptoms for RP, night blindness generally precedes tunnel vision by years or even decades. Many people with RP do not become legally blind until their 40s or 50s and retain some sight all their lives [*American Journal of Ophthalmology* (**2003**), 136(*4*), 678-68]. Others go completely blind from RP, in some cases as early as childhood. Progression of RP is different in each case. RP is a type of progressive retinal dystrophy, a group of inherited disorders in which abnormalities of the photoreceptors (rods and cones) or the retinal pigment epithelium (RPE) of the retina lead to progressive visual loss. Affected individuals first experience defective dark adaptation or nyctalopia (night blindness), followed by reduction of the peripheral visual field (known as tunnel vision) and, sometimes, loss of central vision late in the course of the disease.

[0033] Müller glia, or Müller cells, are glial cells found in the vertebrate retina, which normally serve the functions of any normal glial cells. However, following injury to the retina, it has been seen that Müller glia undergo dedifferentiation into multipotent progenitor cells. At this point, the progenitor cell can divide and differentiate into a number of retinal cell types, including photoreceptors, that may have been damaged during injury. Additionally, recently published research has shown that Müller

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cells act as a light collector in the mammalian eye, analogous to a fiber optic plate, funneling light to the rod and cone cells.

[0034] Multipotent retinal progenitors must solve two fundamental problems. First, they must initially expand their numbers but later limit their proliferation so that the right number of differentiated cells is produced at the appropriate developmental time. Second, the distinct processes of division and differentiation must be coordinated so that differentiation can be initiated when cells stop dividing [*Current Opinion in Genetics & Development* (**1997**), 7(*5*), 651-658; *Nature Reviews Neuroscience* (2001), (*2*), 109-118]. Wnt promotes cell proliferation in multiple tissues [*Cell and Tissue Research* (**2008**), 331(*1*), 193-210], in particular in the developing retina [*Stem Cells* (**2008**), 26(*8*), 2063 - 2074; *Development* (**2003**), 130(*3*), 587-598; *Development* (**2005**), 132(*12*), 2759-2770; *Development* (**2005**), 132(*13*), 3027-3043]. The SoxB1 family of genes (Sox1-3) may be key effectors of *Wnt*/β-catenin signaling in the developing nervous system [*Development* (**2006**), 133(*22*), 4451-4461; *Neuron* (**2005**), 46(*1*), 23-36]. During neurogenesis, Sox2 antagonizes proneural genes and can maintain progenitors [*Nature Neuroscience* (**2003**), (*6*), 1162 - 1168; *Neuron* (**2003**), 39(*5*), 749-765]. In the frog retina, *Wnt*/β-catenin signaling through Fz5 is necessary for Sox2 expression, which is required for proneural gene expression and the transition from progenitors to neurons [*Neuron* (**2005**), 46(*1*), 23-36]. It was discovered that these factors are core components of a conserved hierarchical cascade and propose that they form a powerful directional network that drives cells from a proliferative, undifferentiated state to a nonproliferative, differentiated neuronal or glial fate [*Development* (**2009**), 136(*19*), 3289-3299].

[0035] Regeneration in the mammalian CNS is severely limited. Unlike in the chick, current models hold that retinal neurons are never regenerated. It has been demonstrated that, in the adult mammalian retina, Müller glia dedifferentiate and produce retinal cells, including photoreceptors, after acute neurotoxic injury in vivo. However, the number of newly generated retinal neurons is very limited. It has been demonstrated that *Wnt*/β-catenin signaling promotes proliferation of Müller glia-derived retinal progenitors and neural regeneration after damage or during degeneration. Wnt3a treatment increases proliferation of dedifferentiated Müller glia>20-fold in the photoreceptor-damaged retina. It has also been shown that in the degenerating retina, Wnt3a increased cell proliferation,

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and treatment with RA or VPA promoted the differentiation of these cells into rhodopsin-positive photoreceptor cells [*Journal of Neuroscience* (**2007**), 27(*15*), 4210-4219].

[0036] Therefore, we propose that modulating the *Wnt*/β-catenin pathway is one possible therapeutic strategy to enhance replacement of lost neurons by generating cells derived from endogenous neuronal progenitors.

Bone Formation

[0037] Canonical *Wnt*/β-catenin signaling has been demonstrated to increase bone formation, and *Wnt* pathway components are being pursued as potential drug targets for osteoporosis and other metabolic bone diseases [*Bone* (**2009**), 44(*6*), 1063-1068]. In modern times, bone diseases are increasing due to socio-environmental and genetic factors, particularly due to increase of population of elderly persons. Generally, bone diseases occur and develop without special symptoms, and rapidly worsen with age. Although many drugs have been developed for the treatment of bone diseases thus far, most of them mainly aim to alleviate pain or to retard the decrease of bone density. They are not effective as a curative medication which aims for increasing the bone density of patients who suffer from osteoporosis. Some other drugs are usually in the form of injections and are reported to produce side effects upon long-term administration thereof.

[0038] Signaling through the *Wnt*/β-catenin pathway can increase bone mass through a number of mechanisms, including renewal of stem cells, stimulation of preosteoblast replication, induction of osteoblastogenesis, and inhibition of osteoblast and osteocyte apoptosis. One molecular mechanism is through the stimulation of the Wnt pathway by *Wnt-3a* interaction of its receptors LRP5 and Fzd [*Journal of Medicinal Chemistry* (**2009**), 52(*22*), 6962-6965]. Bone forming osteoblasts express the proteins LRP5 and Fzd on the surface membrane, which serve as co-receptors for the soluble peptide agonist *Wnt-3a*. Once stimulated with *Wnt-3a*, internal concentrations of free β-catenin rise and enter the nucleus and recruit T-cell factor (TCF). Transcriptional events follow and result in the production of additional anabolic gene products. An additional soluble extracellular protein, Dkk-1, antagonizes this process by simultaneously binding to the cell surface receptors Kr2 and LRP5, effectively inhibiting *Wnt-3a* binding to LRP5. In addition, the Kr2/LRP5/Dkk-1 complex undergoes endocytosis to remove LRP5 from the cell membrane, thereby nullifying its function. Loss-of-function

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mutations of secreted *Wnt* antagonists like Dkk-1, SOST/sclerostin and secreted frizzled-related protein (sFRP)-1 result in increased bone formation due to changes in a variety of osteoblast parameters like proliferation, differentiation, recruitment/longevity and function [*Journal of Bone and Mineral Research* (**2009**), 21(*6*), 934-945], while deletion of the β-catenin-activated transcription factor TCF-1 causes osteopenia that arises from a reduction in osteoprotegerin expression by the osteoblast [*Developmental Cell* (**2005**), 8(*5*), 751-764].

Intestinal Diseases

[0039] The adult intestinal epithelium is characterized by continuous replacement of epithelial cells through a stereotyped cycle of cell division, differentiation, migration and exfoliation occurring during a 5-7 day crypt/villus transit time. The putative growth factors regulating proliferation within the adult intestinal stem cell niche have not yet been identified, although studies have implicated the cell-intrinsic action of ß-catenin/Lef/Tcf signaling within the proliferative crypt compartment.

[0040] A number of pathological conditions affect the cells of the intestines. Inflammatory bowel disease (IBD) can involve either or both the small and large bowel. Crohn's disease and ulcerative colitis are the best-known forms of IBD, and both fall into the category of "idiopathic" inflammatory bowel disease because the etiology for them is unknown. "Active" IBD is characterized by acute inflammation. "Chronic" IBD is characterized by architectural changes of crypt distortion and scarring. Crypt abscesses can occur in many forms of IBD.

[0041] Ulcerative colitis (UC) involves the colon as a diffuse mucosal disease with distal predominance. The rectum is virtually always involved, and additional portions of colon may be involved extending proximally from the rectum in a continuous pattern. The etiology for UC is unknown. Patients with prolonged UC are at increased risk for developing colon cancer.

[0042] Patients with UC are also at risk for development of liver diseases including sclerosing cholangitis and bile duct carcinoma.

[0043] Crohn's disease can involve any part of the GI tract, but most frequently involves the distal small bowel and colon. Inflammation is typically transmural and can produce anything from a small ulcer over a lymphoid follicle

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(aphthoid ulcer) to a deep fissuring ulcer to transmural scarring and chronic inflammation. One third of cases have granulomas, and extracolonic sites such as lymph nodes, liver, and joints may also have granulomas. The transmural inflammation leads to the development of fistulas between loops of bowel and other structures. Inflammation is typically segmental with involved bowel separating areas of involved bowel. The etiology is unknown, though infectious and immunologic mechanisms have been proposed.

[0044] Gluten, a common dietary protein present in wheat, barley and rye causes a disease called Celiac disease in sensitive individuals. Ingestion of such proteins by sensitive individuals produces flattening of the normally luxurious, rug-like, epithelial lining of the small intestine.

[0045] Other clinical symptoms of Celiac disease include fatigue, chronic diarrhea, malabsorption of nutrients, weight loss, abdominal distension, anemia, as well as-a substantially enhanced risk for the development of osteoporosis and intestinal malignancies such as lymphoma and carcinoma. Celiac disease is generally considered to be an autoimmune disease and the antibodies found in the serum of the patients support the theory that the disease is immunological in nature.

[0046] Transgenic mice that have a knock-out of the Tcf locus show a loss of proliferative stem cell compartments in the small intestine during late embryogenesis [*Oncogene* (**2006**) 25(*57*), 7512-7521]. However, the knockout is lethal, and so has not been studied in adults. In chimeric transgenic mice that allow analysis of adults, expression of constitutively active NH_2-truncated p-catenin stimulated proliferation in small intestine crypts, although either NH_2-truncated p-catenin or Lef-1/ -catenin fusions induced increased crypt apoptosis as well [*The Journal of Cell Biology* (**1998**), 141(*3*), 765-777; *The Journal of Biological Chemistry* (**2002**), 277(*18*), 15843-15850]. Because diverse factors regulate P-catenin/Lef/Tcf-dependent transcription, including non-Frizzled GPCRs and PTEN/PI-3-kinase, the cause of intestinal stem cell defect is not known. Genes expressed in the gastrointestinal tract that are controlled by *Wnt*/β-catenin include CD44, and EphB2.

Regenerative Medicine

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[0047] Due to the remarkable advances made in the field of medicine in recent years, opportunities for saving lives are continuing to increase in the area of living donor transplant techniques for tissues and organs. However, there are limitations on treatment dependent upon living donor transplants due to such factors as a shortage of transplant donors and the occurrence of rejection. If it were possible to regenerate a tissue or organ that has been lost due to surgical treatment or an unforeseen accident, then it would be possible to considerably improve the quality of life for patients. In addition, regenerative medicine also makes it possible to resolve the problems confronting living donor transplants. From this viewpoint, the degree of expectations being placed on regenerative medicine is high.

[0048] Technologies in which regenerative medicine has been successful are primarily related to comparatively simple tissue in terms of morphology or function in the manner of artificial skin, artificial bone and artificial teeth. Reconstructed artificial skin and artificial bone is incorporated into cells enabling the providing of signals required for tissue construction. However, there have been limitations on the repertoire of differentiation of artificial skin and artificial bone by regenerative medicine techniques. For example, although allogeneic keratinocytes or skin fibroblasts and the like differentiate into structures in the form of the epidermis, are incorporated by surrounding organs to eventually have a horny layer or basal layer having barrier properties, there has been reported to be no derivation of secondary derivatives such as hair follicles, sebaceous glands or sweat glands.

[0049] Body tissue normally contains both cells that are able to self-replicate and possess stem cell properties for maintaining tissue homeostasis by sending signals to differentiated cells or supplying differentiated cells, and cells having properties of somatic cells that have already differentiated that receive various signals or commands from such cells, and is able to function through interaction between both of these types of cells. In the case of vertebrates, for example, interaction between mesenchymal cells and epithelial cells is essential for nearly all tissue and organ formation. In the case of hair follicles, mesenchymal cells in the form of hair papilla cells are responsible for stem cell-like properties, while epithelial cells in the form of keratinocytes are equivalent to cells

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having somatic cell-like properties in their ability to differentiate into hair shafts (hair itself).

[0050] The difficulty encountered when forming organs by regenerative medicine lies in reaching a state of coexistence between cells having stem cell-like properties maintained in an undifferentiated state and cells that have already differentiated as in actual body tissue. In the prior art, even if epithelial cells and mesenchymal cells were able to be co-cultured, they either both ended up differentiating or both maintained an undifferentiated state, thereby preventing the reproduction of the coexistence of undifferentiated cells and differentiated cells so as to mimic actual body tissue.

[0051] Guiding multipotent cells into distinct lineages and controlling their expansion remain fundamental challenges in developmental and stem cell biol. Members of the Wnt pathway control many pivotal embryonic events, including self-renewal or expansion of progenitor cells.

[0052] Published observations suggest that canonical Wnt signals play distinct roles during discrete developmental windows, first positively regulating mesoderm commitment and then possibly playing a negative role in the initial induction of cardiac progenitors [*Genes & Development* **(2001)**, 15(*3*), 316-327; *Ibid.*, 304-315; *Proc Natl Acad Sci U S A.* **(2006)**, 103(*52*), 19812-19817; *Development (Cambridge, UK)* **(2006)**, 133(19), 3787–3796]. The loss- and gain-of-function studies of canonical Wnt signaling in a spatiotemporally restricted manner described here provide compelling evidence that *Wnt*/β-catenin signaling is required in a cell autonomous fashion for the expansion and development of precardiac mesoderm and cardiac mesoderm in mouse. Thus, narrow developmental windows may exist during which canonical Wnt signaling sequentially inhibits then promotes cardiac development. Thus it was shown that canonical Wnt signaling can be manipulated to regulate expansion and differentiation of progenitor cells.

[0053] In contrast to progenitor cells, however, stem cells are far less specific. The most important difference between stem cells and progenitor cells is that stem cells can replicate indefinitely, whereas progenitor cells can only divide a *limited* number of times. The term adult stem cell, also known as somatic and gametes, refers to any cell which is found in a developed organism that has two properties: the ability to divide and

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create another cell like itself and also divide and create a cell more differentiated than itself. They can be found in children, as well as adults [*Nature* (**2002**), 418(*6893*), 41–49]. All somatic cells of an individual are genetically identical in principle, they evolve a variety of tissue-specific characteristics during the process of differentiation, through epigenetic and regulatory alterations. Pluripotent somatic stem cells are rare and generally small in number but can be found in a number of tissues including umbilical cord blood. A great deal of somatic stem cell research has focused on clarifying their capacity to divide or self-renew indefinitely and their differentiation potential. In mice, pluripotent stem cells are directly generated from adult fibroblast cultures. Unfortunately, many mice don't live long with stem cell organs.

[0054] Somatic cells can be reprogrammed to induced pluripotent stem cells (iPSC) by retroviral transduction of four transcription factors [*Cell* (**2008**), 132(*4*), 567–582]. While the reprogrammed pluripotent cells are thought to have great potential for regenerative medicine [*Proc. Natl. Acad. Sci. USA* (**2008**), 105(*15*), 5856–5861], genomic integrations of the retroviruses, especially c-Myc, increase the risk of tumorigenesis [*Nature* (**2007**), 448(*7151*), 313–317]. Generation of iPSCs for use in the clinical setting would benefit from identification of alternative, ultimately safer, initiating stimuli, in preference to genetic modification. This could be transient treatment with defined factors, low-toxicity chemicals, or synthetic small molecules. Since the Wnt pathway is intimately connected to the core circuitry of pluripotency, it has been shown that the stimulation of the pathway using soluble Wnt3a promotes the generation of iPSCs in the absence of c-Myc retrovirus. These data demonstrate that signal transduction pathways and transcription factors can act coordinately to reprogram differentiated cells to a pluripotent state [*Cell Stem Cell* (**2008**), 3(*2*), 132-135; Cell Stem Cell (2008), 3(5), 465-466].

[0055] As discussed above, activators of the *Wnt*/β-catenin signaling pathway are expected to be medicaments useful against cell proliferation disorders, bone disorders, eye diseases, Alzheimer's disease and even tissue generation. Thus, it would be advantageous to have novel activators of the *Wnt*/β-catenin signaling pathway as potential treatment regimens for *Wnt*/β-catenin signaling pathway-related disorders. The instant invention is directed to these and other important ends.

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SUMMARY OF THE INVENTION

[0056] The present invention relates to a method for increasing cell or tissue regeneration in a vertebrate subject. The invention relates to methods for increasing the successful activity of embryonic and/or adult stem cells, progenitor cells, mesenchymal progenitor/stem cells and/or differentiated cells in vivo in a vertebrate subject. The invention further relates to methods for increasing cell or tissue regeneration in a vertebrate subject by administering a compound according to Formulas I, II or III, to the vertebrate subject in need thereof, and increasing in vivo a stem cell, progenitor cell, and/or differentiated cell population in the vertebrate subject compared to the stem cell, progenitor cell, and/or differentiated cell population in the vertebrate subject before treatment, to increase cell or tissue regeneration in the vertebrate subject. Increasing the stem cell, progenitor cell, or differentiated cell population in the vertebrate subject can be a result of cell proliferation, cell homing, decreased apoptosis, self-renewal, or increased cell survival.

[0057] In one embodiment, the cell or tissue regeneration can occur in tissues including but not limited to, bone, chondrocytes/cartilage, muscle, skeletal muscle, cardiac muscle, pancreatic cells, endothelial cells, vascular endothelial cells, adipose cells, liver, skin, connective tissue, hematopoietic stem cells, neonatal cells, umbilical cord blood cells, fetal liver cells, adult cells, bone marrow cells, peripheral blood cells, erythroid cells, granulocyte cells, macrophage cells, granulocyte-macrophage cells, B cells, T cells, multipotent mixed lineage colony types, embryonic stem cells, mesenchymal progenitor/stem cells, mesodermal progenitor/stem cells, neural progenitor/stem cells, or nerve cells. The vertebrate can be mammalian, avian, reptilian, amphibian, osteichthyes, or chondrichthyes.

[0058] In one embodiment, the present invention is a composition for preventing or decreasing the loss of hair and/or for stimulating or increasing hair growth or regrowth, wherein the composition comprises a compound according to Formulas I, II or III.

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[0059] One embodiment of the present invention provides a pharmaceutical composition for the treatment of a neurodegenerative disease.

[0060] In another embodiments, the neurological disorder is Alzheimer's disease, schizophrenia or schizo-affective disorder, bipolar disorder or unipolar disorder, depression, substance abuse, neurodegenerative disease, autism or autism spectrum disorder, or a disorder resulting from neural damage such as spinal injuries or brain injuries. The neurodegenerative disease may be for instance, amyotrophic lateral sclerosis (Lou Gehrig's disease) or Parkinson's disease. In some embodiments, the invention provides methods for treating brain injury resulting from traumatic injury or stroke.

[0061] In another embodiments, the neurological disorder is an eye disease such as age related macular degeneration, diabetic macular edema or retinitis pigmentosa.

[0062] In one embodiment, the invention relates to a method for (i) reducing loss of bone mass or bone density, (ii) increasing bone mass or bone density, (iii) maintaining bone mass or bone density and/or (iv) reducing loss of calcium from bone, comprising: administering to a subject a therapeutically effective amount of a compound according to Formulas I, II or III. As used in this patent specification, the term "bone mass" and "bone density" are used interchangeably.

[0063] In one embodiment, the invention relates to a method to regulate osteoblast activity or osteoclast activity comprising the use of a compound according to Formulas I, II or III. Osteoblast activity can be regulated by regulating the proliferation or function of osteoblasts. The function of osteoblasts and/or osteoclasts can be regulated directly or indirectly.

[0064] In one embodiment, the method is for the treatment of a bone condition or a bone defect.

[0065] In another embodiment, the bone condition being treated is frailty, an osteoporotic fracture, a bone defect, childhood idiopathic bone loss, alveolar bone loss, mandibular bone loss, bone fracture, osteotomy, bone loss associated with periodontitis, or prosthetic ingrowth.

[0066] In yet another embodiment, the bone condition being treated is Paget's disease.

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[0067] In another embodiment, the bone condition being treated is oncolytic bone disease.

[0068] In another embodiment, the invention relates to method for promoting healing of bone fractures, bone defects, craniofacial defects, otosclerosis or osteogenesis imperfecta comprising: administering to a subject a therapeutically effective amount of a compound according to Formulas I, II or III.

[0069] In another embodiment, the invention relates to method for bone tissue engineering comprising the use a compound according to Formulas I, II or III,. In one embodiment the cells used for bone tissue engineering are treated with a compound according to Formulas I, II or III.

[0070] In another embodiment, the invention relates to the use of a compound according to Formulas I, II or III as a medicament for (i) reducing loss of bone mass, (ii) increasing bone mass, (iii) maintaining bone mass and/or (iv) reducing loss of calcium from bone in a subject in need thereof. In another embodiment, the invention relates to the use of a compound according to Formulas I, II or III as a medicament for healing bone fractures or repairing bone defects in a mammal.

[0071] In one embodiment, the bone condition being treated is osteoporosis. In one embodiment, the osteoporosis being treated is selected from the group consisting of: glucocorticoid-induced osteoporosis, hyperthyroidism-induced osteoporosis, immobilization-induced osteoporosis, heparin-induced osteoporosis and immunosuppressive-induced osteoporosis.

[0072] In one embodiment, a compound according to Formulas I, II or III is administered conjointly with an agent that increases bone mass or prevents the loss of bone mass. In one embodiment, the agent that increases bone mass is a growth factor, a mineral, a vitamin, a hormone, a prostaglandin, an inhibitor of 15-lipoxygenase, a bone morphogenic protein or another member of the TGF-beta superfamily which increases bone formation, an ACE inhibitor, a Hedgehog protein, examethasone, calcitonin, or an active fragment thereof. In one embodiment, the agent that prevents the loss of bone mass is progestin, estrogen, an estrogen/progestin combinations, estrone, estriol, 17α- or 17β-ethynyl estradiol, SB242784, polyphosphonates, biphosphonates or an active fragment thereof.

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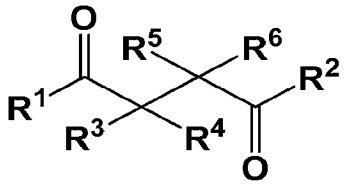
[0073] In one embodiment of the invention, a compound according to Formulas I, II or III, is administered to enhance proliferation of intestinal epithelium, for the treatment, or as a therapeutic adjunct in the treatment, of diseases that compromise the intestinal epithelia, including inflammatory bowel diseases and Celiac disease.

[0074] In another embodiment, the invention relates to a method for organ tissue engineering comprising the use of a compound according to Formulas I, II or III. In one embodiment the cells used for organ tissue engineering are treated with a compound according to Formulas I, II or III.

[0075] Some embodiments disclosed herein include a *Wnt*/β-catenin signaling pathway activator containing a β-diketone, γ-diketone or γ-hydroxyketone core. Other embodiments disclosed herein include pharmaceutical compositions and methods of treatment using these compounds.

[0076] One embodiment of a *Wnt*/β-catenin signaling pathway activator disclosed herein includes a compound having the structure of Formula **I**:



I

R^1 is selected from the group consisting of substituted or unsubstituted heteroaryl and substituted or unsubstituted heterocyclyl, with the proviso that a carbon atom is attached to the carbonyl;

R^2 is selected from the group consisting of substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, substituted or unsubstituted carbocyclyl and substituted or unsubstituted heterocyclyl, with the proviso that a carbon atom is attached to the carbonyl; and

R^3, R^4, R^5 and R^6 are independently selected from a group consisting of H, -C_{1-9}alkyl, -C_{1-9}alkylaryl and -C_{1-9}alkylheteroaryl.

[0077] Another embodiment of a *Wnt*/β-catenin signaling pathway activator disclosed herein includes a compound having the structure of Formula **II**:

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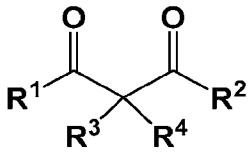


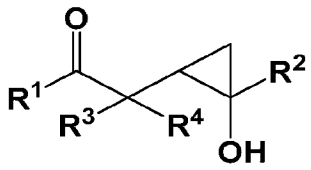
II

R^1 is selected from the group consisting of substituted or unsubstituted heteroaryl and substituted or unsubstituted heterocyclyl, with the proviso that a carbon atom is attached to the carbonyl;

R^2 is selected from the group consisting of substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, substituted or unsubstituted carbocyclyl and substituted or unsubstituted heterocyclyl, with the proviso that a carbon atom is attached to the carbonyl; and

R^3 and R^4 are independently selected from a group consisting of H, -C_{1-9}alkyl, -C_{1-9}alkylaryl and -C_{1-9}alkylheteroaryl.

[0078] Another embodiment of a *Wnt*/β-catenin signaling pathway activator disclosed herein includes a compound having the structure of Formula **III**:



III

R^1 is selected from the group consisting of substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, substituted or unsubstituted carbocyclyl and substituted or unsubstituted heterocyclyl, with the proviso that a carbon atom is attached to the carbonyl;

R^2 is selected from the group consisting of substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, substituted or unsubstituted carbocyclyl and substituted or unsubstituted heterocyclyl, with the proviso that a carbon atom is attached to the carbonyl; and

R^3 and R^4 are independently selected from a group consisting of H, -C_{1-9}alkyl, -C_{1-9}alkylaryl and -C_{1-9}alkylheteroaryl.

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[0079] Some embodiments include stereoisomers and pharmaceutically acceptable salts of a compound of Formulas **I**, **II** or **III**.

[0080] Some embodiments include pro-drugs of a compound of Formulas **I**, **II** and **III**.

[0081] Some embodiments of the present invention include pharmaceutical compositions comprising a compound of Formulas **I**, **II** or **III** and a pharmaceutically acceptable carrier.

[0082] Another embodiment disclosed herein includes a pharmaceutical composition comprising a compound according to any of the above formulas and a pharmaceutically acceptable carrier, diluent, or excipient.

[0083] Some embodiments of the present invention include methods to prepare compounds of Formulas **I**, **II** or **III**.

[0084] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

DETAILED DESCRIPTION OF THE INVENTION

[0085] It has been discovered that β-diketones, γ-diketones and γ-hydroxyketones are capable of activating the *Wnt*/β-catenin signaling pathway. The *Wnt*/β-catenin signaling pathway has been found to play a crucial role in the differentiation and development of nerve cells for the central nervous system, bone formation, hair follicle development and regeneration, and stimulation of stem cell growth, maintenance and differentiation.

[0086] The present invention relates a method for increasing cell or tissue regeneration in a vertebrate subject. The invention relates to methods for increasing the successful activity of embryonic and/or adult stem cells, progenitor cells, mesenchymal progenitor/stem cells, or differentiated cells in vivo in a vertebrate subject. The invention further relates to methods for increasing cell or tissue regeneration in a vertebrate subject by administering a compound according to Formulas I, II or III to the vertebrate subject in need thereof, and increasing in vivo a stem cell, progenitor cell population, or

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differentiated cell in the vertebrate subject compared to the stem cell or progenitor cell, or differentiated cell population in the vertebrate subject before treatment, to increase cell or tissue regeneration in the vertebrate subject. A method for increasing stem cell or progenitor cell population is provided to repair or replace damaged tissue in a vertebrate subject, wherein the cell or tissue regeneration occurs in bone, chondrocytes/cartilage, muscle, skeletal muscle, cardiac muscle, pancreatic cells, endothelial cells, vascular endothelial cells, adipose cells, liver, skin, connective tissue, hematopoietic stem cells, neonatal cells, umbilical cord blood cells, fetal liver cells, adult cells, bone marrow cells, peripheral blood cells, erythroid cells, granulocyte cells, macrophage cells, granulocyte-macrophage cells, B cells, T cells, multipotent mixed lineage colony types, embryonic stem cells, mesenchymal progenitor/stem cells, mesodermal progenitor/stem cells, neural progenitor/stem cells, or nerve cells.

Hair Growth

[0087] Compositions comprising compounds according to Formulas I, II or III can be used to promote hair growth.

[0088] "Promoting hair growth" refers to maintaining, inducing, stimulating, accelerating, or revitalizing the germination of hair.

[0089] The method of the present invention is useful in the treatment of alopecia in mammals, and as such may be used to promote, increase, or assist in the growth of hair. Subjects may be male or female. The term alopecia refers to both the complete absence of hair in skin which typically exhibits hair growth, as well as to a loss or diminution in the amount of hair. Multiple types and causes of alopecia are recognized in humans, including male pattern baldness, chemotherapy induced hair loss, congenital alopecia, and alopecia areata. The term treating alopecia refers to both the treatment of skin with a total absence of hair growth as well as the treatment of skin having reduced or patchy hair growth. Successful treatment results in an increased number of hairs.

[0090] Subjects to be treated according to the invention include human subjects as well as other mammalian subjects, such as dogs, cats, mice, rats, goats, llamas, minks, seals, beavers, ermines, and sheep. These can be treated for hair loss due or simply for enhancing wool or pelt production.

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[0091] "Treating alopecia" refers to (i) preventing alopecia in an animal which may be predisposed to alopecia, (ii) inhibiting, retarding or reducing alopecia, (iii) promoting hair growth and/or (iv) prolonging the anagen phase of the hair cycle.

[0092] A method for promoting hair growth in accordance with the present invention is characterized by applying an effective amount of a compound according to Formulas I, II or III, or a pharmacologically acceptable salt thereof on the skin of mammals and in particular, on human scalp.

Neurological Disorder

[0093] Compounds according to the present invention can modulate the cellular fate of neural stem cells and promote the differentiation of these neural precursors to functional neurons and glial cells.

[0094] Compositions comprising compounds according to Formulas I, II or III can be used to treat neurodegenerative diseases.

[0095] Non-limiting examples of neurodegenerative diseases are Alzheimer's disease, schizophrenia or schizo-affective disorder, bipolar disorder or unipolar disorder, depression, substance abuse, neurodegenerative disease, autism or autism spectrum disorder, or a disorder resulting from neural damage such as spinal injuries or brain injuries. The neurodegenerative disease may be for instance, amyotrophic lateral sclerosis (Lou Gehrig's disease) or Parkinson's disease.

[0096] Other non-limiting examples of neurodegenerative diseases are eye diseases such as age related macular degeneration, diabetic macular edema or retinitis pigmentosa.

[0097] The invention also provides a method for treating brain injury resulting from traumatic injury or stroke.

[0098] Another aspect of the invention is a method of enhancing neural progenitor proliferation and differentiation by contacting a neural progenitor cell with a compound according to Formulas I, II or III in an effective amount to enhance neural progenitor proliferation and differentiation.

[0099] In one aspect the invention provides a method of enhancing nerve generation, by contacting a nerve with a compound according to Formulas I, II or III in an effective amount to enhance nerve generation.

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[00100] In another aspect, the present invention provides a method of treating a neurodegenerative disease in a patient requiring treatment, which comprises administering an effective amount of a compound of Formulas I, II or III, or a pharmaceutically acceptable salt thereof as defined hereinabove.

[00101] The compounds according to the present invention may be administered alone or co-administered with compounds working by a different mechanism, for example neuroprotectant agents. In one embodiment, the compounds are co-administered compounds with an acetylcholinesterase inhibitor (e.g. Aricept) for Alzheimer's disease or L-DOPA for Parkinson disease.

Bone Formation

[00102] Compositions comprising compounds of Formulas I, II or III can be used to treat, prevent and alleviate bone conditions. The present invention provides a method for (i) reducing loss of bone mass, (ii) increasing bone mass, (iii) maintaining bone mass and/or (iv) reducing loss of calcium from bone, comprising: administering to a subject a therapeutically effective amount of a compound according to Formulas I, II or III. The method could be used for treating, preventing or delaying a bone condition. The invention further provides a method for promoting healing of bone fractures or bone defects comprising: administering to a subject a therapeutically effective amount of a compound according to Formulas I, II or III. Any of the above mentioned methods can involve the conjoint administration of an agent that increases bone mass or prevents the loss of bone mass.

[00103] The invention also provides for the use of a compound according to Formulas I, II or III as a medicament for treating, preventing or delaying a bone condition.

[00104] As used herein, the term "bone condition" includes any condition where it is desirable to increase bone mass or bone density and/or prevent the loss of bone mass or bone density. A bone condition includes any condition that increases osteoclast number, increases osteoclast activity, increases bone resorption, increases marrow fibrosis, or alters the calcium content of bone.

[00105] Non-limiting examples of bone conditions include metabolic bone conditions such as renal osteodystrophy, primary forms of osteoporosis (e.g.,

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postmenopausal and senile osteoporosis), and secondary forms of osteoporosis that develop as a result of an underlying disease state. For example, osteoporosis can develop in patients that have endocrine disorders such as hyperparathyroidism, hypo- and hyperthyroidism, hypogonadism, hypercalcemia due to malignancy, pituitary tumors, type I diabetes, or Addison's disease. Neoplasias such as multiple myeloma and carcinomatosis also can lead to development of osteoporosis. In addition, gastrointestinal problems such as malnutrition, malabsorption, hepatic insufficiency, and vitamin C or D deficiencies, and chronic administration of drugs such as anticoagulants, chemotherapeutics, corticosteroids, anticonvulsants, and alcohol can lead to development of osteoporosis.

[00106] Non-limiting examples of bone conditions also include osteonecrosis, osteoarthritis, rheumatoid arthritis, Paget's disease, osteogenesis imperfecta, chronic hyperparathyroidism, hyperthyroidism, Gorham-Stout disease, McCune-Albright syndrome, and alveolar ridge bone loss.

[00107] The term "bone condition" includes, without limitation, all conditions resulting in bone loss, including, cancers and tumors (such as osteosarcoma and multiple myeloma), renal disease (including acute renal failure, chronic renal failure, renal bone dystrophy and renal reperfusion injury), kidney disease, premature ovarian failure and other conditions.

[00108] Endocrine disorders, vitamin deficiencies and viral infections also can lead to development of bone conditions that can be treated with methods of the invention. An example of a bone condition caused by a nutritional disorder is osteomalacia, a nutritional disorder caused by a deficiency of vitamin D and calcium. It is referred to as "rickets" in children, and "osteomalacia" in adults. It is marked by a softening of the bones (due to impaired mineralization, with excess accumulation of osteoid), pain, tenderness, muscle wasting and weakness, anorexia, and overall weight loss. It can result from malnutrition, repeated pregnancies and lactation (exhausting or depleting vitamin D and calcium stores), and vitamin D resistance.

[00109] Bone conditions include conditions resulting from the treatment of a subject with drugs, for example the osteopenia resulting from the treatment with Cyclosporin A or FK506.

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[00110] Bone conditions also include bone fractures, bone trauma, conditions associated with post-traumatic bone surgery, post-prosthetic joint surgery, post-plastic bone surgery, post-dental surgery, bone chemotherapy, post-dental surgery and bone radiotherapy. Fractures include all types of microscopic and macroscopic fractures. Examples of fractures includes avulsion fracture, comminuted fracture, transverse fracture, oblique fracture, spiral fracture, segmental fracture, displaced fracture, impacted fracture, greenstick fracture, torus fracture, fatigue fracture, intra-articular fracture (epiphyseal fracture), closed fracture (simple fracture), open fracture (compound fracture) and occult fracture.

[00111] Other non-limiting examples of bone conditions include bone deformation, spinal deformation, prosthesis loosening, bone dysplasia, scoliosis, periodontal disease and defects, tooth repair, and fibrous osteitis.

[00112] The invention also provides a method for treating a subject with a therapeutically effective amount of a compound according to Formulas I, II or III, wherein the subject is in need of bone repair following surgery, such as cranio-maxillofacial repair following tumor removal, surgical bone reconstruction following traumatic injury, repair of hereditary or other physical abnormalities, and promotion of bone healing in plastic surgery.

[00113] The invention also provides a method for treating a subject with a therapeutically effective amount of a compound according to Formulas I, II or III, wherein the subject is in need of bone repair after receiving an implant (including joint replacements and dental implants), a prosthesis or a bone graft.

[00114] The invention also provides a method for treating a subject with a therapeutically effective amount of a compound according to Formulas I, II or III, wherein the subject: a) is in need of increased bone density or bone healing; b) has undergone or is presently undergoing corticosteroid therapy, dialysis, chemotherapy for post-menopausal bone loss, radiation therapy for cancer or hormone replacement therapy; c) is immobilized or subjected to extended bed rest due to bone injury; d) suffers from alcoholism, diabetes, hyperprolactinemia, anorexia nervosa, primary and secondary amenorrhea, or oophorectomy; e) suffers from renal failure; f) is 50 years or older; or g) is a female.

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[00115] The invention also provides a method for treating a subject with a therapeutically effective amount of a compound according to Formulas I, II or III, wherein the subject is affected by a disease selected from arterial calcification, ankylosing spondylitis, ossification of the posterior longitudinal ligament, myositis ossificans, diffuse idiopathic skeletal hyperostosis, calcific tendonitis, rotator cuff disease of the shoulders, bone spurs, cartilage or ligament degeneration due to hydroxyapatite crystal deposition, and chondrocalcinosis.

[00116] By the term "effective amount" or "therapeutically effective amount" of a compound according to Formulas I, II or III, is meant an amount sufficient to obtain the desired physiological effect, e.g., activation of osteoblasts, increase in osteoblast number, increase in bone formation, a decrease in osteoclasts number or the deactivation of osteoclasts. An effective amount of a *Wnt*/β-catenin signaling pathway activator is determined by the care giver in each case on the basis of factors normally considered by one skilled in the art to determine appropriate dosages, including the age, sex, and weight of the subject to be treated, the condition being treated, and the severity of the medical condition being treated.

[00117] The invention also provides a method for treating a subject with a therapeutically effective amount of a compound according to Formulas I, II or III conjointly with an agent that increases bone mass or prevents the loss of bone mass. In one embodiment, the agent that increases bone mass is a growth factor, a mineral, a vitamin, a hormone, a prostaglandin, an inhibitor of 15-lipoxygenase, a bone morphogenic protein or another member of the TGF-beta superfamily which increases bone formation, an ACE inhibitor, a Hedgehog protein, examethasone, calcitonin, or an active fragment thereof. In one embodiment, the agent that prevents the loss of bone mass is progestin, estrogen, an estrogen/progestin combinations, estrone, estriol, 17α- or 17β-ethynyl estradiol, SB242784, polyphosphonates, biphosphonates or an active fragment thereof.

Intestinal Diseases

[00118] Compounds according to Formulas I, II or III are also administered for the treatment of gastrointestinal inflammation. "Gastrointestinal inflammation" as used herein refers to inflammation of a mucosal layer of the gastrointestinal tract, and

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encompasses acute and chronic inflammatory conditions. Acute inflammation is generally characterized by a short time of onset and infiltration or influx of neutrophils.

[00119] "Chronic gastrointestinal inflammation" refers to inflammation of the mucosal of the gastrointestinal tract that is characterized by a relatively longer period of onset, is long-lasting (e. g., from several days, weeks, months, or years and up to the life of the subject), and is associated with infiltration or influx of mononuclear cells and can be further associated with periods of spontaneous remission and spontaneous occurrence. Thus, subjects with chronic gastrointestinal inflammation may be expected to require a long period of supervision, observation, or care. "Chronic gastrointestinal inflammatory conditions" (also referred to as "chronic gastrointestinal inflammatory diseases") having such chronic inflammation include, but are not necessarily limited to, inflammatory bowel disease (IBD), colitis induced by environmental insults (e. g., gastrointestinal inflammation (e. g., colitis) caused by or associated with (e. g., as a side effect) a therapeutic regimen, such as administration of chemotherapy, radiation therapy, and the like), colitis in conditions such as chronic granulomatous disease, celiac disease, celiac sprue (a heritable disease in which the intestinal lining is inflamed in response to the ingestion of a protein known as gluten), food allergies, gastritis, infectious gastritis or enterocolitis (e. g., Helicobacter pylori-infected chronic active gastritis) and other forms of gastrointestinal inflammation caused by an infectious agent, and other like conditions.

[00120] As used herein, "inflammatory bowel disease" or "IBD" refers to any of a variety of diseases characterized by inflammation of all or part of the intestines. Examples of inflammatory bowel disease include, but are not limited to, Crohn's disease and ulcerative colitis. Reference to IBD throughout the specification is often referred to in the specification as exemplary of gastrointestinal inflammatory conditions, and is not meant to be limiting.

[00121] Compounds according to Formulas I, II or III can be administered to a subject prior to onset of more severe symptoms (e. g., prior to onset of an acute inflammatory attack), or after onset of acute or chronic symptoms (e. g., after onset of an acute inflammatory attack). As such, the agents can be administered at any time, and may be administered at any interval. In one embodiment, compounds according to Formulas I, II or III are administered about 8 hours, about 12 hours, about 24 hours, about 2 days,

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about 4 days, about 8 days, about 16 days, about 30 days or 1 month, about 2 months, about 4 months, about 8 months, or about 1 year after initial onset of gastrointestinal inflammation-associated symptoms and/or after diagnosis of gastrointestinal inflammation in the subject.

[00122] When multiple doses are administered, subsequent doses are administered within about 16 weeks, about 12 weeks, about 8 weeks, about 6 weeks, about 4 weeks, about 2 weeks, about 1 week, about 5 days, about 72 hours, about 48 hours, about 24 hours, about 12 hours, about 8 hours, about 4 hours, or about 2 hours or less of the previous dose. In one embodiment, ISS are administered at intervals ranging from at least every two weeks to every four weeks (e. g., monthly intervals) in order to maintain the maximal desired therapeutic effect (e. g., to provide for maintenance of relief from BD-associated symptoms).

Regenerative Medicine

[00123] According to the present invention, somatic cells can be provided that are capable as serving as a primitive organ-like structure comprised of a plurality of types of somatic cell types.

[00124] Somatic cells as referred to in the present invention refer to cells that have reached differentiation into cells that compose various organs of the body, and refer to cells that are the opposite of undifferentiated stem cells. The present invention is characterized by the use of two or more somatic cells, and preferably consists of various combinations thereof, such as a combination of an epithelial cell line and mesenchymal cells, a combination of endothelial cells and mesenchymal cells, or a combination of epithelial cells and mesenchymal cells.

[00125] There are no particular limitations on organs capable of being formed by the somatic cells as claimed in the present invention, examples of which include various organs such as hair follicle, lung, kidney, liver, pancreas, spleen, heart, gallbladder, small intestine, colon, large intestine, joint, bone, tooth, blood vessel, lymph duct, cornea, cartilage, olfactory organ or auditory organ.

[00126] Various mammals can be used without limitation as the origin of the cells as claimed in the present invention corresponding to the purpose thereof, examples of which include chimpanzees, other primates, domestic animals such as dogs or cats,

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farm animals such as cows, pigs, horses, sheep or goats, laboratory animals such as rabbits, rats, mice or guinea pigs, and more preferably nude mice, SCID mice or nude rats. In addition, although combinations thereof may be homogeneous combinations or heterogeneous combinations, homogeneous combinations are preferable.

[00127] The present invention is characterized by the addition of a *Wnt*/β-catenin signaling pathway activator according to Formulas I, II or III to a mixture of types of differentiated somatic cells as described above followed by culturing thereof. Wnt signaling refers to a series of actions that demonstrate the function of transcription factors by promoting nuclear migration of β-catenin. These signals originate from cellular interaction that includes, for example, a series of processes in which a protein referred to as *Wnt3A* secreted from certain cells further acts on other cells causing nuclear migration of intracellular β-catenin which acts as a transcription factor. This series of processes give rise to the initial phenomenon of organ construction in the example of epithelial-mesenchymal interaction. The *Wnt*/β-catenin signaling pathway is known to control cell proliferation and differentiation, organ formation and various cell functions such as cell migration during initial development. Although *Wnt* signaling is used when culturing ES cells for the purpose of inhibiting differentiation due to their function of maintaining an undifferentiated state, their utilization and effects during culturing of somatic cells are completely unknown.

[00128] Another characteristic of the present invention is the subjecting of the mixture of types of differentiated somatic cells, to which a compound according to Formulas I, II or III has been added, to non-plate contact culturing. Non-plate contact culturing refers to a method of culturing cells on an interface having a spherical surface so as not to allow adhesion of plate-adhering cells. An example of non-plate contact culturing is a hanging drop method. The hanging drop method refers to adhering a drop of culture medium containing cultured cells onto the inside of the upper lid of a culture dish, carefully closing the lid so that the culture medium does not drop or run down, and culturing cells within the culture medium to be cultured in the form of an inverted drop due to surface tension. As a result of culturing in this manner, the effects on the cells attributable to contact with a flat surface as in the case of plate culturing can be minimized. Other examples of non-plate contact culturing methods include a formation

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method utilizing a semi-spherical cell culture dish that has been surface-treated in advance to prevent cell adhesion (for example, "Spheroid" commercially available from Sumitomo Bakelite) (referred to as the spheroid formation method), and a suspension method in which cells are aggregated in a suspended state by culturing in a nitrocellulose medium.

[00129] In some embodiments, pharmaceutical compositions are provided that are effective for treatment of a disease of an animal, *e.g.*, a mammal, caused by the pathological activation or mutations of the Wnt pathway. The composition includes a pharmaceutically acceptable carrier and a Wnt pathway activator as described herein.

Definitions

[00130] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as is commonly understood by one of ordinary skill in the art to which this disclosure belongs. All patents, applications, published applications, and other publications are incorporated by reference in their entirety. In the event that there is a plurality of definitions for a term herein, those in this section prevail unless stated otherwise.

[00131] In this specification and in the claims, the following terms have the meanings as defined. As used herein, "alkyl" means a branched, or straight chain chemical group containing only carbon and hydrogen, such as methyl, isopropyl, isobutyl, sec-butyl and pentyl. Alkyl groups can either be unsubstituted or substituted with one or more substituents, e.g., halogen, alkoxy, acyloxy, amino, amido, cyano, nitro, hydroxyl, mercapto, carboxy, carbonyl, benzyloxy, aryl, heteroaryl, or other functionality that may be suitably blocked, if necessary for purposes of the invention, with a protecting group. Alkyl groups can be saturated or unsaturated (e.g., containing -C=C- or -C≡C- subunits), at one or several positions. Typically, alkyl groups will comprise 1 to 9 carbon atoms, preferably 1 to 6, and more preferably 1 to 4 carbon atoms.

[00132] As used herein, "carbocyclyl" means a cyclic ring system containing only carbon atoms in the ring system backbone, such as cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, and cyclohexenyl. Carbocyclyls may include multiple fused rings. Carbocyclyls may have any degree of saturation provided that at least one ring in

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the ring system is not aromatic. Carbocyclyl groups can either be unsubstituted or substituted with one or more substituents, e.g., halogen, alkoxy, acyloxy, amino, amido, cyano, nitro, hydroxyl, mercapto, carboxy, carbonyl, benzyloxy, aryl, heteroaryl, or other functionality that may be suitably blocked, if necessary for purposes of the invention, with a protecting group. Typically, carbocyclyl groups will comprise 3 to 10 carbon atoms, preferably 3 to 6.

[00133] As used herein, "lower alkyl" means a subset of alkyl, and thus is a hydrocarbon substituent, which is linear, or branched. Preferred lower alkyls are of 1 to about 4 carbons, and may be branched or linear. Examples of lower alkyl include butyl, propyl, isopropyl, ethyl, and methyl. Likewise, radicals using the terminology "lower" refer to radicals preferably with 1 to about 4 carbons in the alkyl portion of the radical.

[00134] As used herein, "amido" means a H-CON- or alkyl-CON-, carbocyclyl-CON-, aryl-CON-, heteroaryl-CON- or heterocyclyl-CON group wherein the alkyl, carbocyclyl, aryl or heterocyclyl group is as herein described.

[00135] As used herein, "aryl" means an aromatic radical having a single-ring (e.g., phenyl) or multiple condensed rings (e.g., naphthyl or anthryl) with only carbon atoms present in the ring backbone. Aryl groups can either be unsubstituted or substituted with one or more substituents, e.g., amino, cyano, hydroxyl, lower alkyl, haloalkyl, alkoxy, nitro, halo, mercapto, and other substituents. A preferred carbocyclic aryl is phenyl.

[00136] As used herein, the term "heteroaryl" means an aromatic radical having one or more heteroatom(s) (e.g., N, O, or S) in the ring backbone and may include a single ring (e.g., pyridine) or multiple condensed rings (e.g., quinoline). Heteroaryl groups can either be unsubstituted or substituted with one or more substituents, e.g., amino, cyano, hydroxyl, lower alkyl, haloalkyl, alkoxy, nitro, halo, mercapto, and other substituents. Examples of heteroaryl include thienyl, pyrridyl, furyl, oxazolyl, oxadiazolyl, pyrollyl, imidazolyl, triazolyl, thiodiazolyl, pyrazolyl, isoxazolyl, thiadiazolyl, pyranyl, pyrazinyl, pyrimidinyl, pyridazinyl, triazinyl, thiazolyl and others.

[00137] In these definitions it is clearly contemplated that substitution on the aryl and heteroaryl rings is within the scope of certain embodiments. Where substitution occurs, the radical is called substituted aryl or substituted heteroaryl. Preferably one to

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three and more preferably one or two substituents occur on the aryl ring. Though many substituents will be useful, preferred substituents include those commonly found in aryl compounds, such as alkyl, cycloalkyl, hydroxy, alkoxy, cyano, halo, haloalkyl, mercapto and the like.

[00138] As used herein, "amide" includes both RNR'CO- (in the case of R = alkyl, alkaminocarbonyl-) and RCONR'- (in the case of R = alkyl, alkyl carbonylamino-).

[00139] As used herein, the term "ester" includes both ROCO- (in the case of R = alkyl, alkoxycarbonyl-) and RCOO- (in the case of R = alkyl, alkylcarbonyloxy-).

[00140] As used herein, "acyl" means an H-CO- or alkyl-CO-, carbocyclyl-CO-, aryl-CO-, heteroaryl-CO- or heterocyclyl-CO- group wherein the alkyl, carbocyclyl, aryl or heterocyclyl group is as herein described. Preferred acyls contain a lower alkyl. Exemplary alkyl acyl groups include formyl, acetyl, propanoyl, 2-methylpropanoyl, t-butylacetyl, butanoyl and palmitoyl.

[00141] As used herein, "halo or halide" is a chloro, bromo, fluoro or iodo atom radical. Chloro, bromo and fluoro are preferred halides. The term "halo" also contemplates terms sometimes referred to as "halogen", or "halide".

[00142] As used herein, "haloalkyl" means a hydrocarbon substituent, which is linear or branched or cyclic alkyl, alkenyl or alkynyl substituted with chloro, bromo, fluoro or iodo atom(s). Most preferred of these are fluoroalkyls, wherein one or more of the hydrogen atoms have been substituted by fluoro. Preferred haloalkyls are of 1 to about 3 carbons in length, more preferred haloalkyls are 1 to about 2 carbons, and most preferred are 1 carbon in length. The skilled artisan will recognize then that as used herein, "haloalkylene" means a diradical variant of haloalkyl, such diradicals may act as spacers between radicals, other atoms, or between the parent ring and another functional group.

[00143] As used herein, "heterocyclyl" means a cyclic ring system comprising at least one heteroatom in the ring system backbone. Heterocyclyls may include multiple fused rings. Heterocyclyls may have any degree of saturation provided that at least one ring in the ring system is not aromatic. Heterocyclyls may be substituted or unsubstituted with one or more substituents, e.g., halogen, alkoxy, acyloxy, amino, amido, cyano, nitro, hydroxyl, mercapto, carboxy, carbonyl, benzyloxy, aryl, heteroaryl, and other

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substituents, and are attached to other groups via any available valence, preferably any available carbon or nitrogen. More preferred heterocycles are of 5-7 members. In six membered monocyclic heterocycles, the heteroatom(s) are selected from one up to three of O, N or S, and wherein when the heterocycle is five membered, preferably it has one or two heteroatoms selected from O, N, or S.

[00144] As used herein, "substituted amino" means an amino radical which is substituted by one or two alkyl, cycloalkyl, aryl, heteroaryl or heterocyclyl groups, wherein the alkyl, aryl, heteroaryl or heterocyclyl are defined as above.

[00145] As used herein, "substituted thiol" means RS- group wherein R is an alkyl, an aryl, heteroaryl or a heterocyclyl group, wherein the alkyl, cycloalkyl, aryl, heteroaryl or heterocyclyl are defined as above.

[00146] As used herein, "sulfonyl" means an alkylSO_2, arylSO_2, heteroarylSO_2, carbocyclylSO_2, or heterocyclyl-SO_2 group wherein the alkyl, carbocyclyl, aryl, heteroaryl or heterocyclyl are defined as above.

[00147] As used herein, "sulfamido" means an alkyl-N-$S(O)_2N$-, aryl-$NS(O)_2N$-, heteroaryl-$NS(O)_2N$-, carbocyclyl-$NS(O)_2N$ or heterocyclyl-$NS(O)_2N$- group wherein the alkyl, carbocyclyl, aryl, heteroaryl or heterocyclyl group is as herein described.

[00148] As used herein, "sulfonamido" means an alkyl-$S(O)_2N$-, aryl-$S(O)_2N$-, heteroaryl-$S(O)_2N$-, carbocyclyl-$S(O)_2N$- or heterocyclyl-$S(O)_2N$- group wherein the alkyl, carbocyclyl, aryl, heteroaryl or heterocyclyl group is as herein described.

[00149] As used herein, "ureido" means an alkyl-NCON-, aryl-NCON-, heteroaryl-NCON- , carbocyclyl-NCON- or heterocyclyl-NCON- group wherein the alkyl, carbocyclyl, aryl, heteroaryl or heterocyclyl group is as herein described.

[00150] As used herein, when two groups are indicated to be "linked" or "bonded" to form a "ring," it is to be understood that a bond is formed between the two groups and may involve replacement of a hydrogen atom on one or both groups with the bond, thereby forming a carbocyclyl, heterocyclyl, aryl, or heteroaryl ring. The skilled artisan will recognize that such rings can and are readily formed by routine chemical reactions, and it is within the purview of the skilled artisan to both envision such rings and the methods of their formations. Preferred are rings having from 3-7 members, more

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preferably 5 or 6 members. As used herein the term "ring" or "rings" when formed by the combination of two radicals refers to heterocyclic, carbocyclic, aryl, or heteroaryl rings.

[00151] The skilled artisan will recognize that some structures described herein may be resonance forms or tautomers of compounds that may be fairly represented by other chemical structures, even when kinetically, the artisan recognizes that such structures are only a very small portion of a sample of such compound(s). Such compounds are clearly contemplated within the scope of this invention, though such resonance forms or tautomers are not represented herein.

[00152] The compounds provided herein may encompass various stereochemical forms. The compounds also encompasses diastereomers as well as optical isomers, e.g. mixtures of enantiomers including racemic mixtures, as well as individual enantiomers and diastereomers, which arise as a consequence of structural asymmetry in certain compounds. Separation of the individual isomers or selective synthesis of the individual isomers is accomplished by application of various methods which are well known to practitioners in the art. Unless otherwise indicated, when a disclosed compound is named or depicted by a structure without specifying the stereochemistry and has one or more chiral centers, it is understood to represent all possible stereoisomers of the compound.

[00153] The term "administration" or "administering" refers to a method of giving a dosage of a compound or pharmaceutical composition to a vertebrate or invertebrate, including a mammal, a bird, a fish, or an amphibian, where the method is, *e.g.*, intrarespiratory, topical, oral, intravenous, intraperitoneal, intramuscular, buccal, rectal, sublingual. The preferred method of administration can vary depending on various factors, *e.g.*, the components of the pharmaceutical composition, the site of the disease, the disease involved, and the severity of the disease.

[00154] A "diagnostic" as used herein is a compound, method, system, or device that assists in the identification and characterization of a health or disease state. The diagnostic can be used in standard assays as is known in the art.

[00155] The term "mammal" is used in its usual biological sense. Thus, it specifically includes humans, cattle, horses, monkeys, dogs, and cats, but also includes many other species.

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[00156] The term "pharmaceutically acceptable carrier" or "pharmaceutically acceptable excipient" includes any and all solvents, dispersion media, coatings, antibacterial and antifungal agents, isotonic and absorption delaying agents and the like. The use of such media and agents for pharmaceutically active substances is well known in the art. Except insofar as any conventional media or agent is incompatible with the active ingredient, its use in the therapeutic compositions is contemplated. Supplementary active ingredients can also be incorporated into the compositions. In addition, various adjuvants such as are commonly used in the art may be included. These and other such compounds are described in the literature, *e.g.*, in the Merck Index, Merck & Company, Rahway, NJ. Considerations for the inclusion of various components in pharmaceutical compositions are described, *e.g.*, in Gilman *et al.* (Eds.) (2006); Goodman and Gilman's: The Pharmacological Basis of Therapeutics, 11th Ed., The McGraw-Hill Companies.

[00157] The term "pharmaceutically acceptable salt" refers to salts that retain the biological effectiveness and properties of the compounds of the preferred embodiments and, which are not biologically or otherwise undesirable. In many cases, the compounds of the preferred embodiments are capable of forming acid and/or base salts by virtue of the presence of amino and/or carboxyl groups or groups similar thereto. Pharmaceutically acceptable acid addition salts can be formed with inorganic acids and organic acids. Inorganic acids from which salts can be derived include, for example, hydrochloric acid, hydrobromic acid, sulfuric acid, nitric acid, phosphoric acid, and the like. Organic acids from which salts can be derived include, for example, acetic acid, propionic acid, glycolic acid, pyruvic acid, oxalic acid, maleic acid, malonic acid, succinic acid, fumaric acid, tartaric acid, citric acid, benzoic acid, cinnamic acid, mandelic acid, methanesulfonic acid, ethanesulfonic acid, p-toluenesulfonic acid, salicylic acid, and the like. Pharmaceutically acceptable base addition salts can be formed with inorganic and organic bases. Inorganic bases from which salts can be derived include, for example, sodium, potassium, lithium, ammonium, calcium, magnesium, iron, zinc, copper, manganese, aluminum, and the like; particularly preferred are the ammonium, potassium, sodium, calcium and magnesium salts. Organic bases from which salts can be derived include, for example, primary, secondary, and tertiary amines, substituted amines including naturally occurring substituted amines, cyclic amines, basic

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ion exchange resins, and the like, specifically such as isopropylamine, trimethylamine, diethylamine, triethylamine, tripropylamine, and ethanolamine. Many such salts are known in the art, as described in World Patent Publication 87/05297, Johnston et al., published September 11, 1987 (incorporated by reference herein).

[00158] "Solvate" refers to the compound formed by the interaction of a solvent and a Wnt pathway inhibitor, a metabolite, or salt thereof. Suitable solvates are pharmaceutically acceptable solvates including hydrates.

[00159] "Subject" as used herein, means a human or a non-human mammal, *e.g.*, a dog, a cat, a mouse, a rat, a cow, a sheep, a pig, a goat, a non-human primate or a bird, *e.g.*, a chicken, as well as any other vertebrate or invertebrate.

[00160] By "therapeutically effective amount" or "pharmaceutically effective amount" is typically one which is sufficient to achieve the desired effect and may vary according to the nature and severity of the disease condition, and the potency of the compound. It will be appreciated that different concentrations may be employed for prophylaxis than for treatment of an active disease. This amount can further depend upon the patient's height, weight, sex, age and medical history.

[00161] A therapeutic effect relieves, to some extent, one or more of the symptoms of the disease, and includes curing a disease. "Curing" means that the symptoms of active disease are eliminated. However, certain long-term or permanent effects of the disease may exist even after a cure is obtained (such as extensive tissue damage).

[00162] "Treat," "treatment," or "treating," as used herein refers to administering a pharmaceutical composition for therapeutic purposes. The term "therapeutic treatment" refers to administering treatment to a patient already suffering from a disease thus causing a therapeutically beneficial effect, such as ameliorating existing symptoms, preventing additional symptoms, ameliorating or preventing the underlying metabolic causes of symptoms, postponing or preventing the further development of a disorder and/or reducing the severity of symptoms that will or are expected to develop.

[00163] The expression "drug-eluting" shall be understood to refer to any and all mechanisms, e.g., diffusion, migration, permeation, and/or desorption by which the

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drug(s) incorporated in the drug-eluting material pass therefrom over time into the surrounding body tissue.

[00164] The expression "drug-eluting material" shall be understood herein to mean any natural, synthetic or semi-synthetic material capable of acquiring and retaining a desired shape or configuration and into which one or more drugs can be incorporated and from which incorporated drug(s) are capable of eluting over time.

[00165] The expression "elutable drug" shall be understood to mean any drug or combination of drugs having the ability to pass over time from the drug-eluting material in which it is incorporated into the surrounding areas of the body.

[00166] The following abbreviations have the indicated meanings:

Aβ = amyloid beta

ACE = angiotensin I-converting enzyme

AD = Alzheimer's disease

ALS = amyotrophic Lateral Sclerosis

AMD = age related macular degeneration

APC = adenomatous polyposis coli

β-TrCP = β-transducin repeat-containing protein

CD44 = cell-surface glycoprotein

CK1,2 = casein kinase 1 and 2

DHT = dihydrotestosterone

Dkk = dickkopf

DME = diabetic macular edema

Dsh/Dvl = dishevelled

EphB2 = ephrin type-B receptor 2

ES cells = embryonic stem cells

FTD = frontotemporal Dementia

Fzd = frizzled

GBP = GSK-3 binding protein

GI = gastrointestinal

GPCR = G protein-coupled receptor

GSK-3 = glycogen synthase kinase-3

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HCC = hepatocellular carcinoma

IBD = inflammatory bowel disease

Kr2 = kringle domain 2

L-DOPA = L-3,4-dihydroxyphenylalanine

Lef = lymphoid enhancing factor

LRP = low density lipoprotein receptor related protein

MMTV = mouse mammary tumor virus

PD = Parkinson's disease

PKC = protein kinase C

PI-3 = phosphatidylinositol-3 kinase

PPAR = peroxisome proliferator-activated receptors

PTEN = phosphatase and tensin homolog

RP = retinitis pigmentosa

SCID = severe combined immunodeficiency

SOD1 = Superoxide dismutase protein

SOST = sclerostin

sFRP = secreted frizzled-related protein

TCF = T-cell factor

TGF = transforming growth factor

UC = ulcerative colitis

Wg = wingless

Wnt =wingless-type MMTV integration site family member

Compounds

[00167] The compounds and compositions described herein are capable of activating the *Wnt*/β-catenin signaling pathway. The *Wnt*/β-catenin signaling pathway has been found to play a crucial role in the differentiation and development of nerve cells for the central nervous system, bone formation, hair follicle development and regeneration, and stimulation of stem cell growth, maintenance and differentiation. Such compounds and compositions are therefore expected to be useful against cell proliferation disorders, bone disorders, Alzheimer's disease and even tissue generation.

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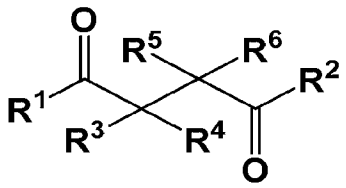
[00168] Some embodiments of the present invention include compounds, salts, pharmaceutically acceptable salts or pro-drug thereof of formula (**I**):



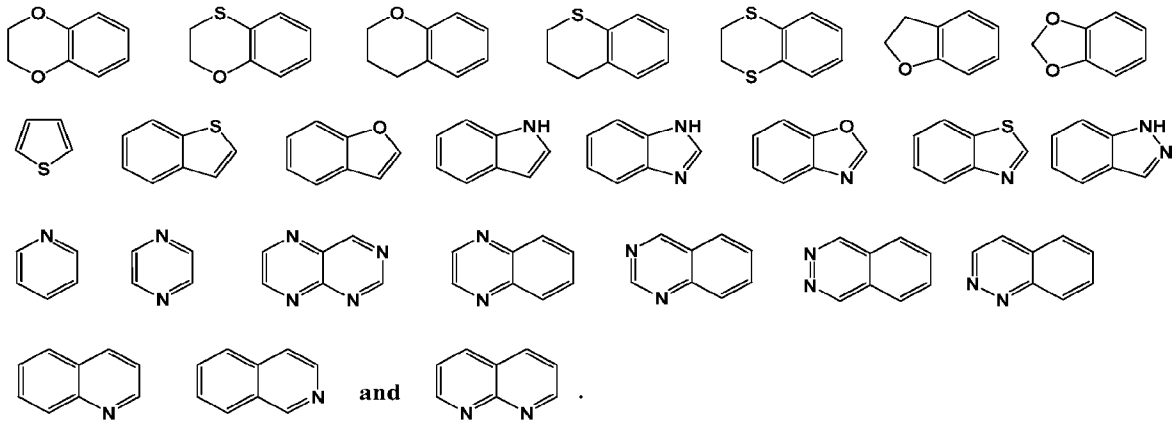
I

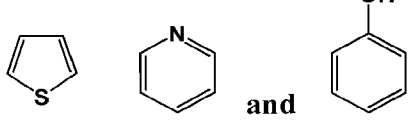
[00169] In some embodiments, R^1 is selected from the group consisting of substituted or unsubstituted heteroaryl and substituted or unsubstituted heterocyclyl, with the proviso that a carbon atom is attached to the carbonyl.

[00170] In some embodiments, R^2 is selected from the group consisting of substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, substituted or unsubstituted carbocyclyl and substituted or unsubstituted heterocyclyl, with the proviso that a carbon atom is attached to the carbonyl.

[00171] In some embodiments, R^3, R^4, R^5 and R^6 are independently selected from a group consisting of H, -C_{1-9}alkyl, -C_{1-9}alkylaryl and -C_{1-9}alkylheteroaryl.

[00172] In more specific embodiments, R^1 is selected from the group consisting of



[00173] In another specific embodiments, R^2 is selected from the group consisting of substituted or unsubstituted aryl,  .

[00174] In another specific embodiments, R^3, R^4, R^5 and R^6 are H.

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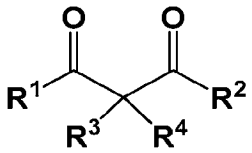
[00175] Some embodiments of the present invention include compounds, salts, pharmaceutically acceptable salts or pro-drug thereof of formula (**II**):



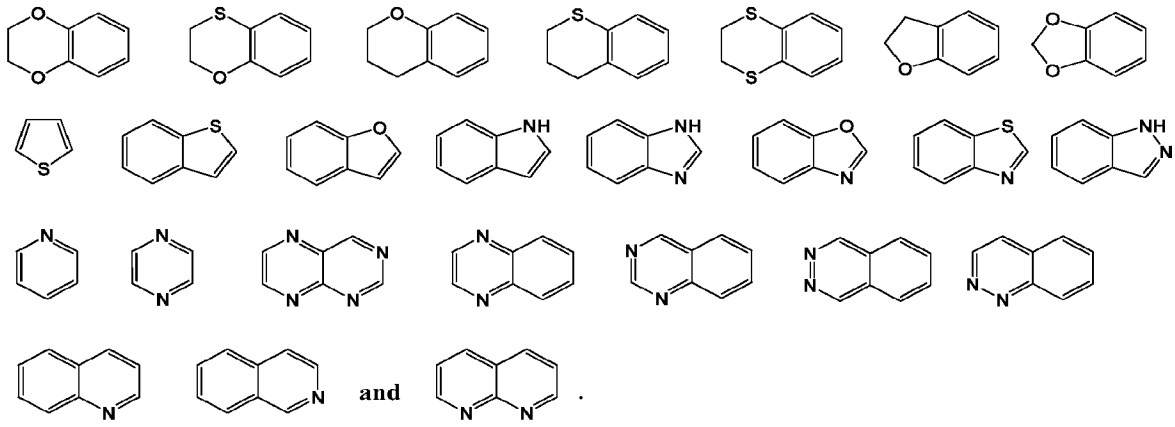
II

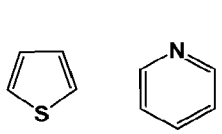
[00176] In some embodiments, R^1 is selected from the group consisting of substituted or unsubstituted heteroaryl and substituted or unsubstituted heterocyclyl, with the proviso that a carbon atom is attached to the carbonyl.

[00177] In some embodiments, R^2 is selected from the group consisting of substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, substituted or unsubstituted carbocyclyl and substituted or unsubstituted heterocyclyl, with the proviso that a carbon atom is attached to the carbonyl.

[00178] In some embodiments, R^3 and R^4 are independently selected from a group consisting of H, -$C_{1\text{-}9}$alkyl, -$C_{1\text{-}9}$alkylaryl and -$C_{1\text{-}9}$alkylheteroaryl.

[00179] In more specific embodiments, R^1 is selected from the group consisting of



[00180] In another specific embodiments, R^2 is selected from the group consisting of substituted or unsubstituted aryl,  .

[00181] In another specific embodiments, R^3 and R^4 are H.

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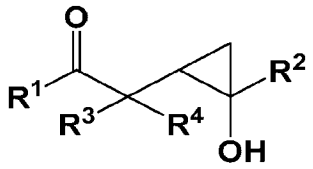
[00182] Some embodiments of the present invention include compounds, salts, pharmaceutically acceptable salts or pro-drug thereof of formula (**III**):



III

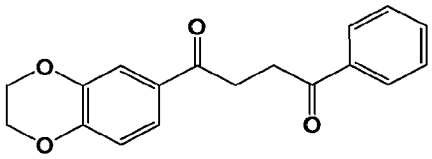
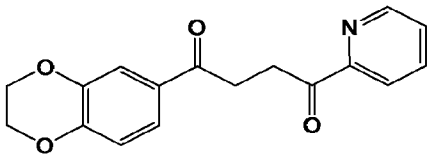
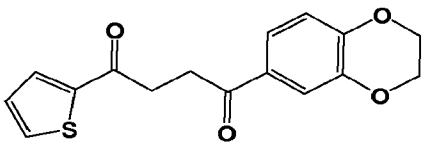
[00183] In some embodiments, R^1 is selected from the group consisting of substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, substituted or unsubstituted carbocyclyl and substituted or unsubstituted heterocyclyl, with the proviso that a carbon atom is attached to the carbonyl.

[00184] In some embodiments, R^2 is selected from the group consisting of substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, substituted or unsubstituted carbocyclyl and substituted or unsubstituted heterocyclyl, with the proviso that a carbon atom is attached to the carbonyl.

[00185] In some embodiments, R^3 and R^4 are independently selected from a group consisting of H, -C_{1-9}alkyl, -C_{1-9}alkylaryl and -C_{1-9}alkylheteroaryl.

[00186] Illustrative compounds of Formulas **I**, **II** and **III** are shown in Table 1.

Table 1.

1	
2	
3	

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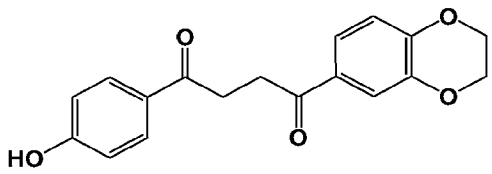
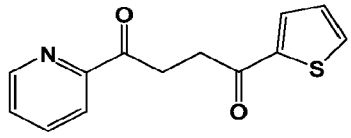
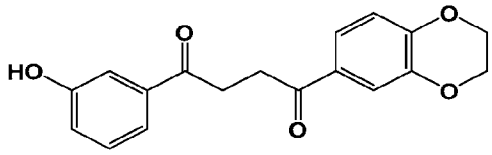
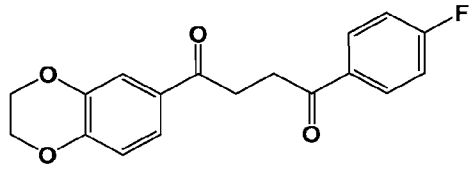
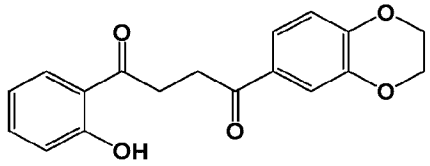
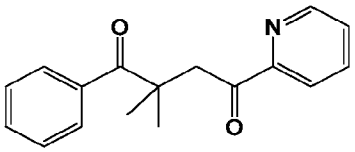
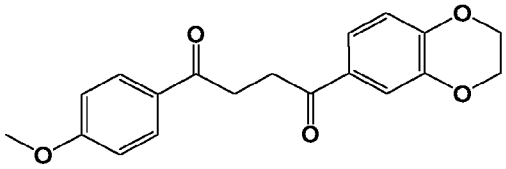
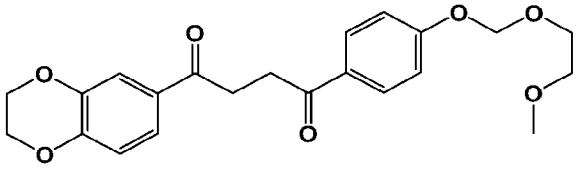
4	
5	
6	
7	
8	
9	
10	
11	

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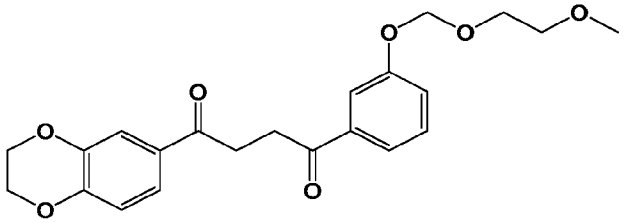
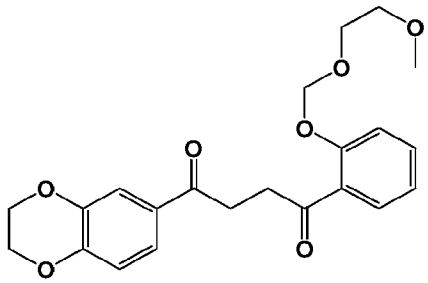
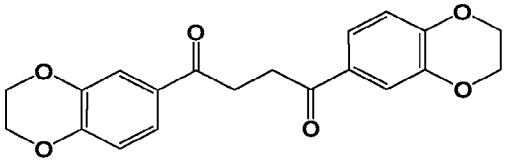
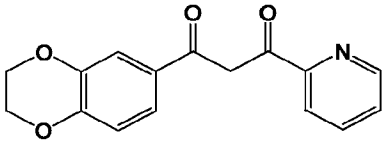
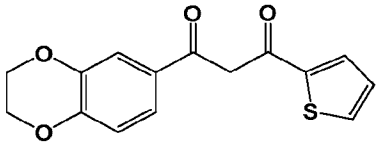
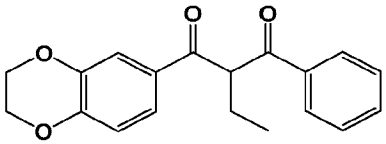
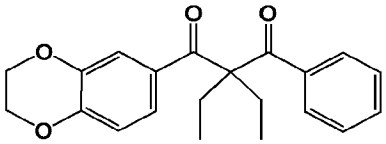
12	
13	
14	
15	
16	
17	
18	

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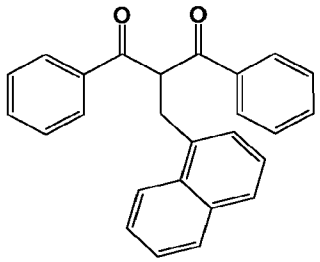
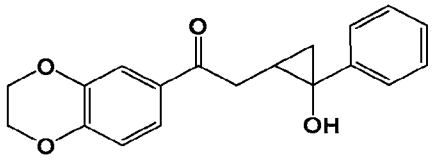
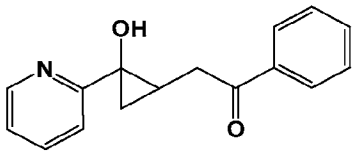
19	
20	
21	

Compound preparation

[00187] The starting materials used in preparing the compounds of the invention are known, made by known methods, or are commercially available. It will be apparent to the skilled artisan that methods for preparing precursors and functionality related to the compounds claimed herein are generally described in the literature. The skilled artisan given the literature and this disclosure is well equipped to prepare any of the compounds.

[00188] It is recognized that the skilled artisan in the art of organic chemistry can readily carry out manipulations without further direction, that is, it is well within the scope and practice of the skilled artisan to carry out these manipulations. These include reduction of carbonyl compounds to their corresponding alcohols, oxidations, acylations, aromatic substitutions, both electrophilic and nucleophilic, etherifications, esterification and saponification and the like. These manipulations are discussed in standard texts such as *March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure* 6th Ed., John Wiley & Sons (2007), Carey and Sundberg, *Advanced Organic Chemistry* 5th Ed., Springer (2007), *Comprehensive Organic Transformations: A Guide to Functional Group*

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Transformations, 2nd Ed., John Wiley & Sons (1999) (incorporated herein by reference in its entirety)and the like.

[00189] The skilled artisan will readily appreciate that certain reactions are best carried out when other functionality is masked or protected in the molecule, thus avoiding any undesirable side reactions and/or increasing the yield of the reaction. Often the skilled artisan utilizes protecting groups to accomplish such increased yields or to avoid the undesired reactions. These reactions are found in the literature and are also well within the scope of the skilled artisan. Examples of many of these manipulations can be found for example in T. Greene and P. Wuts *Protecting Groups in Organic Synthesis,* 4th Ed., John Wiley & Sons (2007), incorporated herein by reference in its entirety.

[00190] The following example schemes are provided for the guidance of the reader, and represent preferred methods for making the compounds exemplified herein. These methods are not limiting, and it will be apparent that other routes may be employed to prepare these compounds. Such methods specifically include solid phase based chemistries, including combinatorial chemistry. The skilled artisan is thoroughly equipped to prepare these compounds by those methods given the literature and this disclosure. The compound numberings used in the synthetic schemes depicted below are meant for those specific schemes only, and should not be construed as or confused with same numberings in other sections of the application.

[00191] To further illustrate this invention, the following examples are included. The examples should not, of course, be construed as specifically limiting the invention. Variations of these examples within the scope of the claims are within the purview of one skilled in the art and are considered to fall within the scope of the invention as described, and claimed herein. The reader will recognize that the skilled artisan, armed with the present disclosure, and skill in the art is able to prepare and use the invention without exhaustive examples.

[00192] Trademarks used herein are examples only and reflect illustrative materials used at the time of the invention. The skilled artisan will recognize that variations in lot, manufacturing processes, and the like, are expected. Hence the examples, and the trademarks used in them are non-limiting, and they are not intended to

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be limiting, but are merely an illustration of how a skilled artisan may choose to perform one or more of the embodiments of the invention.

[00193] ^{1}H nuclear magnetic resonance spectra (NMR) were measured in the indicated solvents on a Bruker NMR spectrometer (Avance TM DRX300, 300 MHz for 1H). Peak positions are expressed in parts per million (ppm) downfield from tetramethylsilane. The peak multiplicities are denoted as follows, s, singlet; d, doublet; t, triplet; m, multiplet.

[00194] The following abbreviations have the indicated meanings:

$Bi(OTf)_3$ = bismuth(III) triflate

brine = saturated aqueous sodium chloride

$CDCl_3$ = deuterated chloroform

DMSO-d_6 = deuterated dimethylsulfoxide

ESIMS = electron spray mass spectrometry

EtOAc = ethyl acetate

HCl = hydrochloric acid

$MgSO_4$ = magnesium sulfate

NaH = sodium hydride

NMR = nuclear magnetic resonance

Ph = phenyl

K_2CO_3 = potassium carbonate

rt = room temperature

TFA = trifluoroacetic acid

THF = tetrahydrofuran

TLC = thin layer chromatography

[00195] The following example schemes are provided for the guidance of the reader, and collectively represent an example method for making the compounds provided herein. Furthermore, other methods for preparing compounds of the invention will be readily apparent to the person of ordinary skill in the art in light of the following reaction schemes and examples. Unless otherwise indicated, all variables are as defined above.

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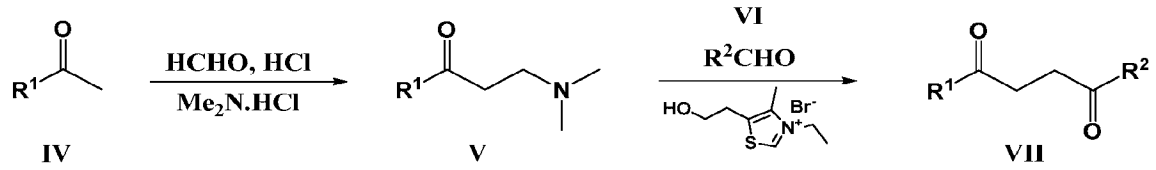
General procedures

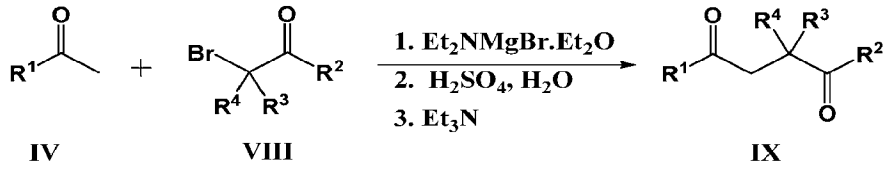
[00196] Compounds of Formula **I** of the present invention can be prepared as depicted in Scheme **1**.



Scheme 1

[00197] Scheme 1 describes a method for preparation of unsubstituted 1,4-diketones derivatives (**VII**) by the modified Stetter reaction of a Mannich base as a vinyl ketone precursor with aldehyde. The Mannich base is formed by first reacting a methyl ketone (**IV**) with paraformaldehyde and dimethylamine hydrochloride to form the 3-dimethylamino-propan-1-one (**V**). Next, Mannich base (**V**) was reacted with various aldehydes (**VI**) under standard Stetter conditions using a thiazolium salt as the catalyst yields unsubstituted 1,4-diketone derivatives (**VII**).

[00198] Compounds of Formula **I** of the present invention where the alpha and/or beta positions are substituted can be prepared as depicted in Scheme **2**.



Scheme 2

[00199] Scheme 2 describes a method for preparation of substituted 1,4-diketones derivatives (**IX**) by the method of Kel'in and Kulinkovich [*Synthesis* **(1996)**, *(3)*, 330-2] which is based on the application of magnesium reagents in the cross-aldol condensation of methyl ketones with α-bromo ketones. A methyl ketone (**IV**) is reacted with a substituted α-bromo ketone (**VIII**) in the presence of diethylamidomagnesium bromide and acid followed by treatment with triethylamine to produce the desired substituted 1,4-diketone derivatives (**IX**).

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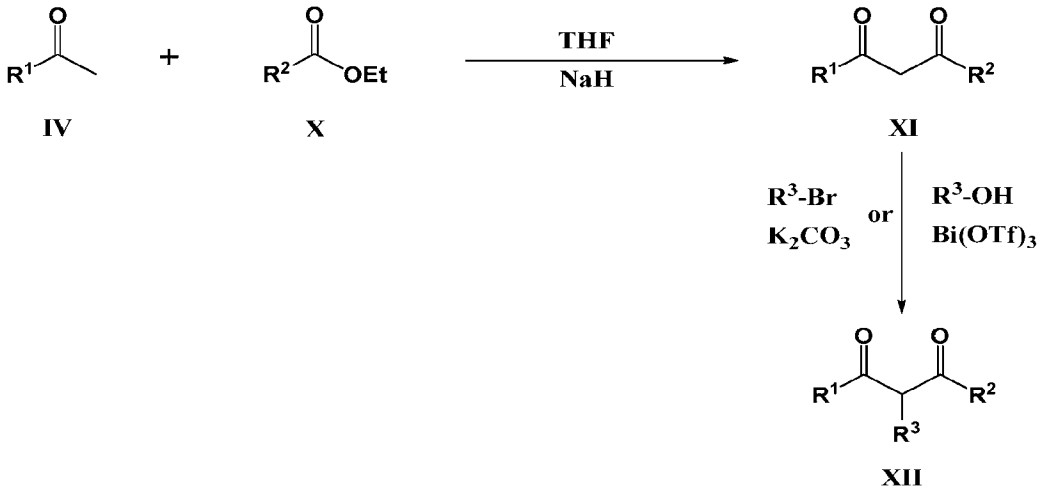
[00200] Compounds of Formula **II** of the present invention can be prepared as depicted in Scheme **3**.

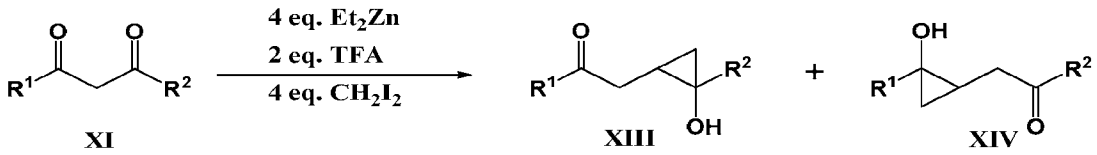


IV X XI XII

Scheme 3

[00201] Scheme 3 describes a method for preparation of β-diketone derivatives (**VII**) by a crossed Claisen condensation. A methyl ketone (**IV**) is condensed with an ester (**X**) in the presence of sodium hydride to yield β-diketone derivatives (**XI**). The α-position can be further substituted with alkylbromides and base or by alkyl alcohols in the presence of a Lewis acid catalyst to yield β-diketone derivatives (**XII**).

[00202] Compounds of Formula **III** of the present invention can be prepared as depicted in Scheme **4**.



XI XIII XIV

Scheme 4

[00203] Scheme 4 describes a method for preparation of γ-hydroxyketone derivatives (**XIII**) by the method of Xue, et al [*Journal of Organic Chemistry* **(2006)**, *71(1)*, 215-218]. A mixture of zinc species formed from 4.0 equiv of Et_2Zn, 2.0 equiv of TFA, and 4.0 equiv of CH_2I_2 efficiently converts β-diketones into γ-hydroxyketones. R^1 groups containing electron-donating substituents tend to insert the cyclopropane near R^2

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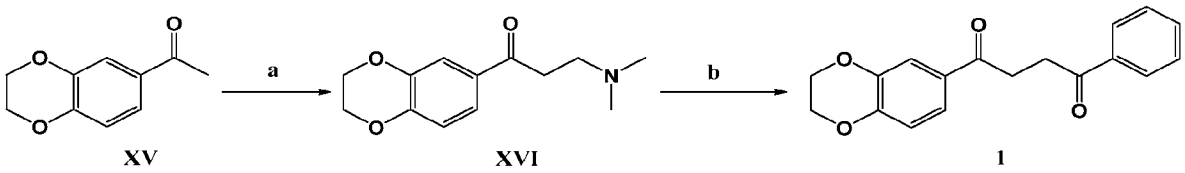
(**XIII**) where R^1 groups containing electron-withdrawing substituents tend to insert the cyclopropane near R^1 (**XIV**).

Illustrative Compound Examples

Example **1**.

[00204] Preparation of compound (**1**) is depicted below in Scheme **5**.



Scheme 5

Reagents and conditions: a) Ethanol, HCHO, HCl, refluxed, overnight; b) Dioxane, PhCHO, 3-Ethyl-5-(2-hydroxyethyl)-4-methylthiazolium bromide, 95°C, overnight.

Step **a**

[00205] A solution of 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)ethanone (**XV**) (11 mmol), dimethylamine hydrochloride (14 mmol), paraformaldehyde (16 mmol) and 12 N HCl (2 drops) in ethanol (5 mL) was refluxed overnight. The solution was cooled to room temperature and the ethanol was evaporated under vacuum. The residue was treated with ethyl acetate, heated slightly and sonicated to disperse into fine particles. The solids were filtered and dried at room temperature to produce 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-3-(dimethylamino)propan-1-one (**XVI**) as a white solid, (82% yield), ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm 2.77 (s, 6H), 3.41 (m, 2H), 3.56 (m, 2H), 4.25 (m, 4H), 6.85 (m, 1H), 7.45 (m, 2H).

Step **b**

[00206] Triethylamine (3.61 mmol) and benzaldehyde (4.3 mmol) in dry dioxane (10 mL) was added to a solution of 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-3-(dimethylamino)propan-1-one (**XVI**) (5.4 mmol) and 3-ethyl-5-(2-hydroxyethyl)-4-methylthiazolium bromide (0.43 mmol) in dioxane heated at 95°C under nitrogen. The

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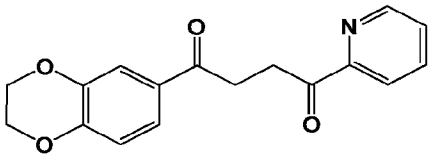
solution was further heated overnight at 95°C. The solution was cooled and excess solvent was evaporated under vacuum. The residue was partitioned between CH_2Cl_2 and water. The organic phase was dried over $MgSO_4$, filtered and concentrated. The residue was purified by flash chromatography eluting with ethyl acetate in hexane gradient to yield 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-4-phenylbutane-1,4-dione **1** as a white solid (12% yield). ^{1}H NMR (DMSO-d_6, 400 MHz): δ ppm 3.33-3.37 (m, 4H), 4.29 (m, 2H), 4.34 (m, 2H), 6.98 (m, 1H), 7.48 (m, 1H), 7.55 (m, 3H), 7.64 (m, 1H), 8.00-8.02 (m, 2H); ESIMS found $C_{18}H_{16}O_4$ *m/z* 297 (M+H).

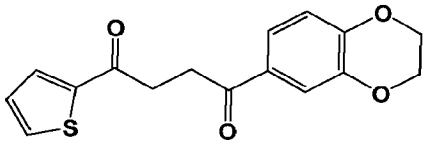
[00207] The following compounds was prepared in accordance with the procedure described in the above Example **1**.



2

[00208] 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-4-(pyridin-2-yl)butane-1,4-dione **2**.

[00209] White solid. ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm 3.37 (m, 2H), 3.40 (m, 2H), 4.31 (m, 4H), 6.92 (m, 1H), 7.47 (m, 2H), 7.56 (m, 1H), 7.83 (m, 1H), 8.03 (m, 1H), 8.71 (m, 1H); ESIMS found $C_{17}H_{15}NO_4$ *m/z* 298 (M+H).



3

[00210] 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-4-(thiophen-2-yl)butane-1,4-dione **3**.

[00211] Yellow solid. ^{1}H NMR (DMSO-d_6, 400 MHz): δ ppm 4.29 (m, 2H), 4.34 (m, 2H), 6.97 (m, 1H), 7.25 (m, 1H), 7.47 (m, 1H), 7.52 (m, 1H), 8.00-8.03 (m, 2H); ESIMS found $C_{16}H_{14}O_4S$ *m/z* 303 (M+H).

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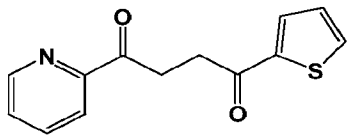
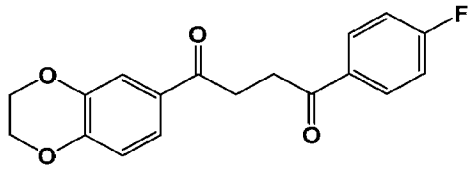


5

[00212] 1-(pyridin-2-yl)-4-(thiophen-2-yl)butane-1,4-dione **5**.

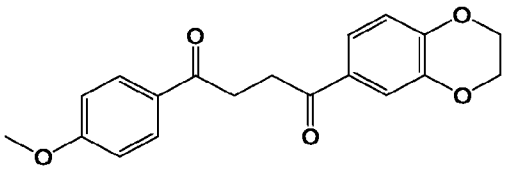
[00213] White solid. ^{1}H NMR (DMSO-d_6, 400 MHz): δ ppm 3.40 (m, 2H), 3.56 (m, 2H), 7.27 (dd, *J* = 4.8, 3.8 Hz, 1H), 7.70 (m, 1H), 7.95 (d, J = 7.8 Hz, 1H), 8.00-8.05 (m, 3H), 8.76 (d, *J* = 4.3 Hz, 1H); ESIMS found $C_{13}H_{11}NO_2S$ *m/z* 246 (M+H).



7

[00214] 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-4-(4-fluorophenyl)butane-1,4-dione **7**.

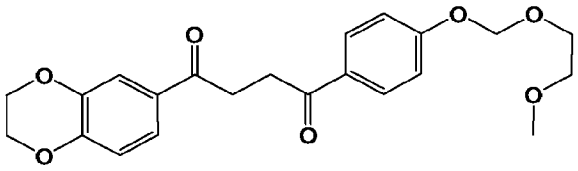
[00215] Off white solid. ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm 3.40 (s, 4H), 4.30 (m, 4H), 6.92 (m, 1H), 7.16 (m, 2H), 7.57 (m, 2H), 8.04 (m, 2H); ESIMS found $C_{18}H_{15}FO_4$ *m/z* 315 (M+H).



10

[00216] 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-4-(4-methoxyphenyl)butane-1,4-dione **10**.

[00217] White solid (19% yield). ^{1}H NMR (DMSO-d_6, 400 MHz): δ ppm 3.85 (s, 3H), 4.30 (m, 2H), 4.34 (m, 2H), 6.99 (d, *J* = 8.3 Hz, 1H), 7.06 (d, *J* = 8.8 Hz, 2H), 7.48 (d, *J* = 2.0 Hz, 1H), 7.54 (dd, *J* = 8.3, 2.0 Hz, 1H), 7.98 (d, *J* = 8.8 Hz, 2H); ESIMS found $C_{19}H_{18}O_5$ *m/z* 327 (M+H).



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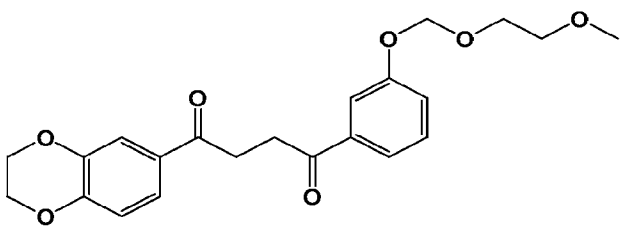
11

[00218] 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-4-(4-((2-methoxyethoxy) methoxy)phenyl)butane-1,4-dione **11**.

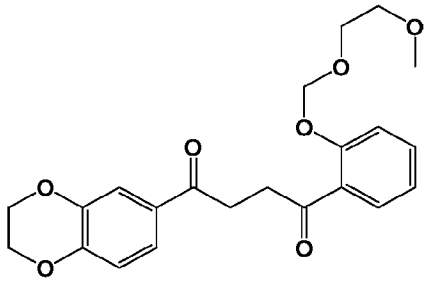
[00219] Off white solid. ^{1}H NMR (DMSO-d_6, 400 MHz): δ ppm 3.33 (m, 4H), 3.46 (m, 2H), 3.75 (m, 2H), 4.30 (m, 2H), 4.34 (m, 2H), 5.36 (s, 2H), 6.99 (d, J = 8.3 Hz, 1H), 7.14 (d, J = 8.8 Hz, 2H), 7.48 (d, J = 2.0 Hz, 1H), 7.55 (dd, J = 8.5, 2.0 Hz, 1H), 7.98 (d, J = 8.8 Hz, 2H); ESIMS found $C_{22}H_{24}O_7$ m/z 401 (M+H).



12

[00220] 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-4-(3-((2-methoxyethoxy) methoxy)phenyl)butane-1,4-dione **12**.

[00221] White solid. ^{1}H NMR (DMSO-d_6, 400 MHz): δ ppm 3.21 (s, 3H), 3.35 (m, 4H), 3.48 (m, 2H), 3.75 (m, 2H), 4.30 (m, 2H), 4.33 (m, 2H), 5.32 (s, 2H), 6.99 (d, J = 8.3 Hz, 1H), 7.31 (dd, J = 8.2, 2.0 Hz, 1H), 7.49 (m, 2H), 7.55 (dd, J = 8.5, 2.0 Hz, 1H), 7.58 (m, 1H), 7.67 (d, J = 7.8 Hz, 1H); ESIMS found $C_{22}H_{24}O_7$ m/z 401 (M+H).



13

[00222] 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-4-(2-((2-methoxyethoxy) methoxy)phenyl)butane-1,4-dione **13**.

[00223] Viscous oil (14 % Yield). ^{1}H NMR (DMSO-d_6, 400 MHz): δ ppm 3.21 (s, 3H), 3.25-3.29 (m, 4H), 3.46-3.48 (m, 2H), 3.79 (m, 2H), 4.29 (m, 2H), 4.33 (m, 2H), 5.39 (s, 2H), 6.98 (d, J = 8.6 Hz, 1H), 7.10 (m, 1H), 7.25 (dd, J = 8.3 Hz, 1H), 7.47 (m,

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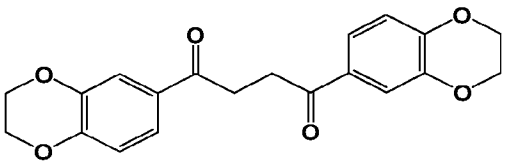
1H), 7.49-7.54 (m, 2H), 7.58 (dd, J = 7.7, 1.6 Hz, 1H); ESIMS found $C_{22}H_{24}O_7$ m/z 401 (M+H).



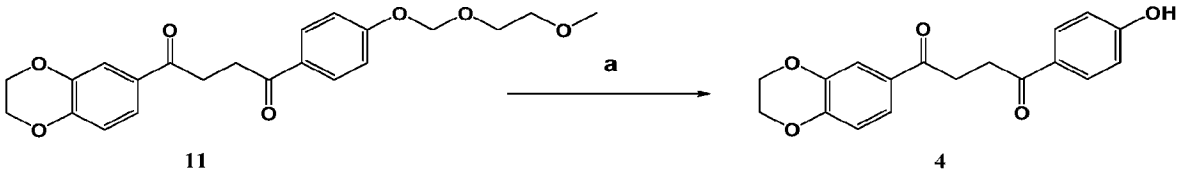
14

[00224] 1,4-bis(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)butane-1,4-dione **14**.

[00225] Off white solid. ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm 3.35 (s, 4H), 4.30 (m, 8H), 6.92 (m, 2H), 7.57 (m, 4H); ESIMS found $C_{20}H_{18}O_6$ m/z 355 (M+H).

Example **2**.

[00226] Preparation of compound (**4**) is depicted below in Scheme **6**.



11 **4**

Scheme 6

Reagents and conditions: a) CH_2Cl_2, TFA, rt, overnight.

Step **a**

[00227] Neat TFA (0.5 mL) was added to a solution of 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-4-(4-((2-methoxyethoxy)methoxy)phenyl)butane-1,4-dione **11** (0.35 mmol) in CH_2Cl_2 (5 mL) stirred at room temperature. The solution was further stirred overnight at room temperature. The volatiles were evaporated under vacuum. The residue was purified by flash chromatography over silica gel eluting with 1% methanol in CH_2Cl_2 to get 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-4-(4-hydroxyphenyl)butane-1,4-dione **4** as an off white solid (21% yield). ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm 3.37 (m, 4H), 4.29 (m, 2H), 4.33 (m, 2H), 5.76 (s, 1H), 6.87 (d, J = 8.8 Hz, 2H), 6.93 (m, 1H), 7.60 (m, 2H), 7.94 (d, J = 8.8 Hz, 2H); ESIMS found $C_{18}H_{16}O_5$ m/z 313 (M+H).

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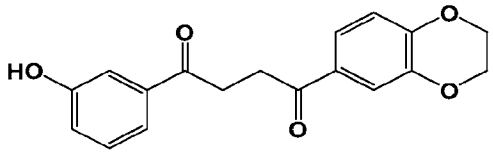
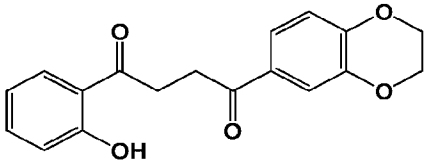
[00228] The following compounds was prepared in accordance with the procedure described in the above Example **2**.



6

[00229] 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-4-(3-hydroxyphenyl)butane-1,4-dione **6**.

[00230] Off white solid (27% yield). ^{1}H NMR (DMSO-d6, 400 MHz): δ ppm 3.27 (m, 4H), 4.30 (m, 2H), 4.34 (m, 2H), 6.99 (d, J = 8.8 Hz, 1H), 7.03 (d, J = 8.8 Hz, 1H), 7.36 (m, 2H), 7.45 (m, 2H), 7.54 (d, J = 8.8 Hz, 1H).



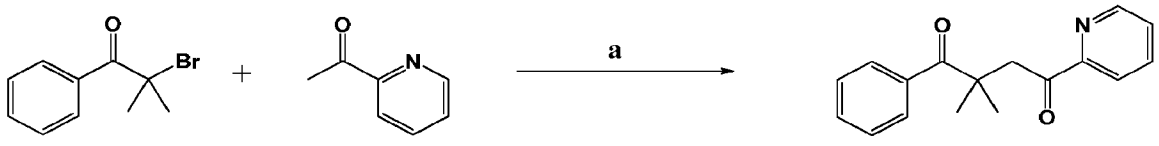
8

[00231] 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-4-(2-hydroxyphenyl)butane-1,4-dione **8**.

[00232] Off white solid (62% yield). ^{1}H NMR (DMSO-d6, 400 MHz): δ ppm 3.43 (m, 4H), 4.00 (m, 4H), 4.34 (m, 2H), 6.96 (m, 3H), 7.48-7.56 (m, 3H), 7.97 (m, 1H).

Example **3**.

[00233] Preparation of compound (**9**) is depicted below in Scheme **7**.



XVII XVIII 9

Scheme 7

Reagents and conditions: a) i) $Et_2NMgBr.Et_2O$, Toluene., 0°C, 3 h ii) H_2SO_4, H_2O, 0°C-rt, iii) Et_3N, rt.

Step **a**

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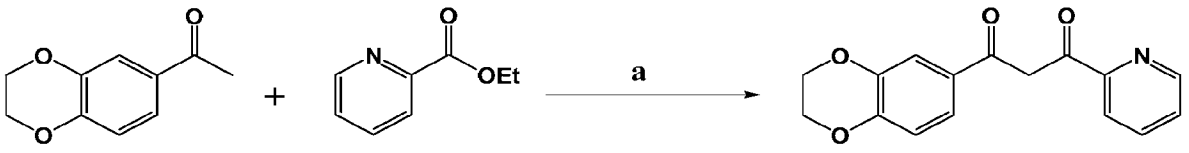
[00234] In a dried 3 neck flask fitted with magnetic stirrer and condensor was placed metal magnesium (12 mmol) and ether (1.8 mL). Neat bromoethane (2.5 mmol) was added via syringe and the reaction was started immediately. A solution of bromoethane (10.5 mmol) in toluene (30 mL) was added to the solution slowly. After completion of the addition, the solution was stirred at room temperature for 30 min under nitrogen before adding neat diethylamine (24 mmol). The solution was further stirred at room temperature for 15 min. The solution was cooled to 0°C and a mixture of 1-(pyridin-2-yl)ethanone (**XVIII**) (12 mmol) and 2-bromoisobutyrophenone (**XVII**) (13 mmol) was added to the solution. The solution was further stirred for 3 h at 0°C under nitrogen. Aqueous 5% H_2SO_4 (20 mL) was added to the solution and the solution was warmed to room temperatue. The organic layer was separated, dried over $MgSO_4$ and filtered. The organic layer was then treated with Et_3N (10 mmol) and allowed to stir overnight at room temperature. The solution was then washed with water, dried over $MgSO_4$, filtered and concentrated. The residue was purified by flash chromatography eluting with 1-5 % EtOAc in hexane gradient to give 2,2-dimethyl-1-phenyl-4-(pyridin-2-yl)butane-1,4-dione **9** as a colorless viscous oil (11% yield). ^1H NMR ($CDCl_3$, 400 MHz): δ ppm 1.47 (s, 6H), 3.80 (s, 2H), 7.34-7.50 (m, 4H), 7.65-7.75 (m, 2H), 7.80 (m, 1H), 7.94 (m, 1H), 8.67 (m, 1H); ESIMS found $C_{17}H_{17}NO_2$ *m/z* 268 (M+H).

Example **4**.

[00235] Preparation of compound (**15**) is depicted below in Scheme **8**.



XV **XIX** **15**

Scheme 8

Reagents and conditions: a) THF, NaH, rt-reflux, overnight.

Step **a**

[00236] A solution of 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)ethanone (**XV**) (1 eq) in THF was added slowly to a suspension of NaH (1.5 eq) in THF stirred under

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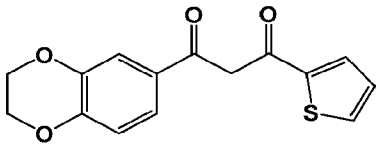
nitrogen at room temperature. The solution was further allowed to stir at room temperature until the evolution of gas was ceased. Ethyl picolinate (**XIX**) (1.1 eq) was added to the solution and refluxed overnight under nitrogen. The solution was cooled, poured into ice water and extracted with ethyl acetate. The organic layer was dried over $MgSO_4$, filtered and concentrated under vacuum. The crude product was purified by column chromatography over silica gel to produce 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-3-(pyridin-2-yl)propane-1,3-dione **15** as a yellow solid (71% yield), ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm 4.13-4.43 (m, 4H), 6.94 (d, J = 8.31 Hz, 1H), 7.42 (m, 1H), 7.44 (m, 1H) 7.59 (m, 2H), 7.85 (m, 1H), 8.14 (d, J = 7.81, 1H), 8.65 (m, 1H); ESIMS found $C_{16}H_{13}NO_4$ *m/z* 284(M+H).

[00237] The following compounds was prepared in accordance with the procedure described in the above Example **4**.



16

[00238] 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-3-(thiophen-2-yl)propane-1,3-dione **16**.

[00239] Yellow solid. ^{1}H NMR (DMSO-d_6, 400 MHz): δ ppm 4.34 (m, 4H), 6.98 (m, 1H), 7.15 (br. s, 1H), 7.59 (m, 1H), 7.64 (m, 2H), 8.01 (m, 1H), 8.28 (m, 1H); ESIMS found $C_{15}H_{12}O_4S$ *m/z* 289 (M+H).

Example **5**.

[00240] Preparation of compounds (**17**) and (**18**) are depicted below in Scheme **9**.

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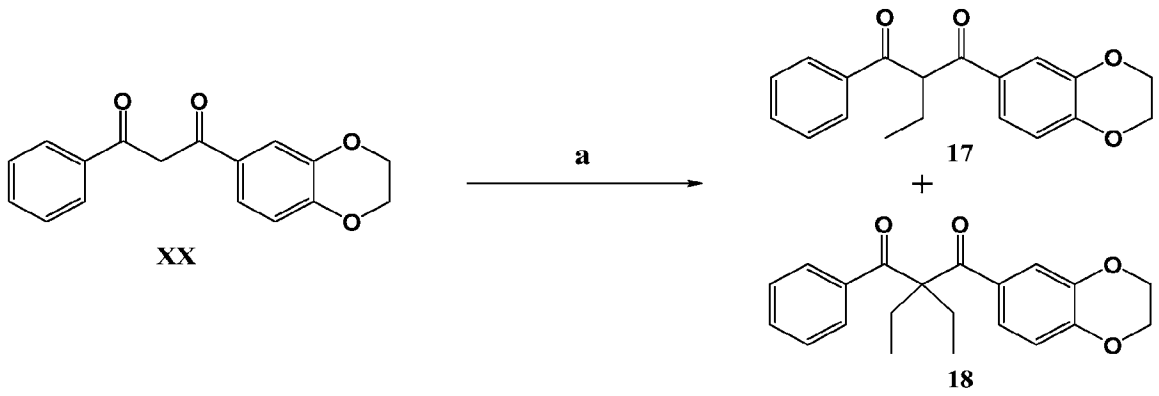

Scheme 9

Reagents and conditions: a) DMSO, bromoethane, K_2CO_3, rt, overnight.

Step **a**

[00241] Bromoethane (0.87 mmol) was added slowly to a solution 1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-3-phenylpropane-1,3-dione (**XX**) (0.39 mmol) and K_2CO_3(1.58 mmol) in DMSO (4 mL) stirred at room temperature under nitrogen. The solution was further stirred overnight at room temperature under nitrogen. The solution was poured into a mixture of water and ether. The etheric layer was separated, washed with brine, dried over $MgSO_4$, filtered and concentrated. The residue was purified by column chromatography to get 1-(2,3-dihydrobenzo[b][1,4]dioxin-6-yl)-2-ethyl-3-phenylpropane-1,3-dione **17** as colorless viscous oil (35% yield). ^{1}H NMR (DMSO-d_6, 400 MHz): δ ppm 0.93 (t, *J* = 7.4 Hz, 3H), 1.93 (m, 2H), 4.28 (m, 2H), 4.33 (m, 2H), 5.60 (t, *J* = 6.5 Hz, 1H), 6.99 (d, *J* = 8.6 Hz, 1H), 7.51-7.55 (m, 4H), 7.66 (m, 1H), 7.98 (d, J = 7.3 Hz, 2H); ESIMS found $C_{19}H_{18}O_4$ *m/z* 311 (M+H) and 1-(2,3-dihydrobenzo[b][1,4]dioxin-6-yl)-2,2-diethyl-3-phenylpropane-1,3-dione **18** as a white solids. ESIMS found $C_{21}H_{22}O_4$ *m/z* 339 (M+H).

Example **6.**

[00242] Preparation of compound **(19)** is depicted below in Scheme **10.**

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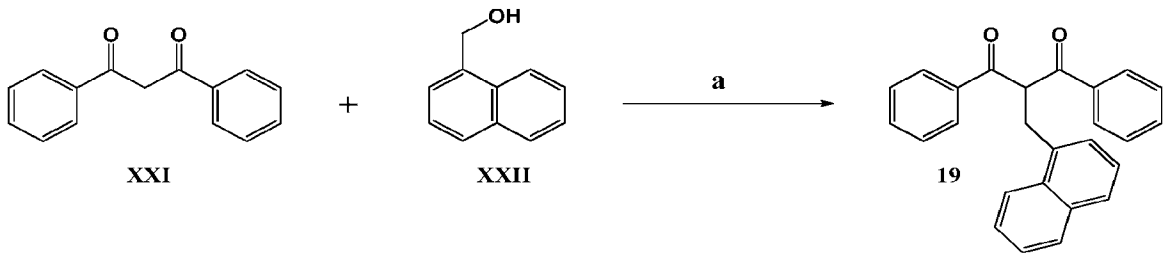

XXI XXII 19

Scheme 10

Reagents and conditions: a) CH_3NO_2, $Bi(OTf)_3$, 100°C, 2h

Step **a**

[00243] A solution of naphthalen-1-ylmethanol (**XXII**) (0.75 mmol) in CH_3NO_2 (1 mL) was added slowly over a period of 45 min to a solution of dibenzoylmethane (**XXI**) (2.27 mmol) and $Bi(OTf)_2$ (0.008 mmol) in CH_3NO_2 heated at 100°C. The solution was further stirred at 100°C for 2 h. The solution was cooled and the solvent was removed under vacuum. The residue was purified by column chromatography to produce 2-(naphthalen-1-ylmethyl)-1,3-diphenylpropane-1,3-dione **19** as a yellow solid (75% yield). ^{1}H NMR (DMSO-d_6, 400 MHz): δ ppm 3.75 (d, J = 7 Hz, 2H), 6.23 (t, J = 7 Hz, 1H), 7.24-7.38 (m, 6H), 7.50-7.55 (m, 4H), 7.57 (m, 1H), 7.81-7.87 (m, 5H), 8.14 (m, 1H); ESIMS found $C_{26}H_{20}O_2$ m/z 365 (M+H).

Administration and Pharmaceutical Compositions

[00244] Some embodiments include pharmaceutical compositions comprising: (a) a safe and therapeutically effective amount of a compound according to Formulas I, II or III, or its corresponding enantiomer, diastereoisomer or tautomer, or pharmaceutically acceptable salt; and (b) a pharmaceutically acceptable carrier.

[00245] Administration of the compounds disclosed herein or the pharmaceutically acceptable salts thereof can be via any of the accepted modes of administration for agents that serve similar utilities including, but not limited to, orally, subcutaneously, intravenously, intranasally, topically, transdermally, intraperitoneally, intramuscularly, intrapulmonarilly, vaginally, rectally, or intraocularly. Oral and parenteral administrations are customary in treating the indications.

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[00246] Compounds of the invention intended for pharmaceutical use may be administered as crystalline or amorphous products. Pharmaceutically acceptable compositions include solid, semi-solid, liquid and aerosol dosage forms, such as, *e.g.*, tablets, capsules, powders, liquids, suspensions, suppositories, aerosols or the like. They may be obtained, for example, as films by methods such as precipitation, crystallization, freeze drying, spray drying, or evaporative drying. Microwave or radio frequency drying may be used for this purpose. The compounds can also be administered in sustained or controlled release dosage forms, including depot injections, osmotic pumps, pills, transdermal (including electrotransport) patches, and the like, for prolonged and/or timed, pulsed administration at a predetermined rate. Preferably, the compositions are provided in unit dosage forms suitable for single administration of a precise dose.

[00247] The compounds can be administered either alone or more typically in combination with a conventional pharmaceutical carrier, excipient or the like. The term "excipient" is used herein to describe any ingredient other than the compound(s) of the invention. Pharmaceutically acceptable excipients include, but are not limited to, ion exchangers, alumina, aluminum stearate, lecithin, self-emulsifying drug delivery systems (SEDDS) such as d-α-tocopherol polyethylene glycol 1000 succinate, surfactants used in pharmaceutical dosage forms such as Tweens or other similar polymeric delivery matrices, serum proteins, such as human serum albumin, buffer substances such as phosphates, glycine, sorbic acid, potassium sorbate, partial glyceride mixtures of saturated vegetable fatty acids, water, salts or electrolytes, such as protamine sulfate, disodium hydrogen phosphate, potassium hydrogen phosphate, sodium-chloride, zinc salts, colloidal silica, magnesium trisilicate, polyvinyl pyrrolidone, cellulose-based substances, polyethylene glycol, sodium carboxymethyl cellulose, polyacrylates, waxes, polyethylene-polyoxypropylene-block polymers, and wool fat. Cyclodextrins such as α-, β, and γ-cyclodextrin, or chemically modified derivatives such as hydroxyalkylcyclodextrins, including 2- and 3-hydroxypropyl-b-cyclodextrins, or other solubilized derivatives can also be advantageously used to enhance delivery of compounds of the formulae described herein. Dosage forms or compositions containing a compound as described herein in the range of 0.005% to 100% with the balance made up from non-toxic carrier may be prepared. The contemplated compositions may contain

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0.001%-100% active ingredient, in one embodiment 0.1-95%, in another embodiment 75-85%. Actual methods of preparing such dosage forms are known, or will be apparent, to those skilled in this art; for example, see *Remington: The Science and Practice of Pharmacy*, 21st Edition (Lippincott Williams & Wilkins. 2005).

[00248] In one preferred embodiment, the compositions will take the form of a unit dosage form such as a pill or tablet and thus the composition may contain, along with the active ingredient, a diluent such as lactose, sucrose, dicalcium phosphate, or the like; a lubricant such as magnesium stearate or the like; and a binder such as starch, gum acacia, polyvinylpyrrolidine, gelatin, cellulose, cellulose derivatives or the like. In another solid dosage form, a powder, marume, solution or suspension (*e.g.*, in propylene carbonate, vegetable oils or triglycerides) is encapsulated in a gelatin capsule. Unit dosage forms in which the two active ingredients are physically separated are also contemplated; *e.g.*, capsules with granules of each drug; two-layer tablets; two-compartment gel caps, etc.

[00249] In another preferred embodiment, compositions described herein are used as a drug-eluting coatings for a medical device including, but not limited to temporary or permanent implants, sponge, polymer, or gel.

[00250] The implant according to an embodiment of the invention is an orthopedic implant including, but not limited to (i) a hip joint, (ii) screws, cannulated screws, nails, meshs, cages, wires, pins, intramedullary nails, rods, posts, anchors, and plates intended to join or attach bone fragments, pieces, or parts with each other, (iii) external skeletal fixators such as monolateral, multiplanar or hybrid fixators, (iv) implants intended for treatment of degenerative instabilities, fractures, tumors, and deformities in respect of the spine, (v) cranio-maxillofacial implants intended for treatment of fractures, reconstruction, and correction of deformities, of mandible, mid-face, or skull, (vi) surgical stents, collagen stents, intramedullary bone stents, (vii) anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) Reconstruction Systems, (viii) dental implants.

[00251] In some instances, a compound according to Formulas I, II or III is administered in combination with one or more therapeutic agents, e.g., therapeutic agents useful in the treatment of bone disorders or conditions described herein. For example,

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certain second therapeutic agents can promote tissue growth or infiltration, such as growth factors. Exemplary growth factors for this purpose include, without limitation, epidermal growth factor (EGF), vascular endothelial growth factor (VEGF), fibroblast growth factor (FGF), platelet-derived growth factor (PDGF), transforming growth factors (TGFs), parathyroid hormone (PTH), leukemia inhibitory factor (LIF), and insulin-like growth factors (IGFs). Other second therapeutic agents can promote bone growth, such as bone morphogenetic proteins (U.S. Pat. No. 4,761,471; PCT Pub. WO 90/11366), osteogenin (Sampath, et al., *Proc. Natl. Acad. Sci. USA* **(1987)**, *84(20)*, 7109-7113), NaF (Tencer, et al., *Journal of Biomedical Materials Research* **(1989)**, *23(6)*, 571-589), Peptide sequences such as IKVAV may be added to attach nerves and have those nerves express neuritis (Tashiro, et al., *The Journal of Biological Chemistry* **(1989)**, *264(27)*, 16174-16182).

[00252] Liquid pharmaceutically administrable compositions can, for example, be prepared by dissolving, dispersing, etc. an active compound as defined above and optional pharmaceutical adjuvants in a carrier (*e.g.*, water, saline, aqueous dextrose, glycerol, glycols, ethanol or the like) to form a solution or suspension. If desired, the pharmaceutical composition can also contain minor amounts of nontoxic auxiliary substances such as wetting agents, emulsifying agents, solubilizing agents, pH buffering agents and the like (*e.g.*, sodium acetate, sodium citrate, cyclodextrine derivatives, sorbitan monolaurate, triethanolamine acetate, triethanolamine oleate, and the like). Injectables can be prepared in conventional forms, either as liquid solutions or suspensions, as emulsions, or in solid forms suitable for dissolution or suspension in liquid prior to injection. The percentage of active compound contained in such parenteral compositions is highly dependent on the specific nature thereof, as well as the activity of the compound and the needs of the subject. However, percentages of active ingredient of 0.01% to 10% in solution are employable, and will be higher if the composition is a solid, which will be subsequently diluted to the above percentages. In some embodiments, the composition will comprise 0.2-2% of the active agent in solution.

[00253] It is to be noted that concentrations and dosage values may also vary with the severity of the condition to be alleviated. It is to be further understood that for any particular patient, specific dosage regimens should be adjusted over time according

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to the individual need and the professional judgment of the person administering or supervising the administration of the compositions, and that the concentration ranges set forth herein are exemplary only and are not intended to limit the scope or practice of the claimed compositions.

[00254] Solid compositions can be provided in various different types of dosage forms, depending on the physicochemical properties of the drug, the desired dissolution rate, cost considerations, and other criteria. In one of the embodiments, the solid composition is a single unit. This implies that one unit dose of the drug is comprised in a single, physically shaped solid form or article. In other words, the solid composition is coherent, which is in contrast to a multiple unit dosage form, in which the units are incoherent.

[00255] Examples of single units which may be used as dosage forms for the solid composition include tablets, such as compressed tablets, film-like units, foil-like units, wafers, lyophilized matrix units, and the like. In a preferred embodiment, the solid composition is a highly porous lyophilized form. Such lyophilizates, sometimes also called wafers or lyophilized tablets, are particularly useful for their rapid disintegration, which also enables the rapid dissolution of the active compound.

[00256] On the other hand, for some applications the solid composition may also be formed as a multiple unit dosage form as defined above. Examples of multiple units are powders, granules, microparticles, pellets, beads, lyophilized powders, and the like. In one embodiment, the solid composition is a lyophilized powder. Such a dispersed lyophilized system comprises a multitude of powder particles, and due to the lyophilization process used in the formation of the powder, each particle has an irregular, porous microstructure through which the powder is capable of absorbing water very rapidly, resulting in quick dissolution.

[00257] Another type of multiparticulate system which is also capable of achieving rapid drug dissolution is that of powders, granules, or pellets from water-soluble excipients which are coated with the drug, so that the drug is located at the outer surface of the individual particles. In this type of system, the water-soluble low molecular weight excipient is useful for preparing the cores of such coated particles, which can be subsequently coated with a coating composition comprising the drug and, preferably, one

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or more additional excipients, such as a binder, a pore former, a saccharide, a sugar alcohol, a film-forming polymer, a plasticizer, or other excipients used in pharmaceutical coating compositions.

[00258] Also provided herein are kits. Typically, a kit includes one or more compounds or compositions as described herein. In certain embodiments, a kit can include one or more delivery systems, e.g., for delivering or administering a compound as provided above, and directions for use of the kit (e.g., instructions for treating a patient). In another embodiment, the kit can include a compound or composition as described herein and a label that indicates that the contents are to be administered to a patient with cancer. In another embodiment, the kit can include a compound or composition as described herein and a label that indicates that the contents are to be administered to a patient with one or more of osteoporosis and osteoarthropathy; osteogenesis imperfecta, bone defects, bone fractures, periodontal disease, otosclerosis, wound healing, craniofacial defects, oncolytic bone disease, traumatic brain injuries related to the differentiation and development of the central nervous system, comprising Parkinson's disease, strokes, ischemic cerebral disease, epilepsy, Alzheimer's disease, depression, bipolar disorder, schizophrenia; eye diseases such as age related macular degeneration, diabetic macular edema, familial exudative vitreoretinopathy or retinitis pigmentosa and diseases related to differentiation and growth of stem cell, comprising hair loss, hematopoiesis related diseases, tissue regeneration related diseases and other diseases associated with abnormalities in development, stem cell differentiation and cell proliferation.

[00259] The actual dose of the active compounds of the present invention depends on the specific compound, and on the condition to be treated; the selection of the appropriate dose is well within the knowledge of the skilled artisan.

Methods of Treatment

[00260] The compounds and compositions provided herein can be used as activators of one or more members of the Wnt pathway, including one or more Wnt proteins, and thus can be used to treat a variety of disorders and diseases in which aberrant Wnt signaling is implicated, such as osteoporosis and osteoarthropathy;

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osteogenesis imperfecta, bone defects, bone fractures, periodontal disease, otosclerosis, wound healing, craniofacial defects, oncolytic bone disease, traumatic brain injuries related to the differentiation and development of the central nervous system, comprising Parkinson's disease, strokes, ischemic cerebral disease, epilepsy, Alzheimer's disease, depression, bipolar disorder, schizophrenia; eye diseases such as age related macular degeneration, diabetic macular edema, familial exudative vitreoretinopathy or retinitis pigmentosa and diseases related to differentiation and growth of stem cell, comprising hair loss, hematopoiesis related diseases, tissue regeneration related diseases and other diseases associated with abnormalities in development, stem cell differentiation and cell proliferation.

[00261] With respect to hair loss, the canonical *Wnt*/β-catenin signaling pathway is known to regulate hair follicle development and regeneration. In the epidermis, hair follicle development is initiated when mesenchymal cells populate the skin. During this process, signals emanating from the dermis induce epithelium thickening, elongation of the epithelial cells, and the formation of placodes containing *Wnt*-responsive cells. In response, placodes signal dermal cells to condense, thereby forming the dermal papilla component of the hair follicle, which is also responsive to *Wnt* signaling. *Wnt3a* is secreted from hair epithelium and acts in an autocrine and paracrine fashion, and it has been demonstrated that *Wnt-3a* maintains anagen gene expression in dermal papilla cells and mediates hair-inductive activity in an organ culture. This *Wnt-3a*-mediated hair growth might depend on the canonical *Wnt*/β-catenin signaling pathway because deletion of β-catenin or the *Lef1* gene resulted in hair loss in mice. Accordingly, the compounds and compositions described herein may be used topically to treat hair loss by modulation of the *Wnt*/β-catenin signaling pathway.

[00262] With respect to neurodegenerative diseases, *Wnt*/β-catenin signal transduction system plays a crucial role in the differentiation and development of nerve cells for the central nervous system. Particularly, it is found that *Wnt*/β-catenin signaling is related to diseases resulting from the abnormality of nerve cells.

[00263] More particularly in Alzheimer's disease, studies indicate that a sustained loss of *Wnt* signaling function may be involved in the Aβ-dependent neurodegeneration observed in Alzheimer's brain. Consequently, the compounds and

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compositions described herein may be used to reactivate lost *Wnt* signaling function involved in neurodegeneration.

[00264] Other neurodegenerative diseases can also be treated with the compounds and compositions described herein.

[00265] More particularly, neurodegenerative diseases that may be treated by the compound, compositions and methods described herein include, but are not limited to, the following:

[00266] Parkinson's disease, schizophrenia, Huntington's disease, amyotrophic lateral sclerosis (Lou Gehrig's disease), primary lateral sclerosis (PLS), progressive muscular atrophy (PMA), bipolar disorder, depression, strokes, ischemic cerebral disease, epilepsy, brain damage and spinocerebellar ataxia type 1(SCA1).

[00267] With respect to eye diseases, *Wnt*/β-catenin signal transduction system regulates the maintenance of a retinal progenitor population in the ciliary marginal zone (CMZ), and thus function as a putative stem cell factor in the retina. Particularly, it is found that *Wnt*/β catenin pathways mediate a process of retinal repair and that application of Wnt activators may promote retinal neuron regeneration. In the setting of injury, Wnts may serve a protective role. It has been recently shown that Wnt3a protects photoreceptors. The results of this study may well be interpreted as an upregulation of self-renewal of stem cells in the setting of injury.

[00268] Accordingly, the compounds and compositions described herein may be used to enhance replacement of lost neurons caused by disease and protect photoreceptors during injury by modulation of the *Wnt*/β-catenin signaling pathway.

[00269] Other eye diseases can also be treated with the compounds and compositions described herein.

[00270] More particularly, eye diseases that may be treated by the compound, compositions and methods described herein include, but are not limited to, the following:

[00271] Age related macular degeneration, diabetic macular edema, familial exudative vitreoretinopathy and retinitis pigmentosa.

[00272] With respect to diseases associated with differentiation and growth of stem cell, *Wnt*/β-catenin signaling is critical in the self-renewal of stem cells in many different tissues, including the skin, intestine, brain and blood. Therefore, the compounds

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and compositions described herein may be used to treat disorders and diseases related to abnormalities in development.

Evaluation of Biological Activity

[00273] The biological activity of the compounds described herein can be tested using any suitable assay known to those of skill in the art, e.g., WO 2001/053268 or WO 2005/009997. For example, the activity of a compound may be tested using one or more of the test methods outlined below.

Example 7.

[00274] Compounds that enhance the Wnt activity, or Activators, were assayed as follows. Reporter cell lines were generated by stably transducing cells of cancer cell lines (e.g., colon cancer) with a lentiviral construct that include a wnt-responsive promoter driving expression of the firefly luciferase gene.

[00275] Lentiviral constructs were made in which the SP5 promoter, a promoter having eight TCF/LEF binding sites derived from the SP5 promoter, is linked upstream of the firefly luciferase gene. The lentiviral constructs can also include a hygromycin resistance gene as a selectable marker. The SP5 promoter construct were used to transduce SW480 cells, a colon cancer cell line having a mutated APC gene that generates a truncated APC protein, leading to de-regulated accumulation of β-catenin.

[00276] Cultured SW480 cells bearing a reporter construct can be distributed at approximately 10,000 cells per well into 384 or 96 well multiwell plates. Compounds from a small molecule compound library can then be added to the wells in half-log dilutions using three or ten micromolar top concentration. A series of control wells for each cell type received only buffer and compound solvent DMSO. Twenty-four hours after the addition of compound, reporter activity for luciferase can be assayed, for example, by addition of the BrightGlo luminescence reagent (Promega) and the Victor3 plate reader (Perkin Elmer). Readings are normalized to DMSO only treated cells, and any activities above DMSO are considered activation. Compounds are considered activators if reporter activities are 2x fold or greater than DMSO. EC_{50} is the

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concentration at half maximal activation. Table 2 shows the activity of selected activators.

Table 2.

Compound	Wnt activation, IC_{50}	Compound	Wnt activation, IC_{50}
1	0.028-0.029 μM	**10**	>10 μM
2	0.013 μM	**11**	>10 μM
3	0.036-0.041 μM	**12**	>10 μM
4	0.61-1.0 μM	**14**	>10 μM
5	0.64-1.9 μM	**15**	0.68-2.1 μM
6	2.1 μM	**16**	2.57 μM
7	0.096-0.27 μM	**17**	>10 μM
8	0.083 μM	**18**	6.0 μM
9	>10 μM	**19**	2.8-5.0 μM

[00277] The term "comprising" as used herein is synonymous with "including," "containing," or "characterized by," and is inclusive or open-ended and does not exclude additional, unrecited elements or method steps.

[00278] The reference to any prior art in this specification is not, and should not be taken as an acknowledgement or any form of suggestion that the referenced prior art forms part of the common general knowledge in Australia.

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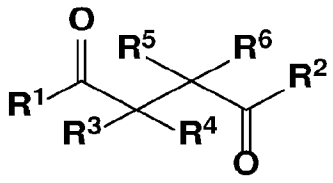
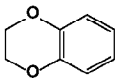
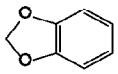
WHAT IS CLAIMED IS:

1. A compound or pharmaceutically acceptable salt thereof having the structure of formula **I**:

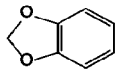


I

wherein R^1 is selected from the group consisting of substituted or unsubstituted  and  ;

R^2 is selected from the group consisting of substituted or unsubstituted aryl; and

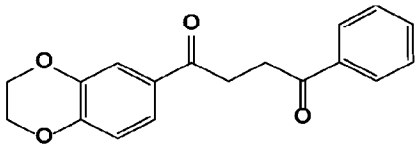
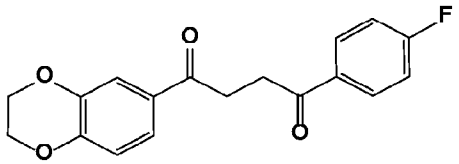
R^3, R^4, R^5 and R^6 are all H.

2. The compound of claim 1 wherein R^1 is unsubstituted  .

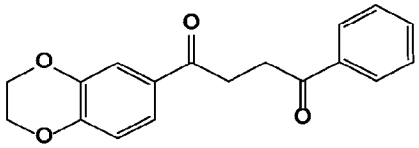
3. The compound of any one of the claims 1-2 wherein R^2 is phenyl, optionally substituted with halide.

4. The compound of claim 1 wherein R^2 is unsubstituted phenyl.

5. The compound of any one of the claims 1 and 3 having a structure selected from the group consisting of:

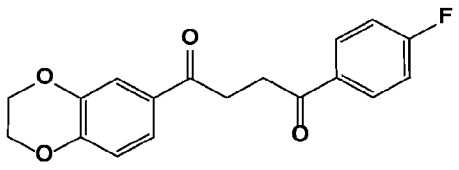
 and  , or a pharmaceutically acceptable salt thereof.

6. The compound of any one of the claims 1 and 3-5 having the structure of:

 , or a pharmaceutically acceptable salt thereof.

7. The compound of any one of the claims 1, 3 and 5 having the structure of:

WINPLUS Ex. 1003, p. 329

8.  , or a pharmaceutically acceptable salt thereof.

9. A pharmaceutical composition comprising a compound according to any one of the claims 1-8, or a pharmaceutically acceptable salt thereof, and a pharmaceutically acceptable excipient.

10. A method of treating alopecia in a mammal, the method comprising topically administering to the mammal a compound according to any one of claims 1-8, or a pharmaceutically acceptable salt thereof.

11. A method of treating alopecia in a mammal, the method comprising topically administering to the mammal a pharmaceutical composition according to claim 9.

12. A method of treating hair loss in a mammal, the method comprising topically administering to the mammal a compound according to any one of claims 1-8, or a pharmaceutically acceptable salt thereof.

13. A method of treating hair loss in a mammal, the method comprising topically administering to the mammal a pharmaceutical composition according to claim 9.

14. A method of increasing tissue regeneration in a mammal, wherein the tissue is skin, the method comprising topically administering to the mammal a compound according to any one of claims 1-8, or a pharmaceutically acceptable salt thereof.

15. A method of increasing tissue regeneration in a mammal, wherein the tissue is skin, the method comprising topically administering to the mammal a pharmaceutical composition according to claim 9.

16. The method of any one of the claims 10-15, wherein the mammal is a human.

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Portable vehicle battery jump start apparatus with safety protection

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Abstract of AU2016269555 (A1)

A handheld device for jump starting a vehicle engine includes a rechargeable lithium ion battery pack (32) and a microcontroller (1). The lithium ion battery is 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

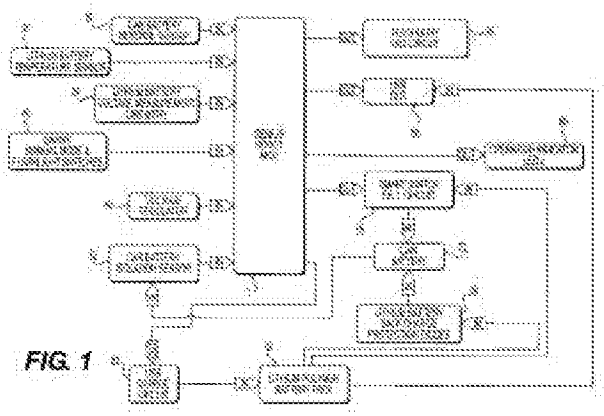

FIG. 1

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.

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ABSTRACT

A handheld device for jump starting a vehicle engine includes a rechargeable lithium ion battery pack (32) and a microcontroller (1). The lithium ion battery is 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.

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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.

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[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

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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.

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[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.

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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.

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[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).

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[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

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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

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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

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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

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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

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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.

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[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.

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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.

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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.

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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.

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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.

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WATERMARK PATENT AND TRADE MARKS ATTORNEYS

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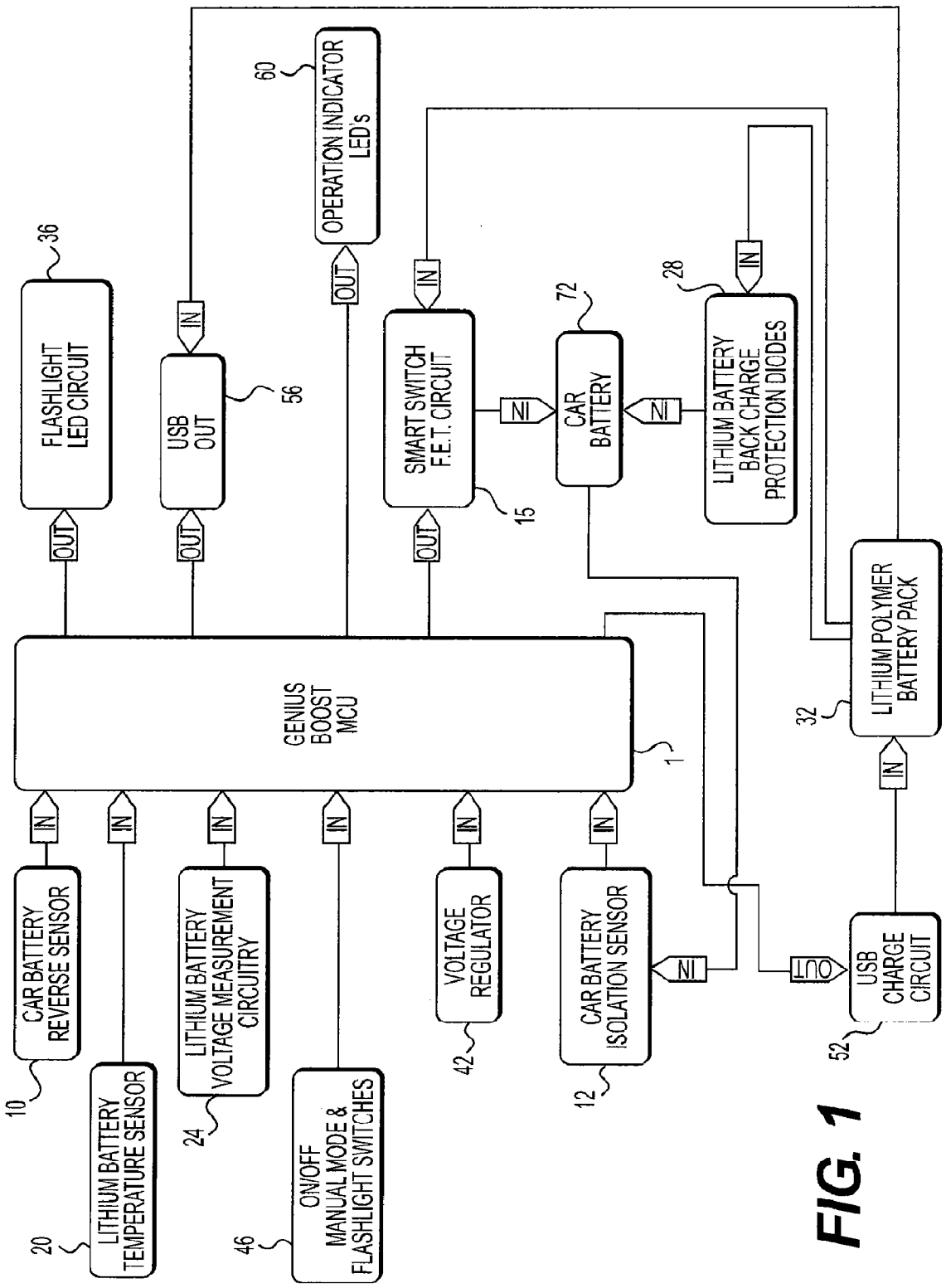

FIG. 1

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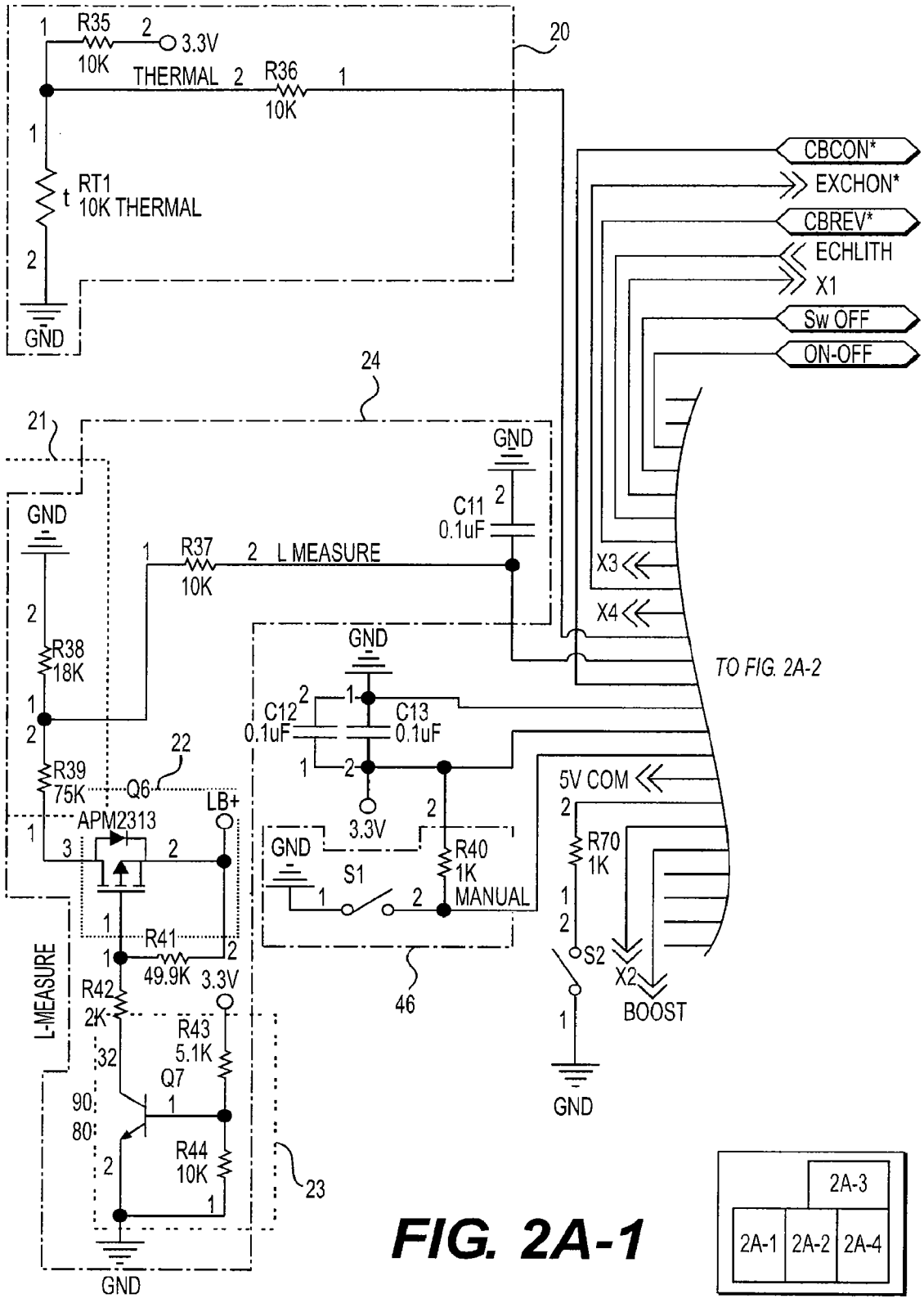

FIG. 2A-1

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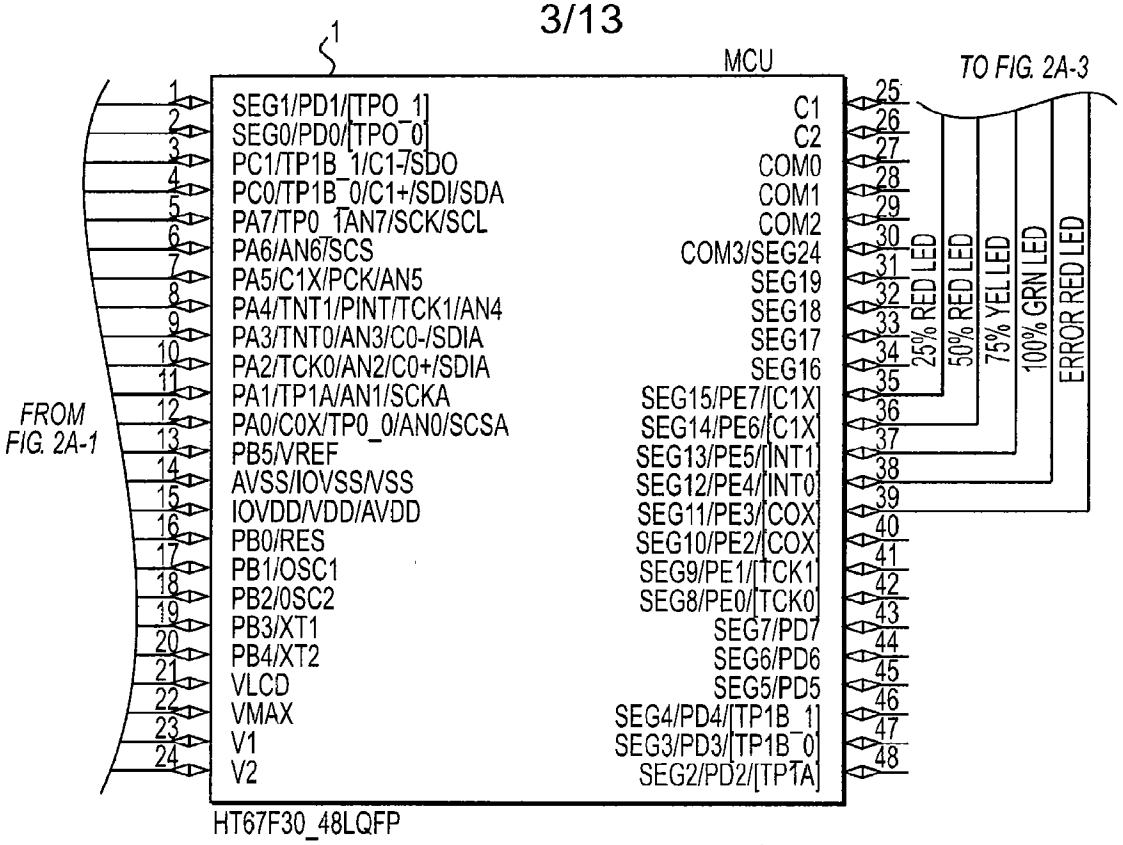

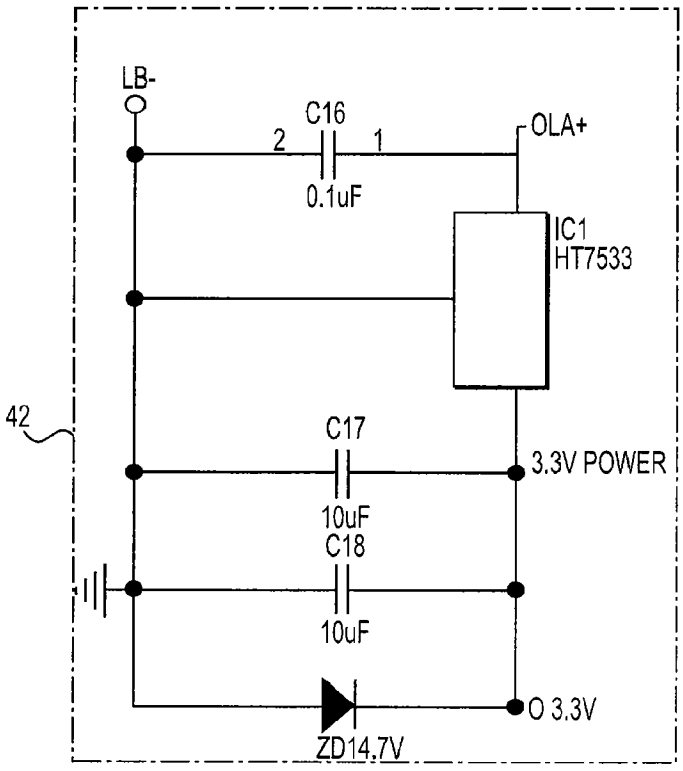

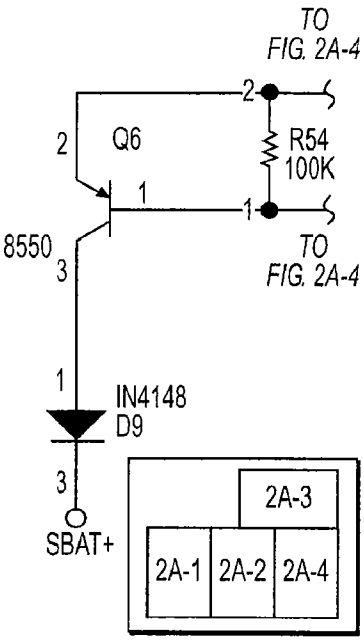

FIG. 2A-2

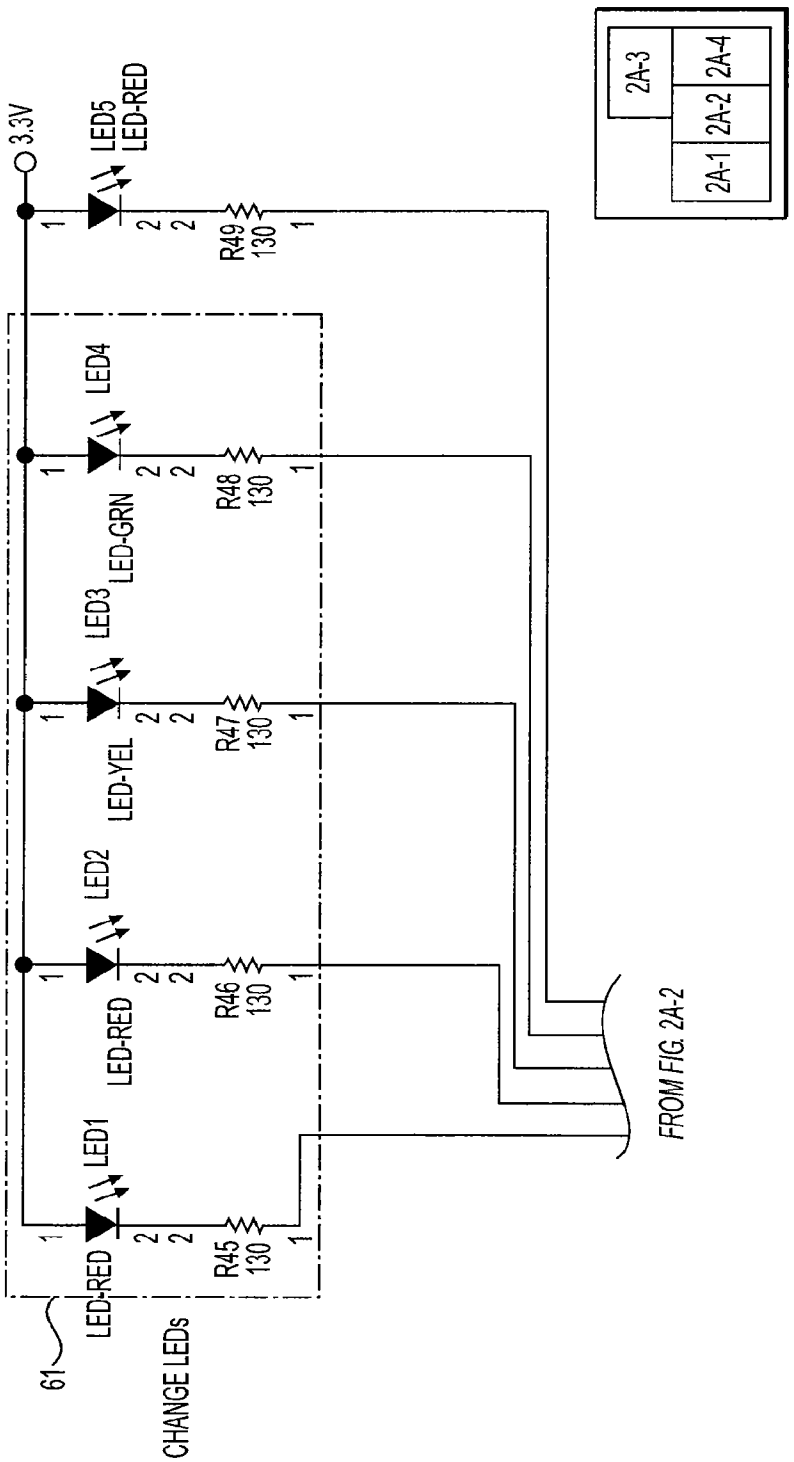
3.3V
LED5
LED-RED
R49
130
LED4
LED-GRN
R48
130
LED3
LED-YEL
R47
130
LED2
LED-RED
R46
130
LED1
LED-RED
R45
130
61
CHANGE LEDs
FROM FIG. 2A-2
2A-3
2A-1
2A-2
2A-4

FIG. 2A-3

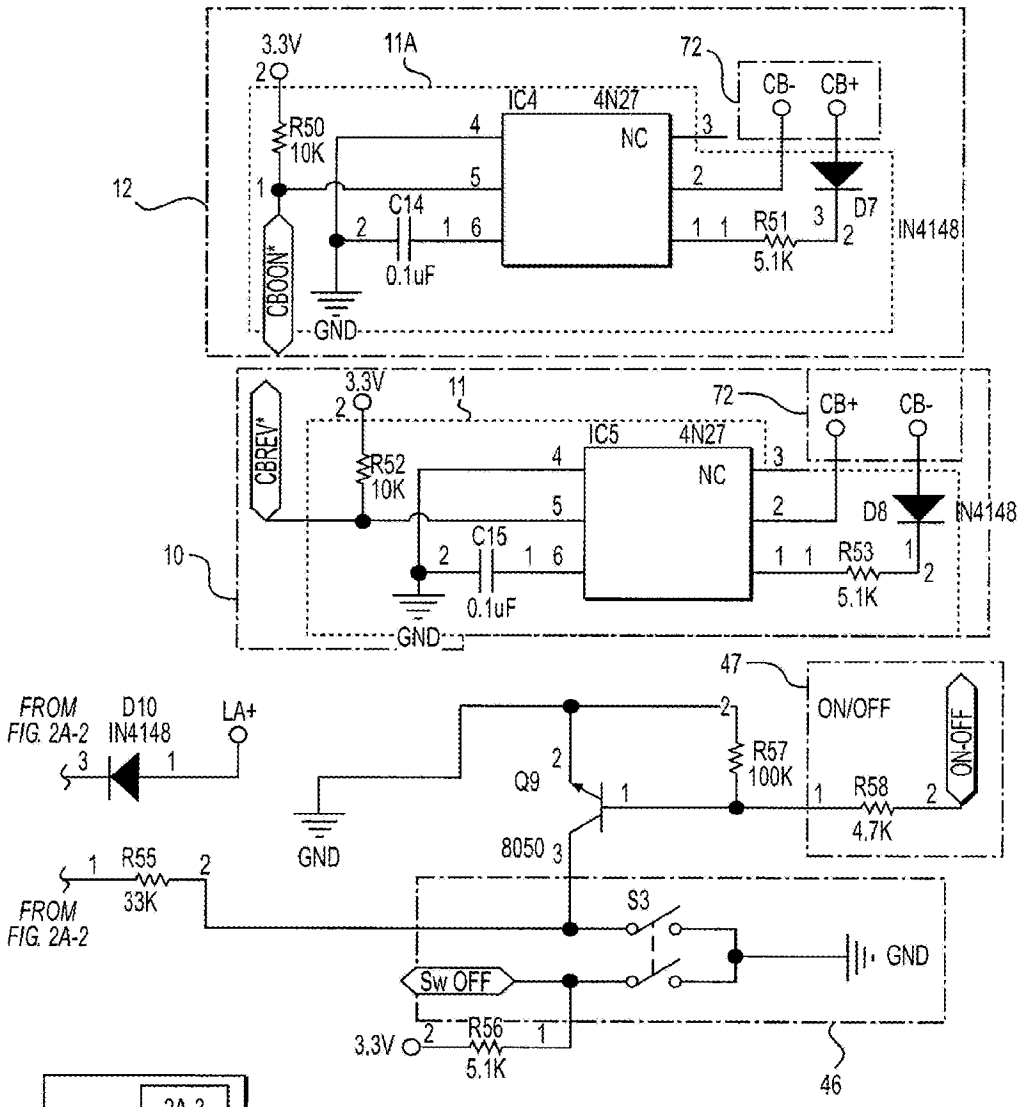
3.3V
11A
72
CB-
CB+
IC4
4N27
R50
10K
NC
12
C14
0.1uF
R51
5.1K
D7
IN4148
CBOON*
GND
CBREV*
11
IC5
R52
C15
D8
R53
10
FROM FIG. 2A-2
D10 IN4148
LA+
47
ON/OFF
R57
100K
Q9
R58
4.7K
8050
R55
33K
S3
Sw OFF
R56
46
2A-3
2A-1
2A-2
2A-4

FIG. 2A-4

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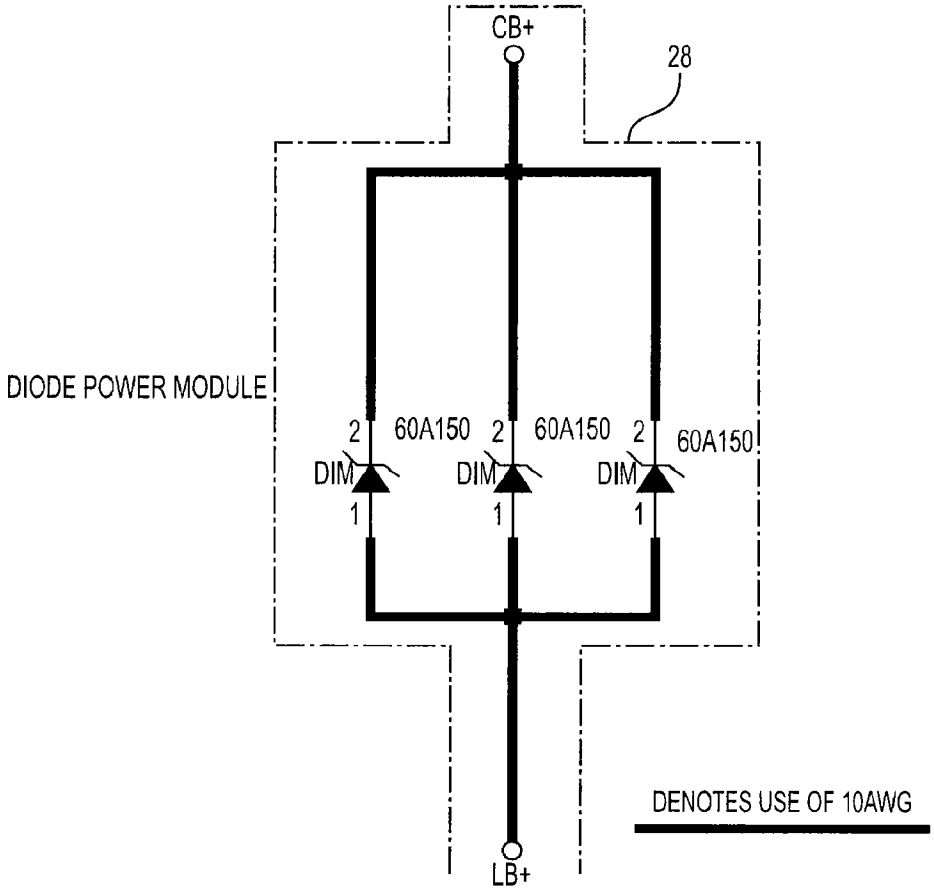
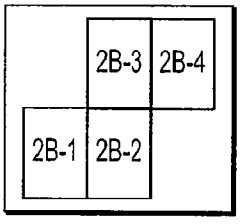


FIG. 2B-1



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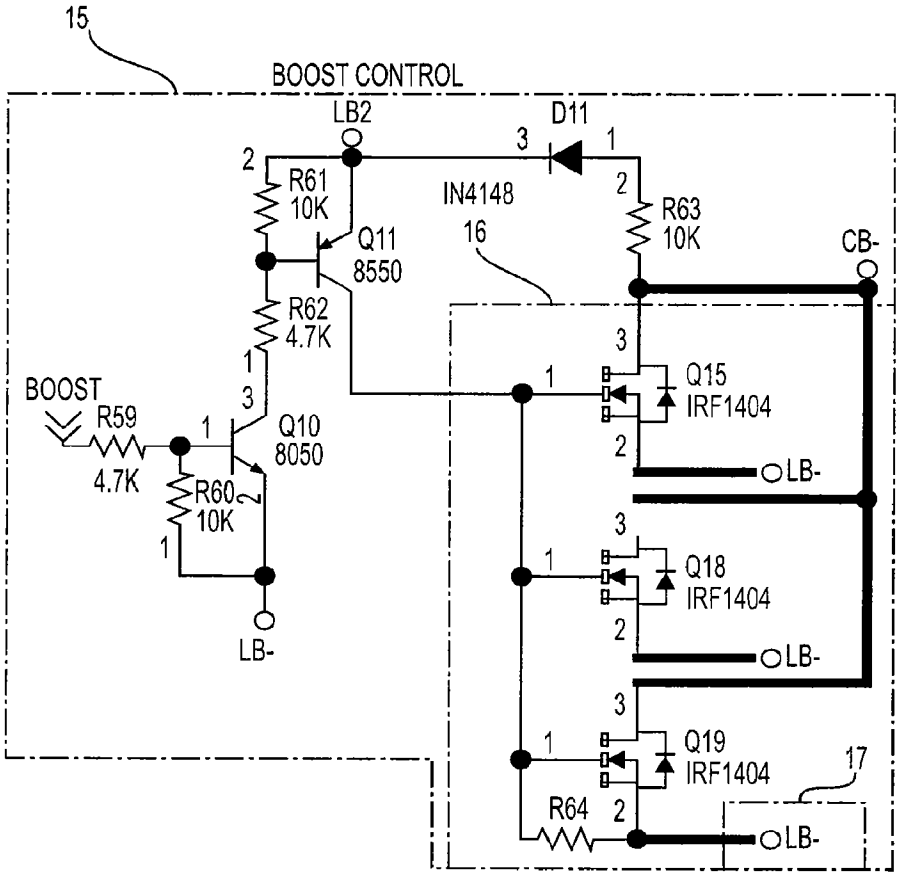
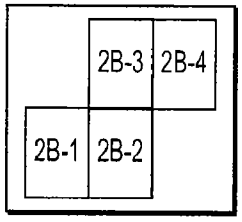


FIG. 2B-2



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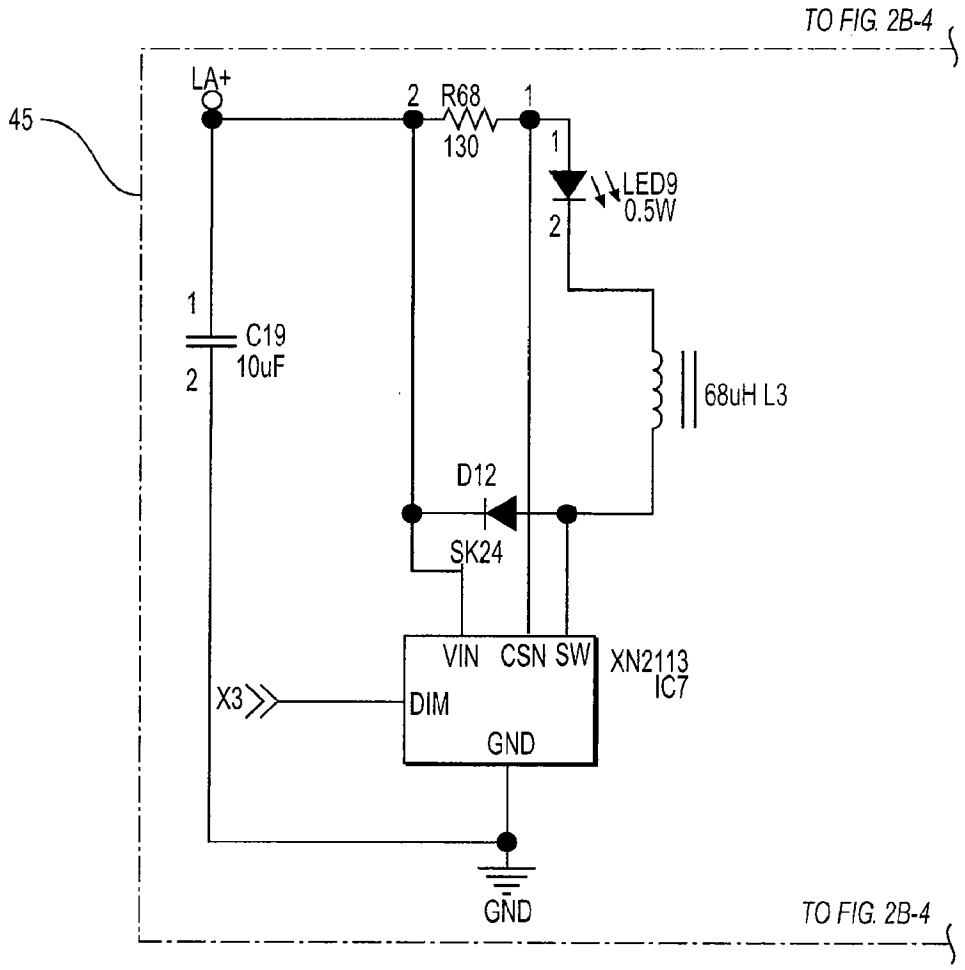
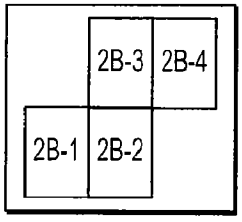


FIG. 2B-3



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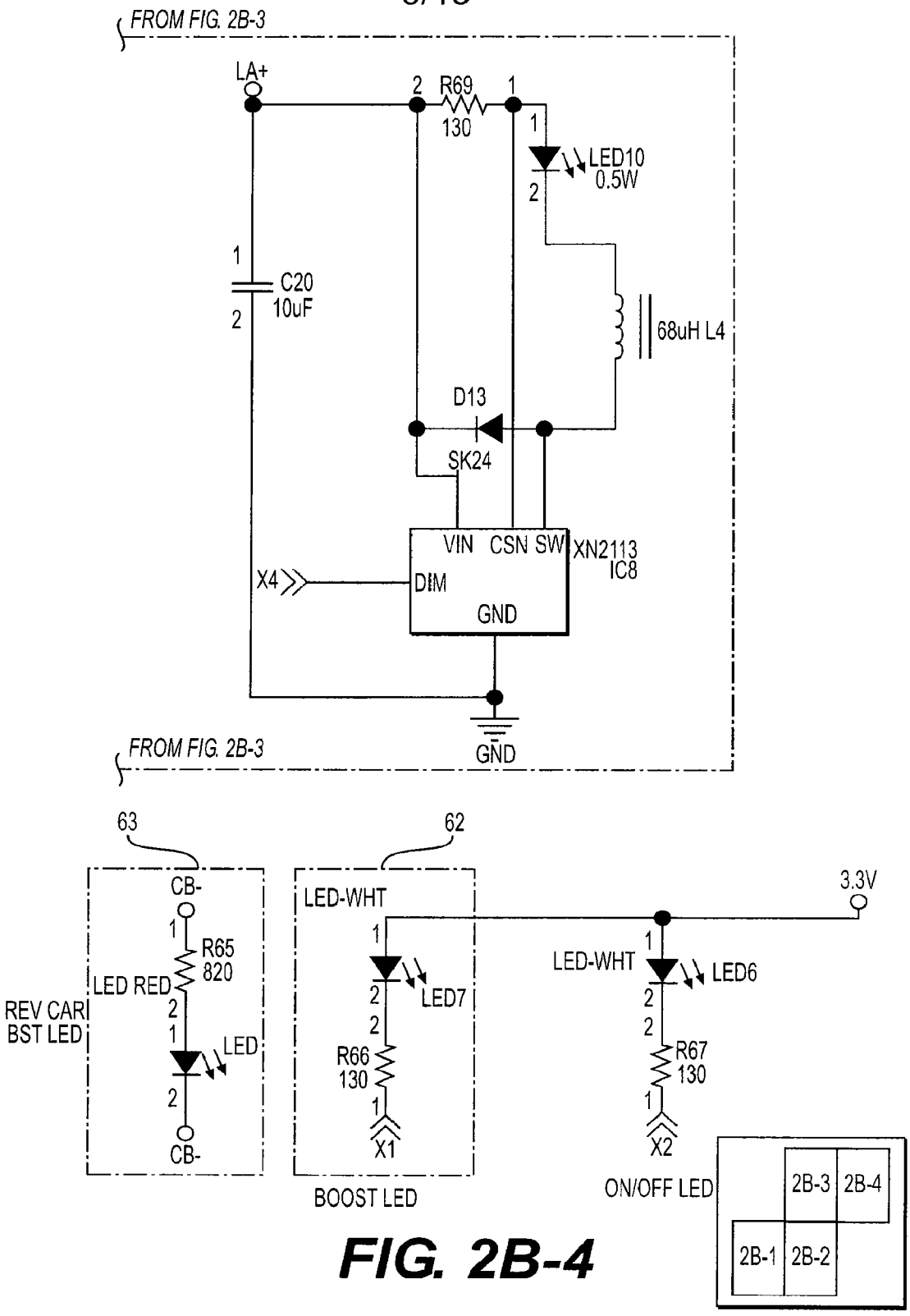

FIG. 2B-4

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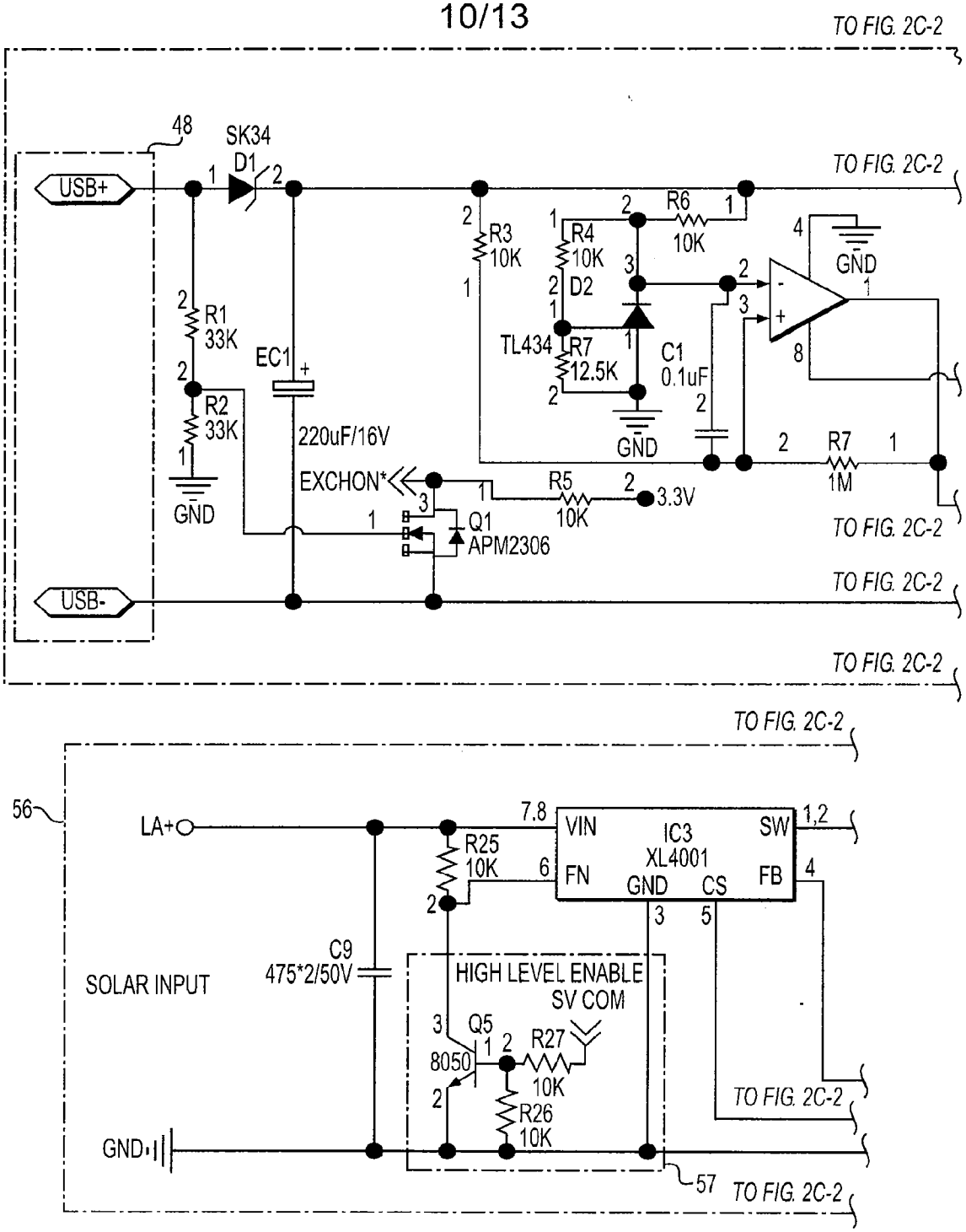
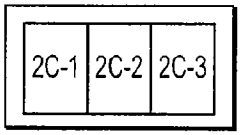


FIG. 2C-1



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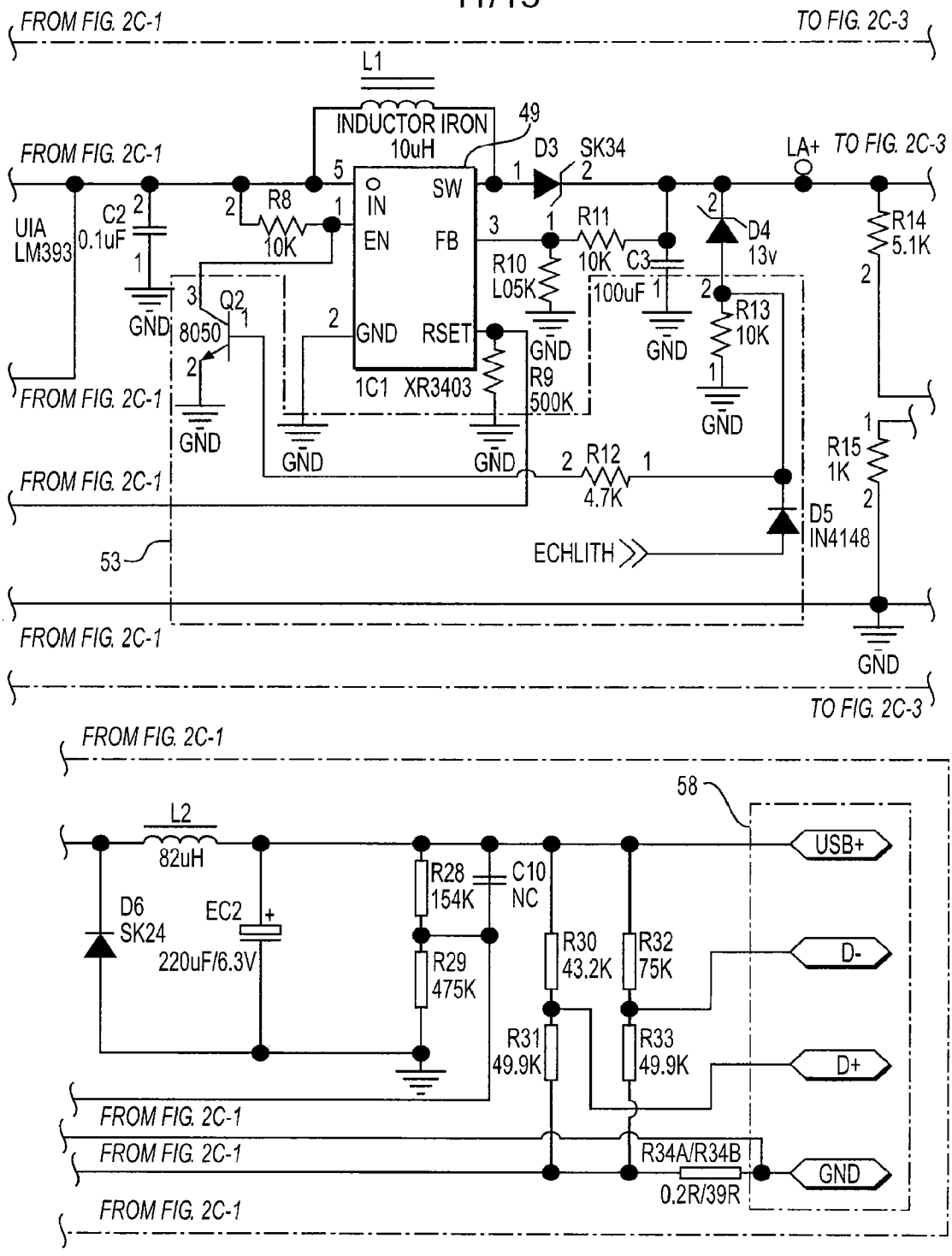

FIG. 2C-2

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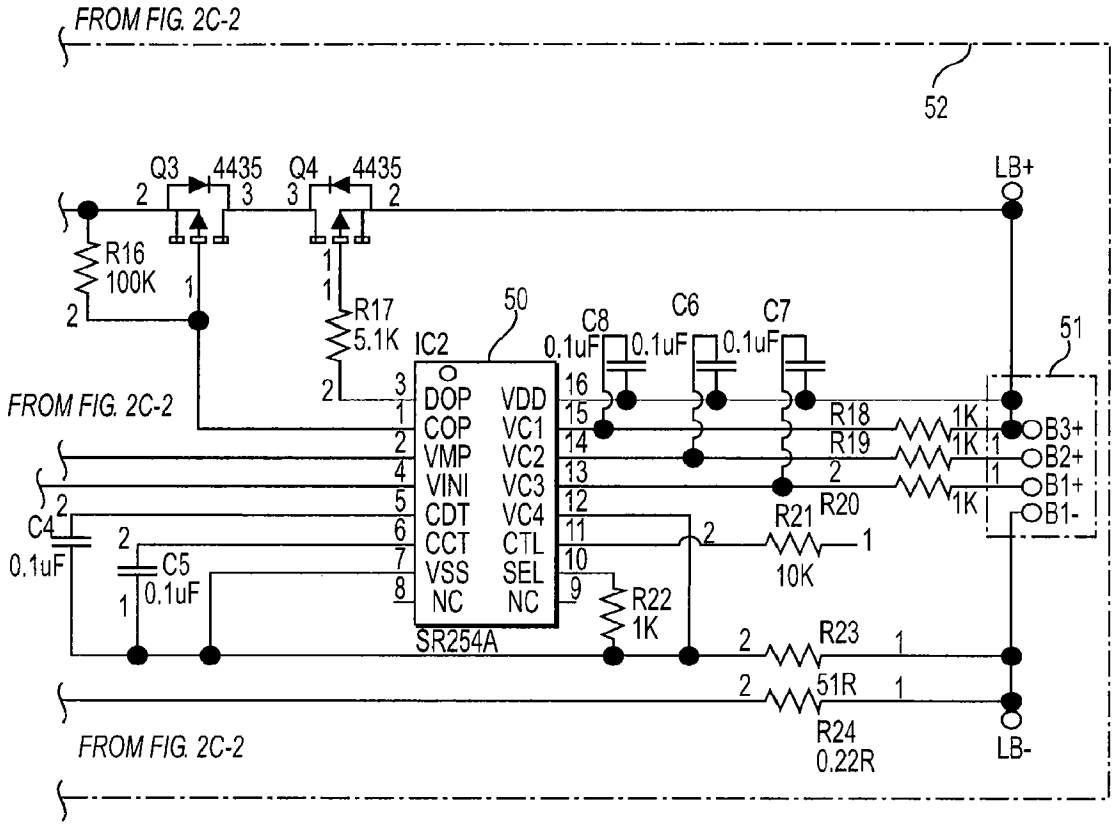

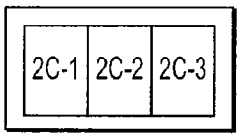

FIG. 2C-3

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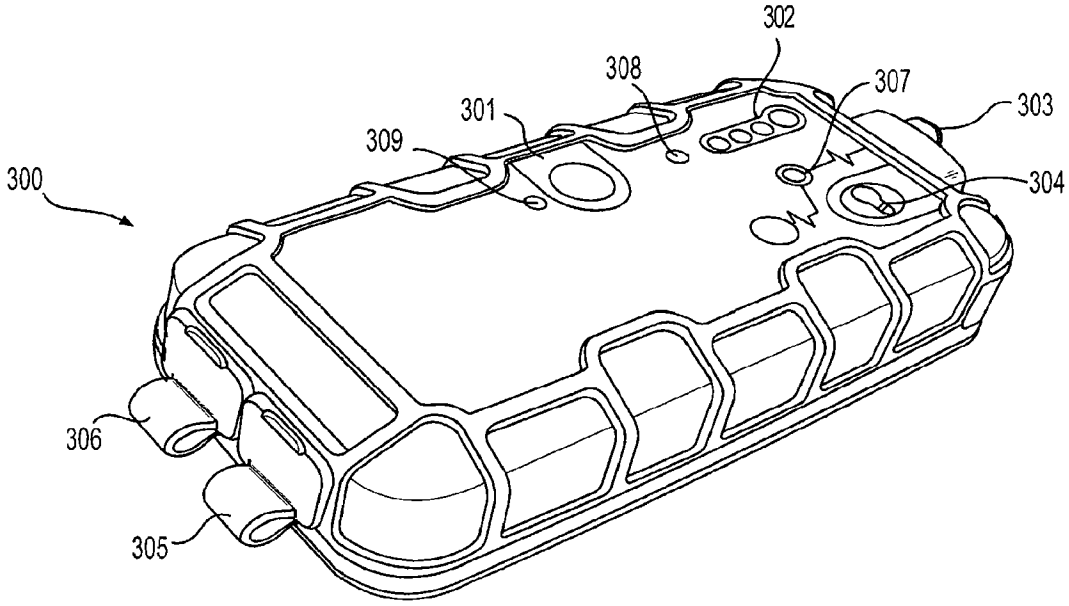

FIG. 3

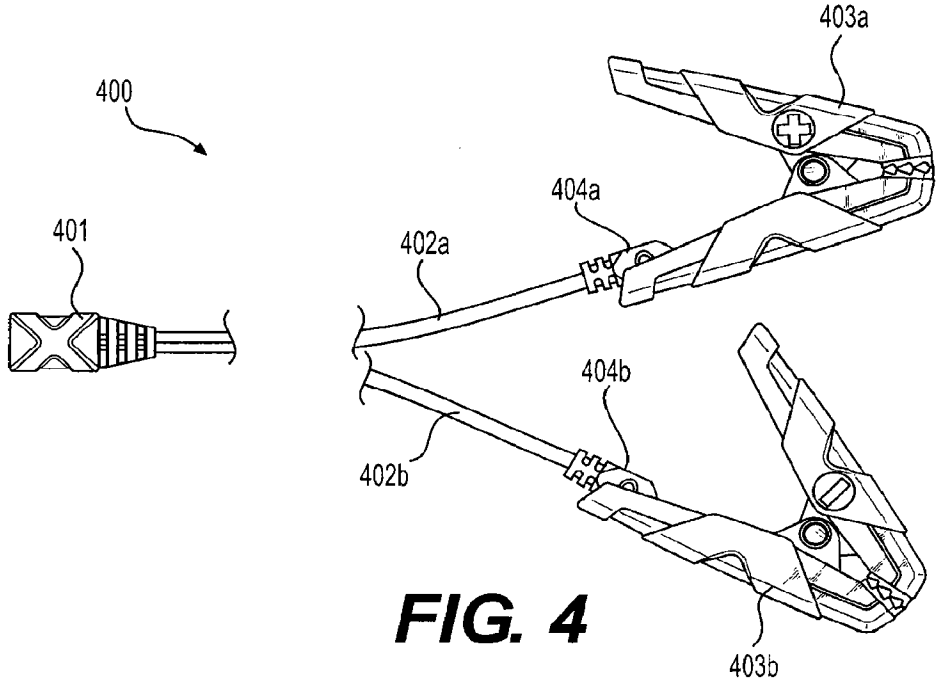

FIG. 4

Espacenet

Bibliographic data: AU2019201559 (A1) — 2019-03-28

Portable vehicle battery jump start apparatus with safety protection

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Applicant(s): NOCO CO ± (The NOCO Company, ; THE NOCO COMPANY)

Classification: - international: ***B60R16/00; B60R16/03; H02J1/00; H02J7/00; H02J7/14***
- cooperative: **H02J7/0034 (EP, GB); H02J7/0036 (EP, GB); H02J7/342 (EP, GB)**

Application number: AU20190201559 20190306

Priority number(s): AU20190201559 20190306 ; AU20160269555 20161209 ; AU20150258229 20151118 ; WO2014US45434 20140703

Also published as: AU2019201559 (B2) AU2019201559 (B9) AU2015258229 (A1) AU2016269555 (A1) AU2016269555 (B2) more

Abstract of AU2019201559 (A1)

A handheld device for jump starting a vehicle engine includes a rechargeable lithium ion battery pack (32) and a microcontroller (1). The lithium ion battery is 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

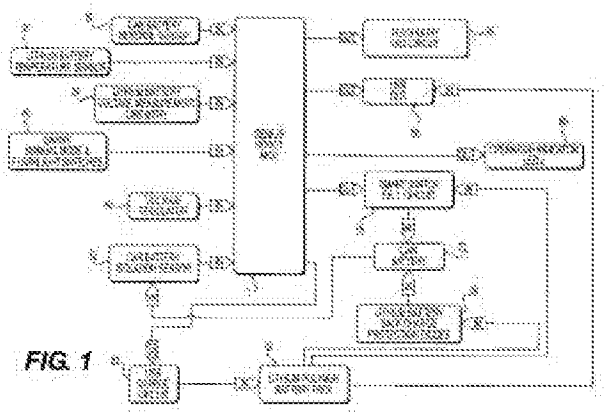

FIG. 1

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.

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ABSTRACT

A handheld device for jump starting a vehicle engine includes a rechargeable lithium ion battery pack (32) and a microcontroller (1). The lithium ion battery is 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.

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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.

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[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

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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.

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[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.

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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.

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[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).

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[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

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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

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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

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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

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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

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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.

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[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.

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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.

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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.

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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.

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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

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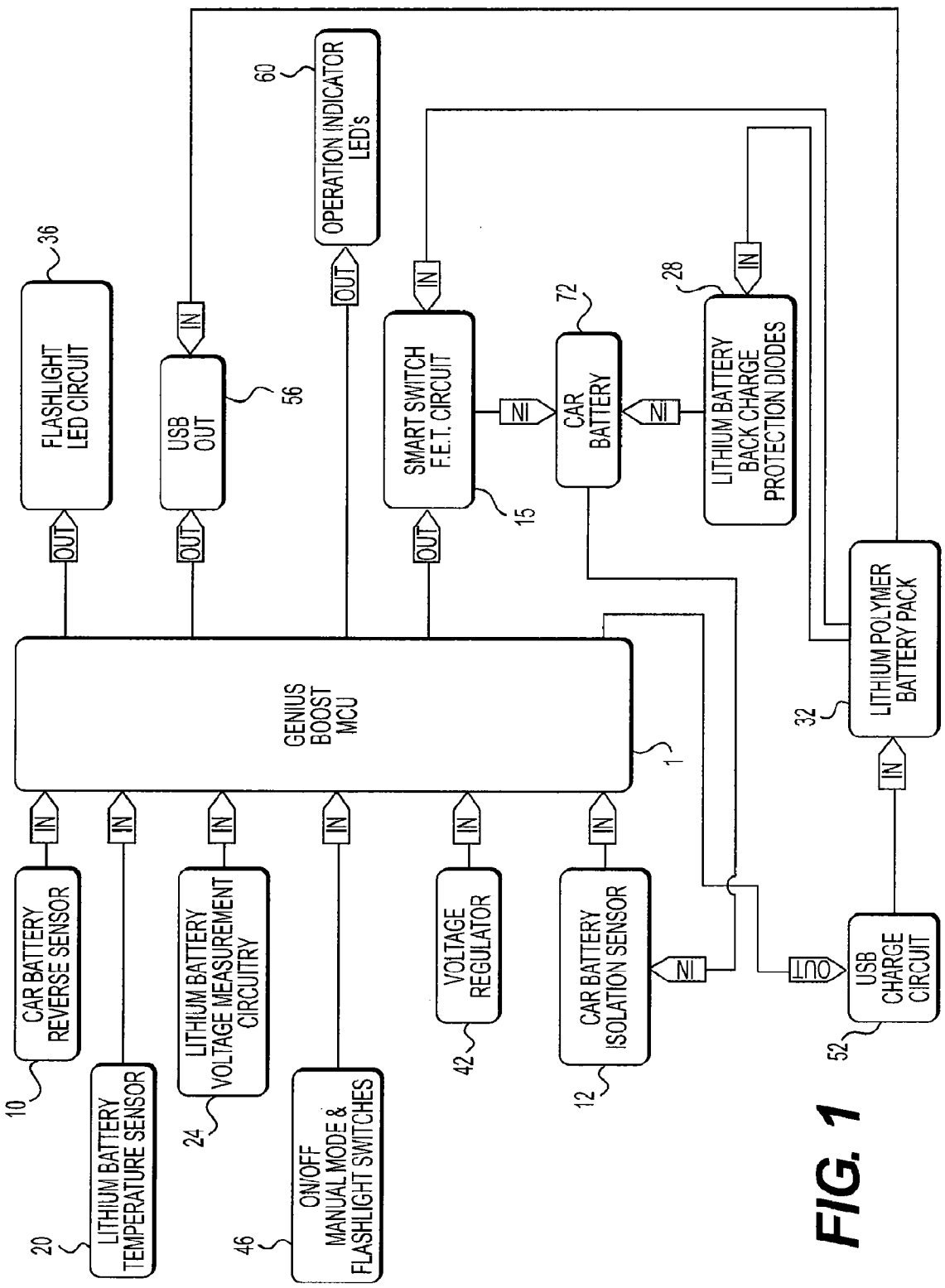

FIG. 1

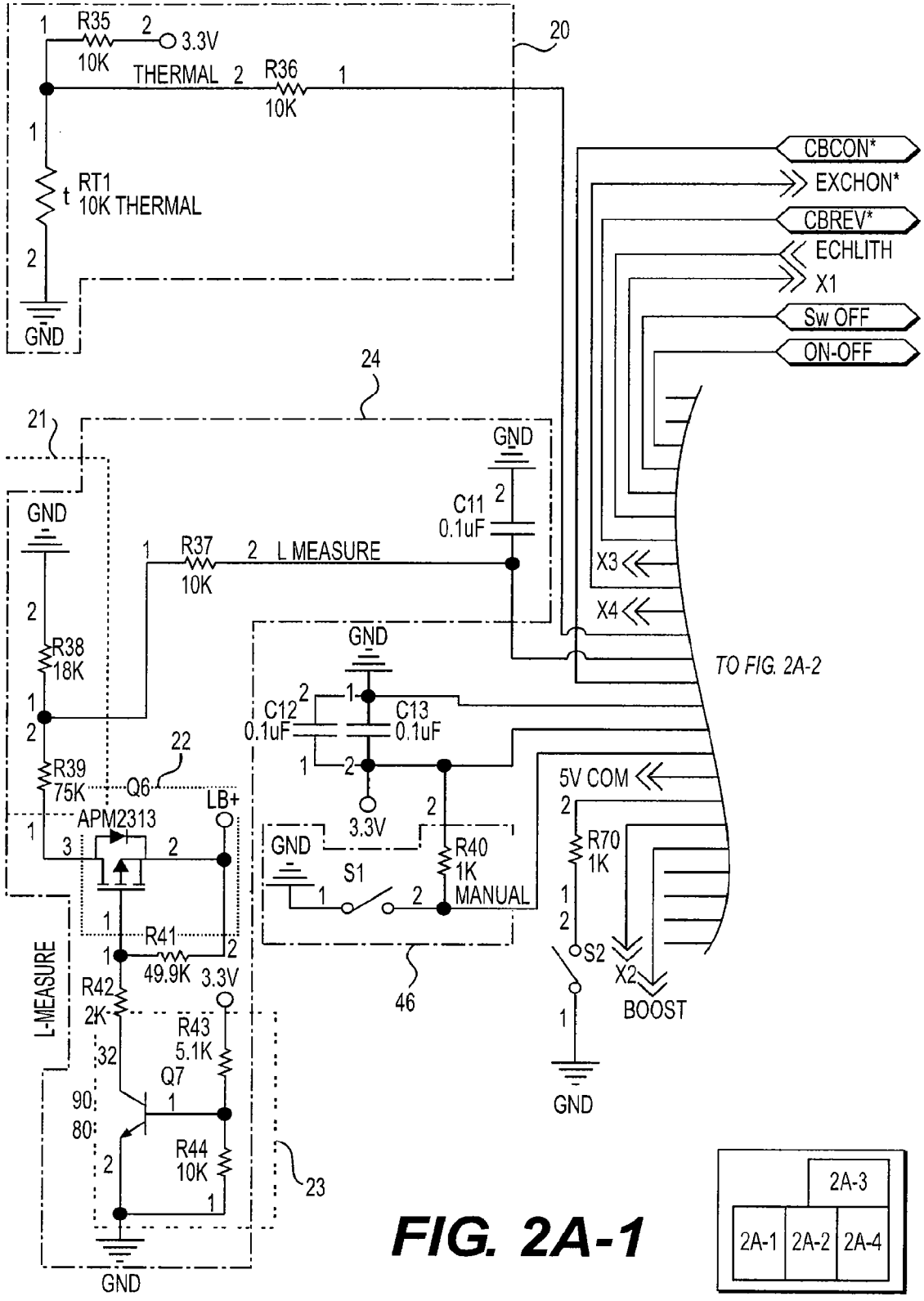
R35
10K
3.3V
THERMAL
R36
10K
20
RT1
10K THERMAL
GND
24
21
GND
C11
0.1uF
R37
10K
L MEASURE
R38
18K
R39
75K
22
Q6
APM2313
LB+
R41
49.9K
3.3V
R42
2K
R43
5.1K
Q7
R44
10K
L-MEASURE
23
GND
C12
0.1uF
C13
0.1uF
3.3V
GND
S1
R40
1K
MANUAL
46
CBCON*
EXCHON*
CBREV*
ECHLITH
X1
Sw OFF
ON-OFF
X3
X4
TO FIG. 2A-2
5V COM
R70
1K
S2
X2
BOOST
GND
2A-3
2A-1
2A-2
2A-4

FIG. 2A-1

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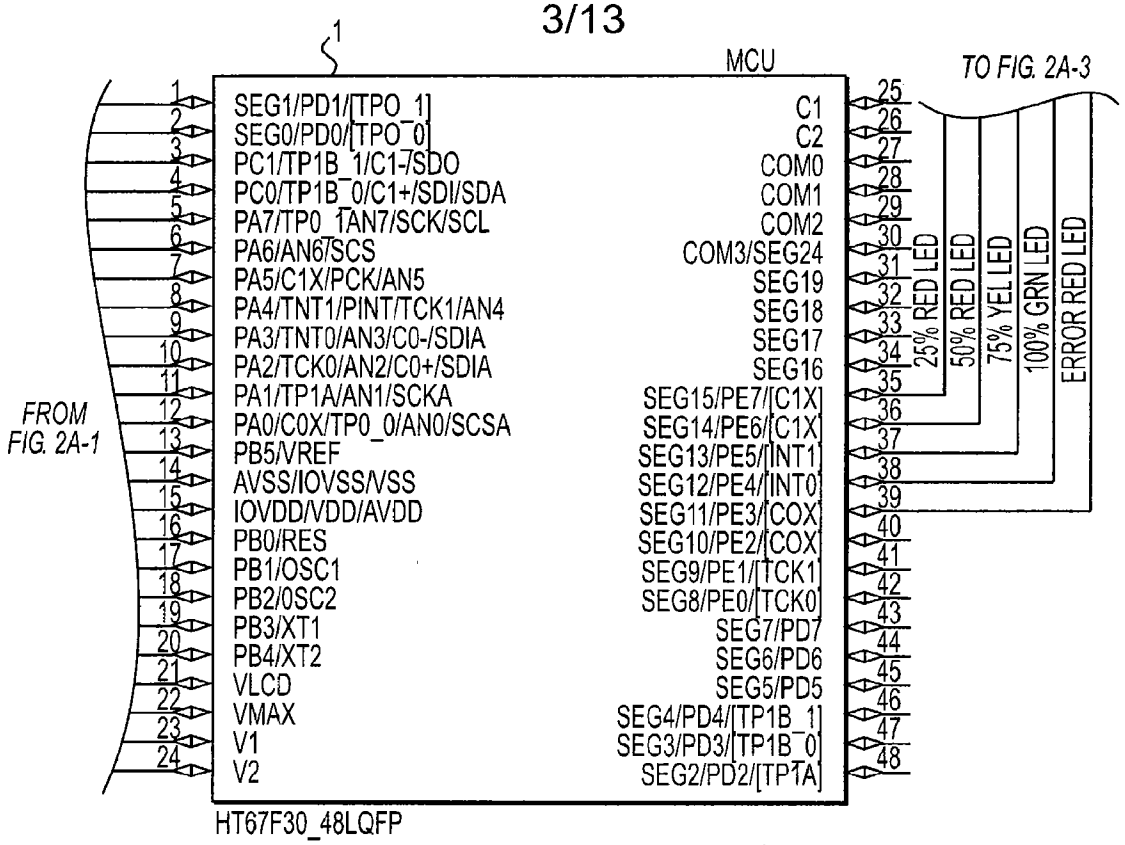

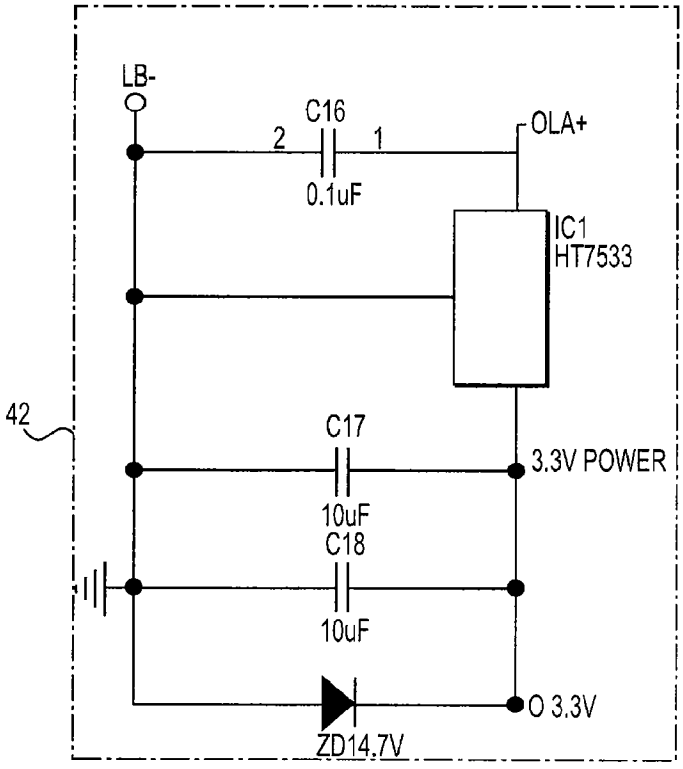

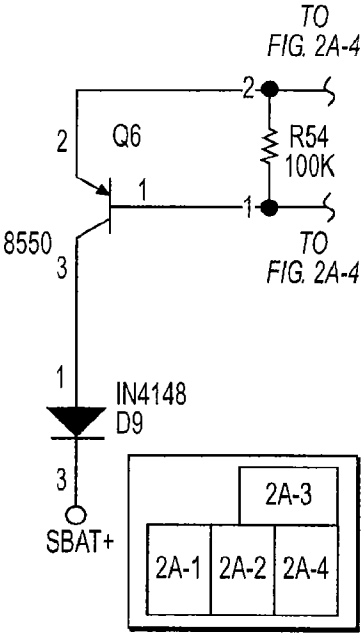

FIG. 2A-2

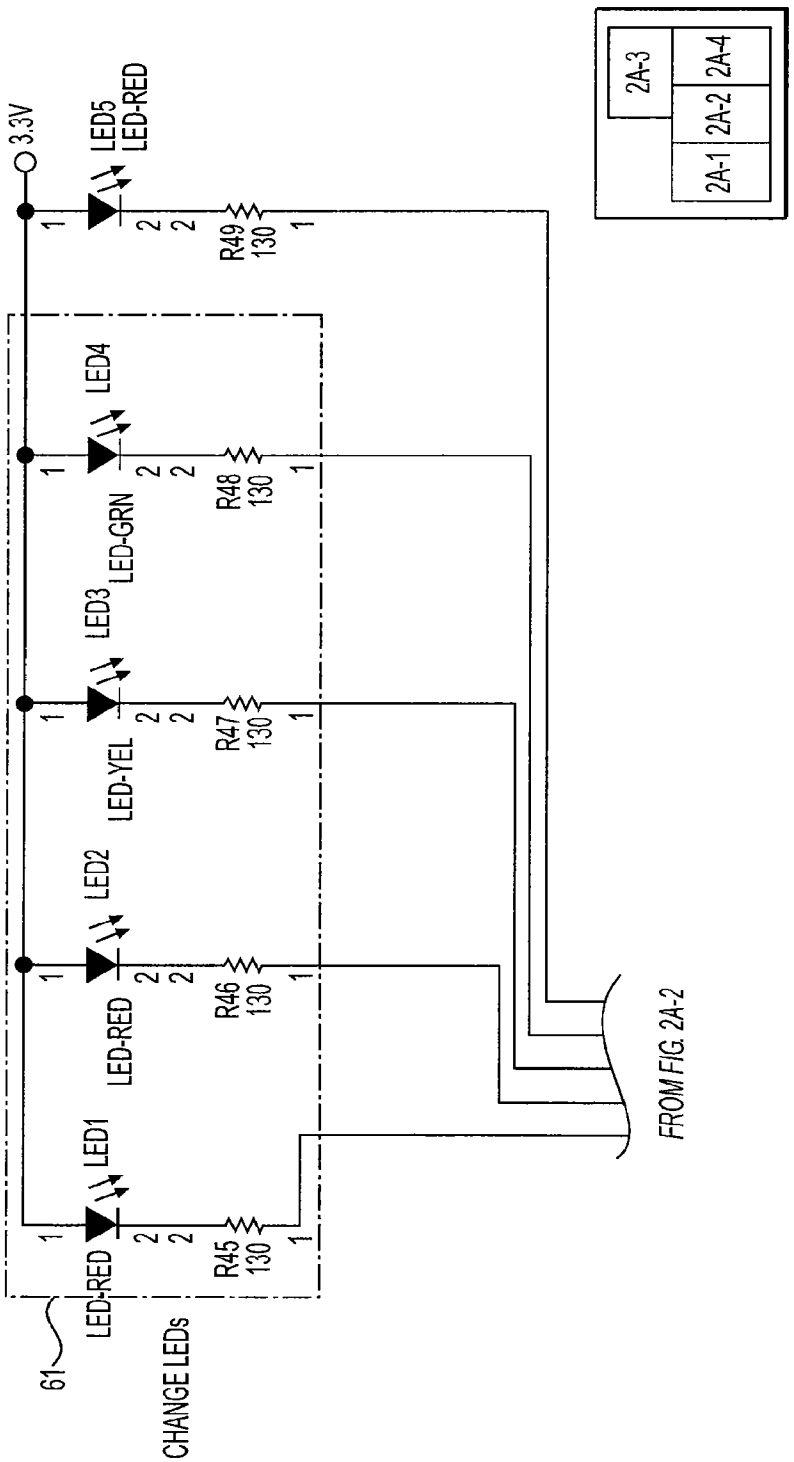
3.3V
LED5
LED-RED
R49
130
LED4
LED-GRN
R48
130
LED3
LED-YEL
R47
130
LED2
LED-RED
R46
130
LED1
LED-RED
R45
130
61
CHANGE LEDs
FROM FIG. 2A-2
2A-3
2A-1
2A-2
2A-4

FIG. 2A-3

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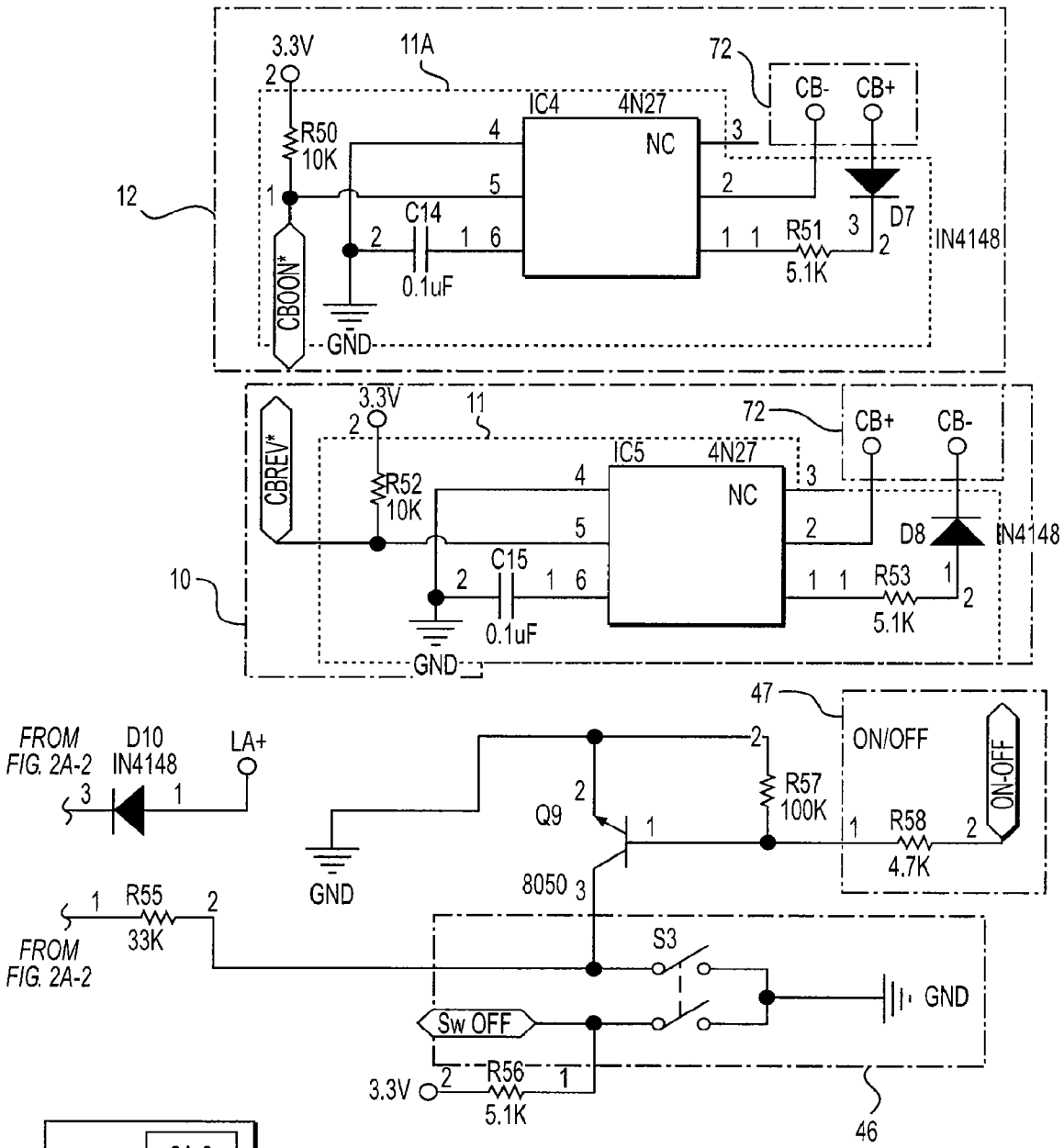

FIG. 2A-4

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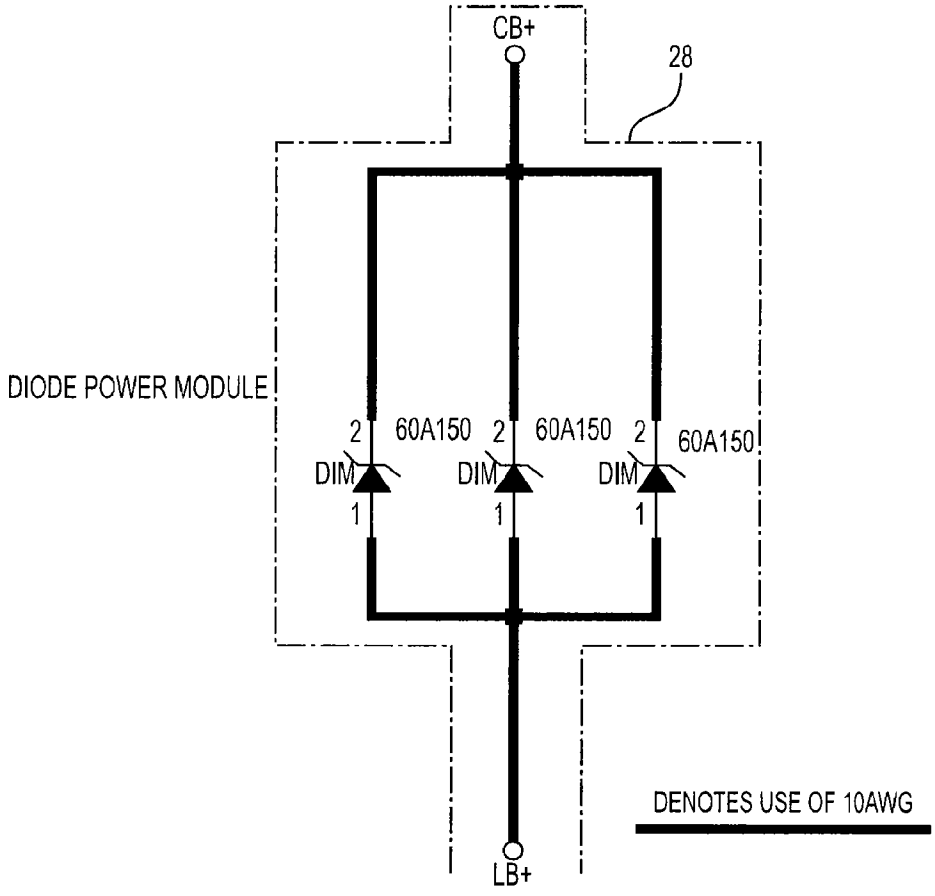
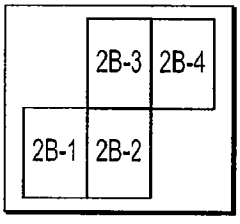


FIG. 2B-1



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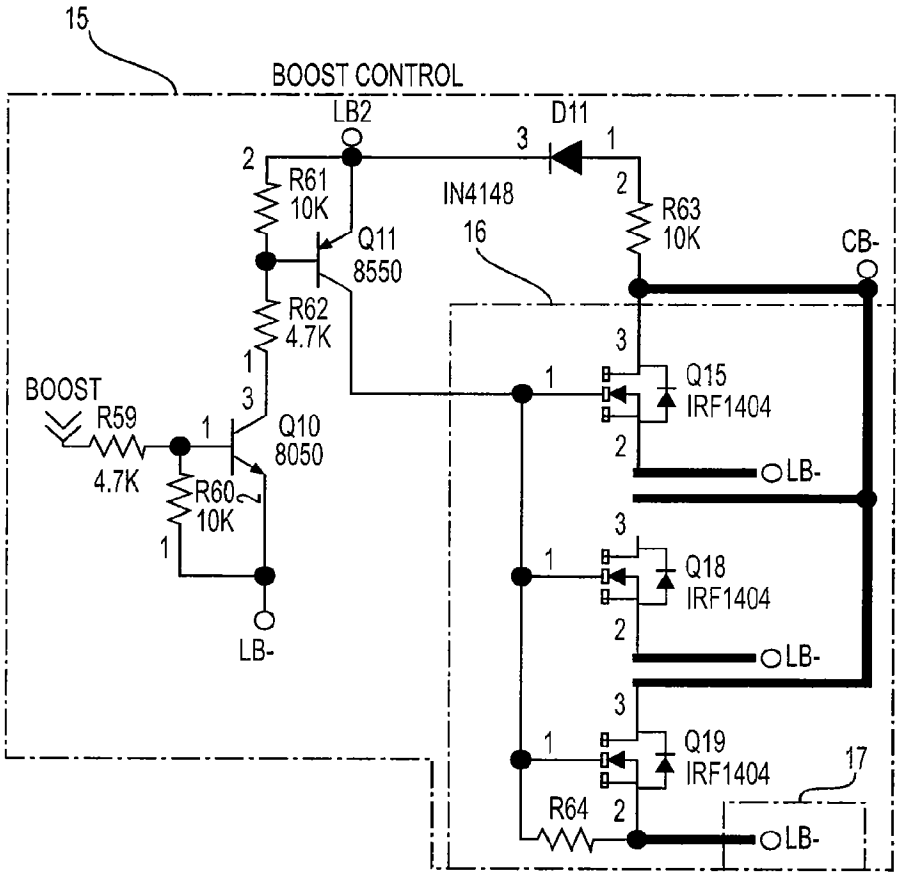
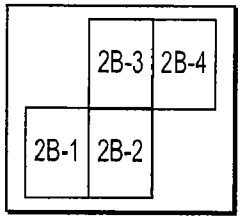


FIG. 2B-2



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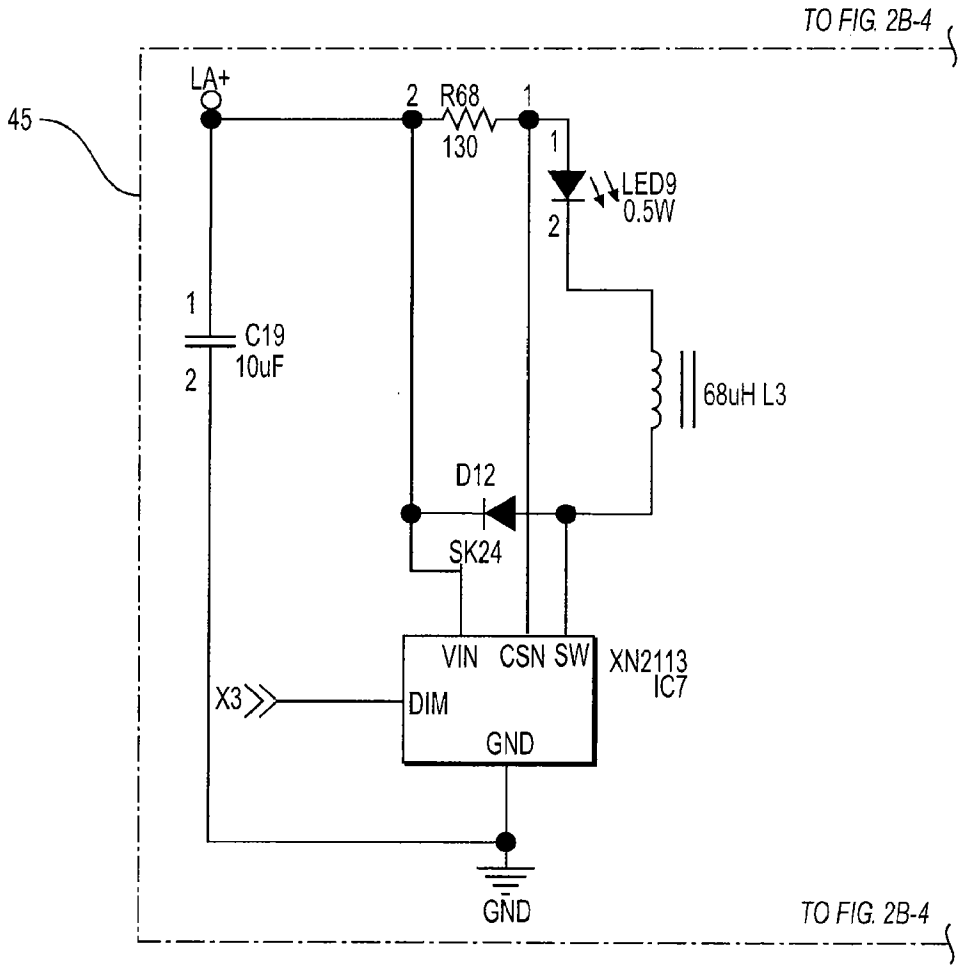
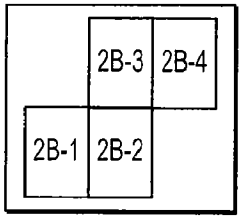


FIG. 2B-3



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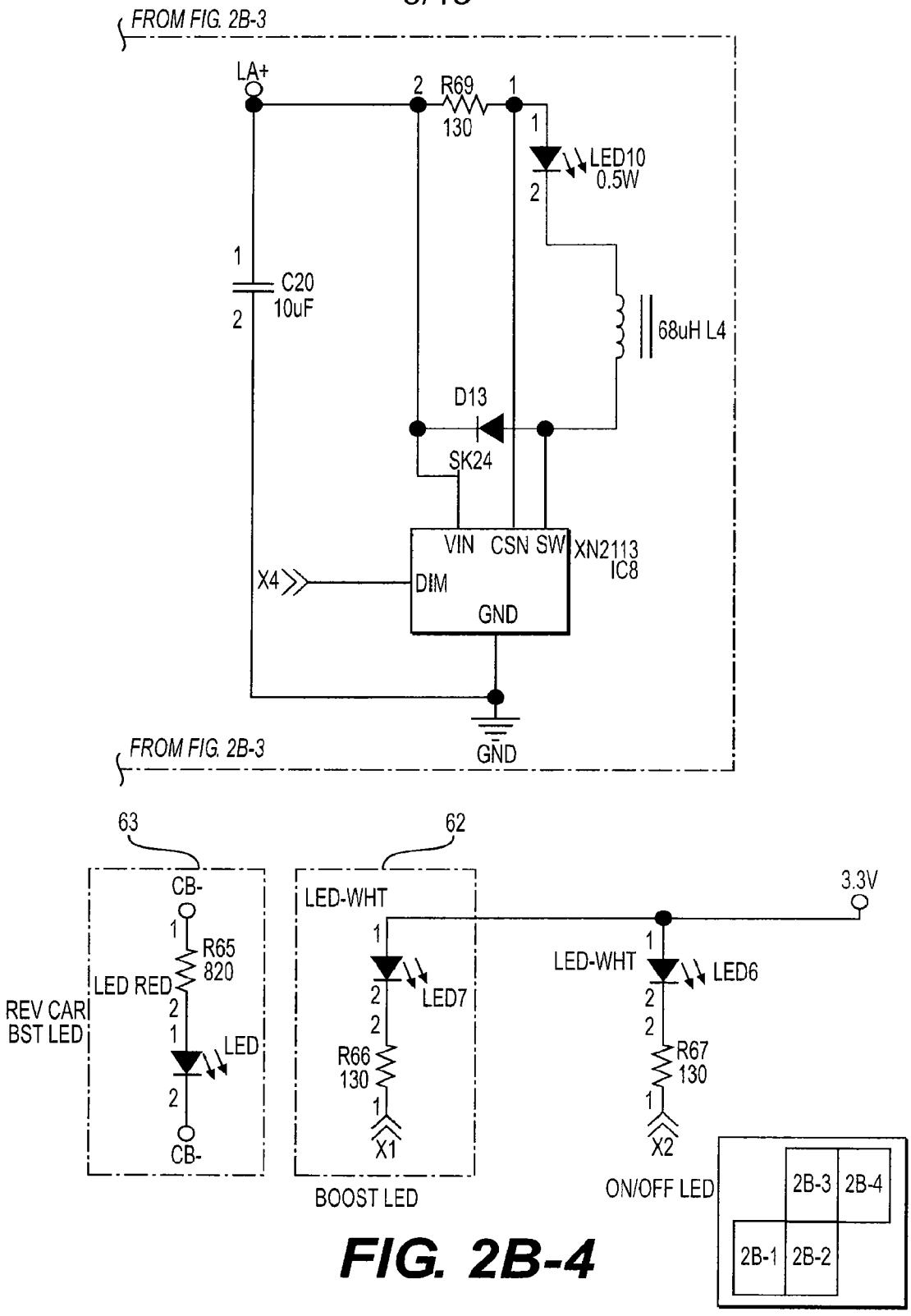
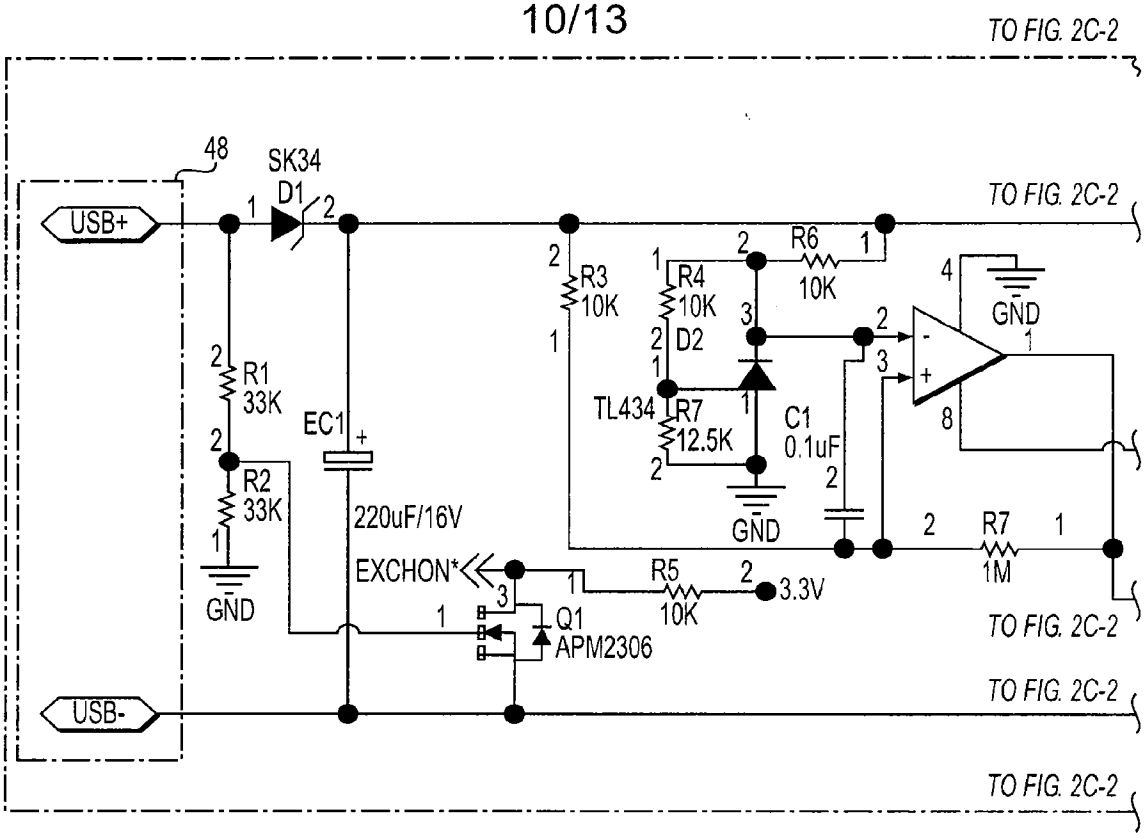


FIG. 2B-4


TO FIG. 2C-2
48
SK34
D1
USB+
USB-
R1
33K
R2
33K
GND
EC1
220uF/16V
EXCHON*
Q1
APM2306
R3
10K
R4
10K
D2
TL434
R7
12.5K
R6
10K
R5
10K
3.3V
C1
0.1uF
R7
1M
GND
TO FIG. 2C-2

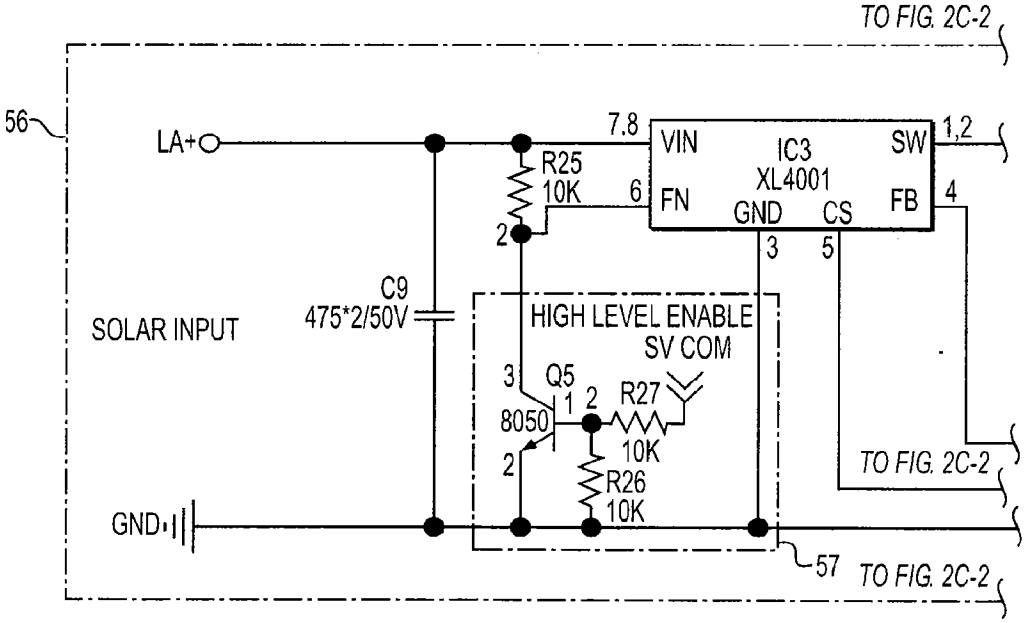
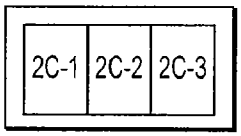

TO FIG. 2C-2
56
LA+
SOLAR INPUT
C9
475*2/50V
R25
10K
IC3
XL4001
VIN
FN
GND
CS
SW
FB
HIGH LEVEL ENABLE
5V COM
Q5
8050
R27
10K
R26
10K
GND
57
TO FIG. 2C-2

FIG. 2C-1


2C-1
2C-2
2C-3

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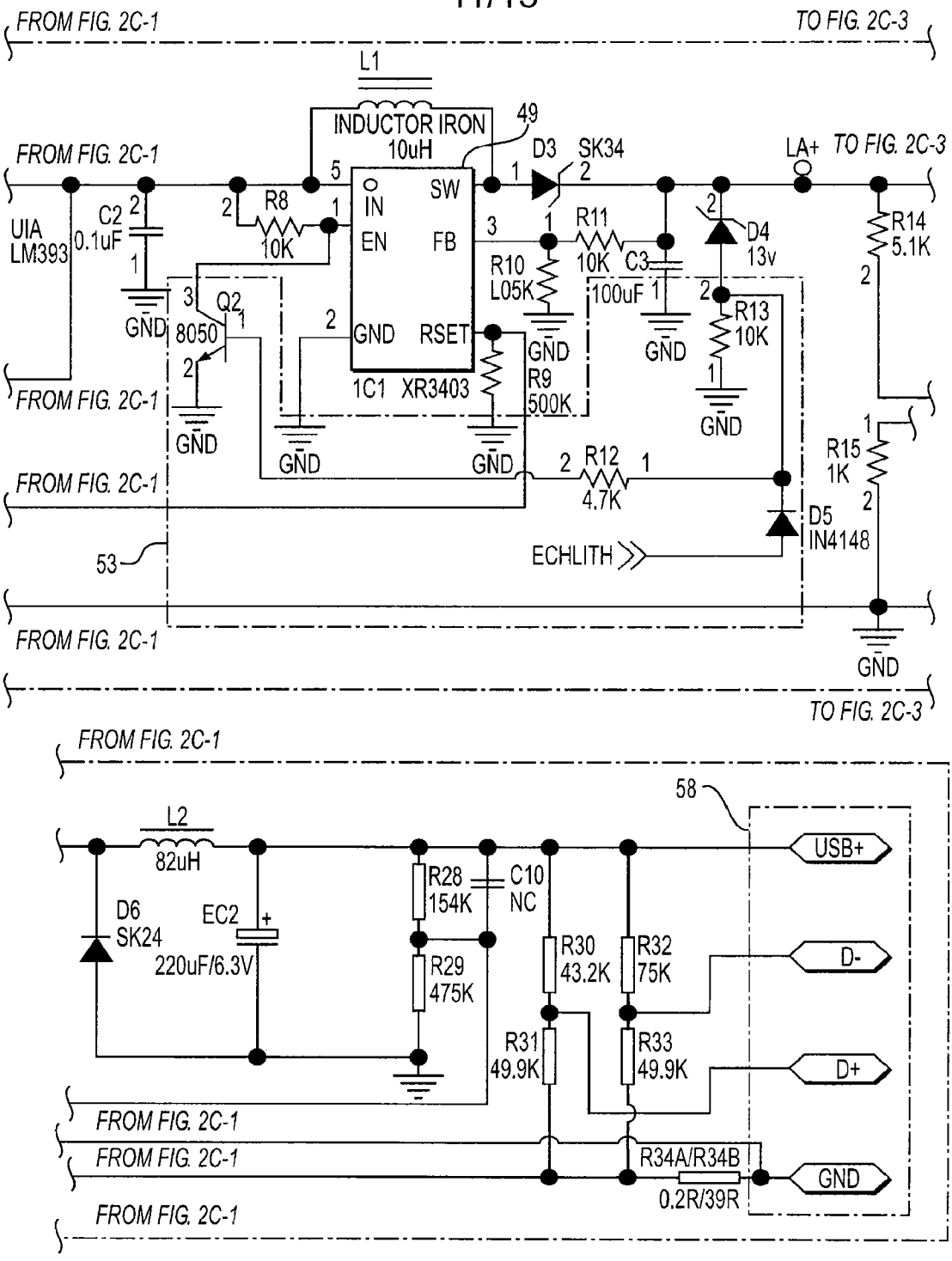
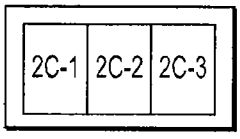


FIG. 2C-2



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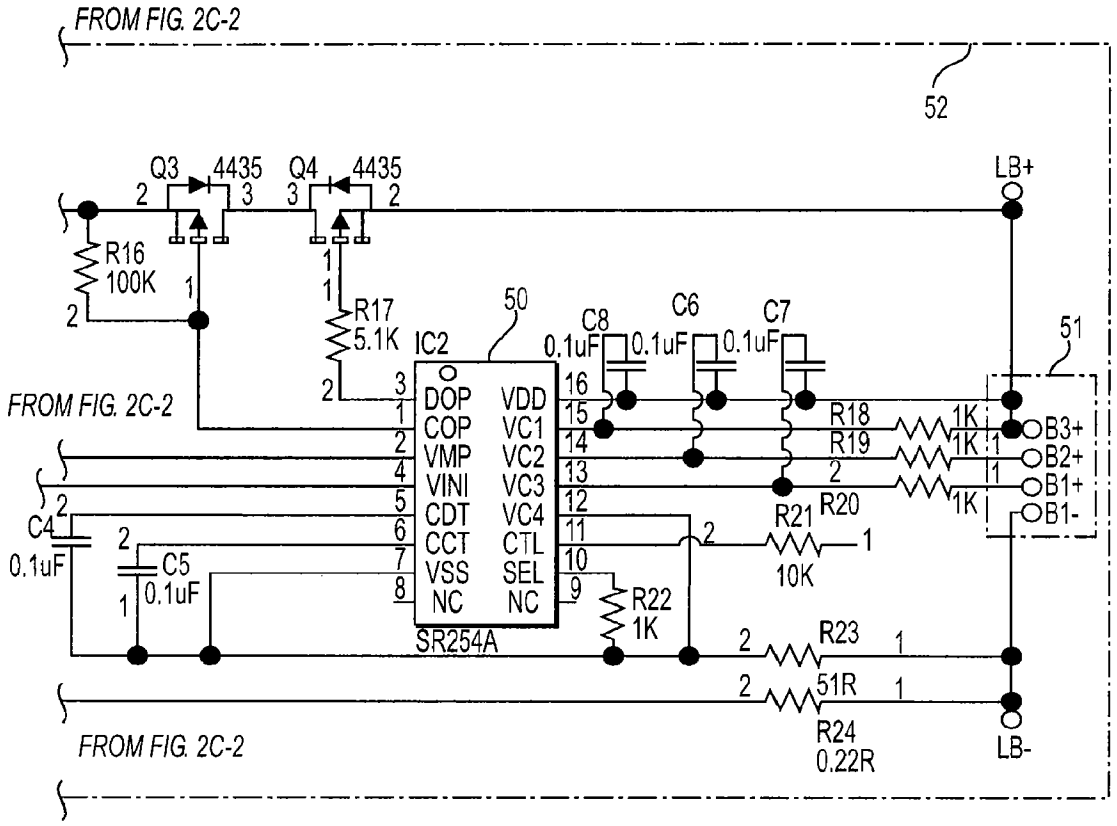

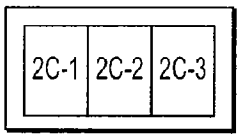

FIG. 2C-3

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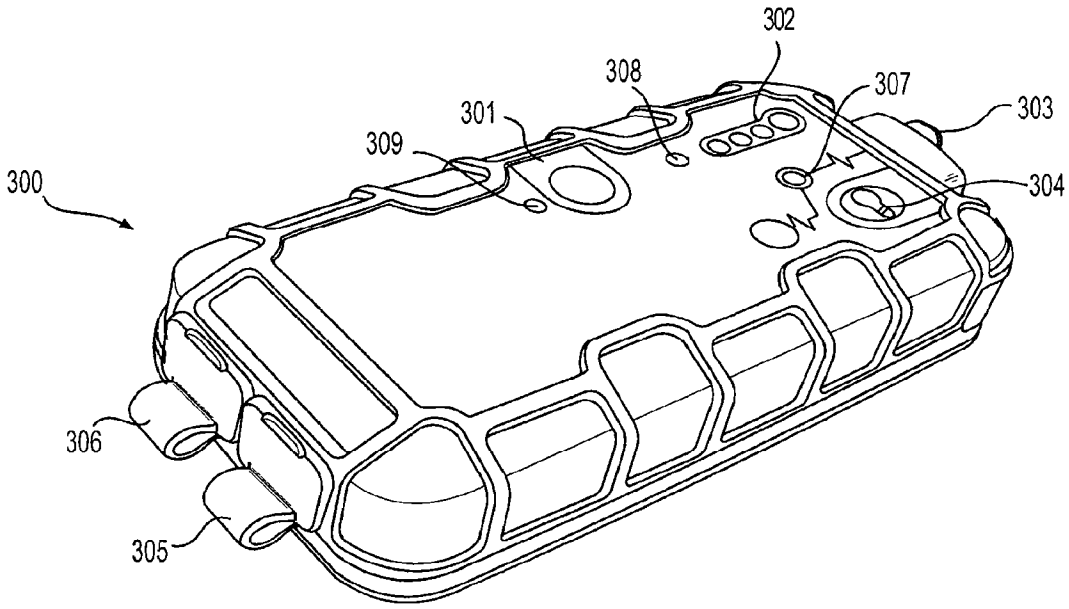

FIG. 3

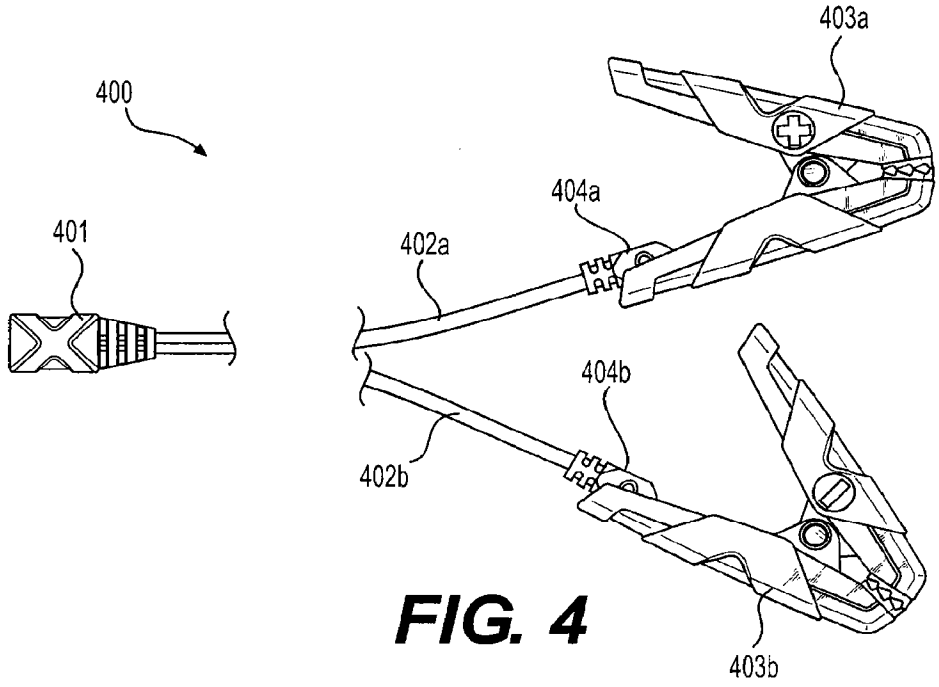

FIG. 4

Espacenet

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Battery connector device for a battery jump starting device

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Abstract of AU2017217661 (A1)

An enhanced conductivity battery connector device for use in a battery jump starting device. The enhance conductivity battery connector providing enhanced conductivity from the battery to a battery being recharged by the battery jump starting device.

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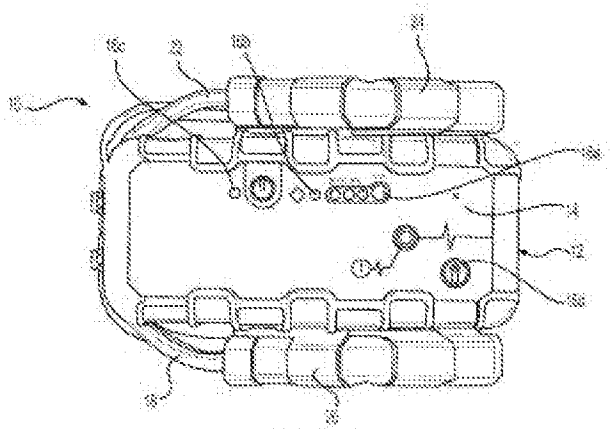

FIG. 1

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(54) Title: BATTERY CONNECTOR DEVICE FOR A BATTERY JUMP STARTING DEVICE

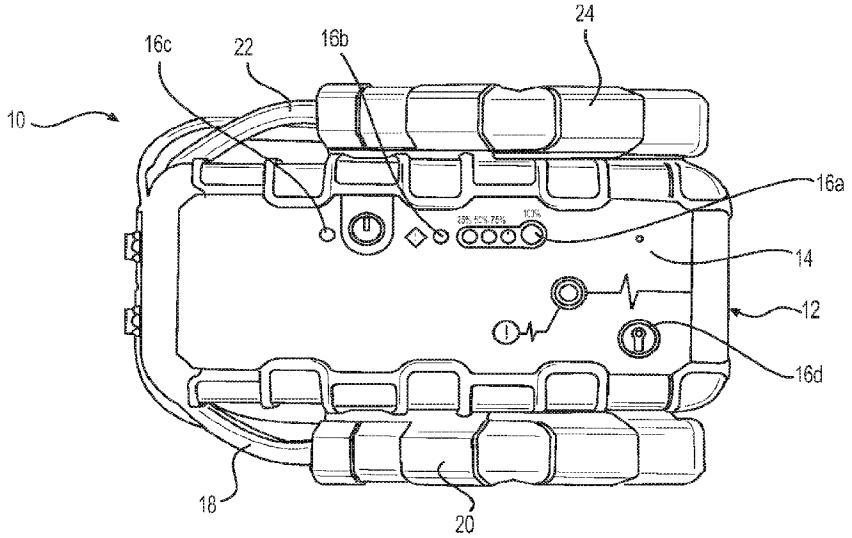

FIG. 1

(57) Abstract: An enhanced conductivity battery connector device for use in a battery jump starting device. The enhance conductivity battery connector providing enhanced conductivity from the battery to a battery being recharged by the battery jump starting device.

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TITLE

BATTERY CONNECTOR DEVICE FOR A BATTERY JUMP STARTING DEVICE

FIELD

A portable battery connector device, for example, a battery connector arrangement or assembly for a battery jump starting device, in particular a portable vehicle jump starting apparatus, configured for enhancing the conductivity between the battery of the jump starting apparatus and a battery being charged.

BACKGROUND

There exists a portable vehicle battery jump start apparatus as disclosed in U.S. Patent No. 9,007,015 to Nook et al. The apparatus utilizes a lithium ion battery pack. In this type of apparatus, there exists a need to maximize conductivity from the battery pack to the vehicle battery of the vehicle being jump started.

For successful car jump-starts, there are two main factors dictating the results. The first factor is the amount of power provided by the lithium ion battery pack, and the second factor is the maximum conductivity. You need both factors to have the best chance to jump-start big engines. One factor without the other factor is not enough.

SUMMARY

The presently described subject matter is directed to a battery device, for example, a battery connector, battery connector arrangement, or battery conductor assembly for use in a device for jump starting a vehicle, and a device for jump starting a vehicle comprising the battery connector device.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having at least one battery conductor connected to a terminal of the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having at least one battery conductor or cable connected to a battery tab of the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive conductor and a negative conductor connected to the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive conductor plate and/or a negative conductor plate connected to the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive conductor plate and/or a negative conductor plate connected to the battery, and a positive cable connected to the positive conductor plate and/or a negative cable connected to the negative conductor plate.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal of the battery and/or a negative battery conductor connected to a negative terminal of the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and/or a negative battery conductor connected to a negative terminal contact of the battery, the battery conductors being soldered to the respective terminals of the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal of the battery and/or a negative battery conductor connected to a negative terminal contact of the battery, and a relay connected to one of the battery conductors of the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and/or a negative battery conductor connected to a negative terminal contact of the battery, and a relay connected to the negative battery conductor.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and/or a negative battery conductor connected to

a negative terminal contact of the battery, and a relay connected to the negative battery conductor.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and/or a negative battery conductor connected to a negative terminal contact of the battery, and multiple relays connected to the negative battery conductor.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and/or a negative battery conductor connected to a negative terminal contact of the battery, and a positive cable connected to the positive battery conductor.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a front view of the battery jump starting device with the clamps un-deployed.

FIG. 2 is a rear perspective view of the battery jump starting device shown in FIG. 1.

FIG. 3 is an end perspective view of the battery jump starting device shown in FIGS. 1 and 2.

FIG. 4 is a front perspective view of the battery jump starting device shown in FIG. 1, however, with the clamps deployed.

FIG. 5 is a front perspective view of a battery connector device contained within the battery jump starting device shown in FIG. 1, however, with the negative cable not yet installed.

FIG. 6 is a top planer view of the battery connector device shown in FIG. 5.

FIG. 7 is a side elevational view of the battery connector device shown in FIG. 5.

FIG. 8 is an end elevational view of the battery connector device shown in FIG. 5.

FIG. 9 is a perspective view of the battery connector device shown in FIG. 5, however, with the negative cable connected to the battery connector device.

FIG. 10 is a view perspective view of the battery connector device shown in FIG. 5, however, with a diode connector installed on the positive cable.

FIG. 11 is a perspective view of the battery connector device connected to other components or parts of the battery jump starting device.

FIG. 12 is a perspective view of the battery assembly of the battery connector device shown in FIG. 5.

FIG. 13 is a front perspective view of another battery connector device for the battery jump starting device.

FIG. 14 is a detailed view of the positive cable connection with the relay printed circuit board prior to being soldered thereto.

FIG. 15 is a detailed view of the positive cable connection with the relay printed circuit board after being soldered thereto.

FIG. 16 is a front perspective view of the battery assembly of the battery connector device shown in FIG. 13.

FIG. 17 is a partial top planar view of the battery assembly shown in FIG. 16, however, with the positive terminal conductor sheet in an unwound condition.

FIG. 18 is a partial top planer view of the positive terminal conductor of the battery assembly shown in FIG. 16.

FIG. 19 is an end perspective view of the positive terminal conductor partially wound around the end of the positive cable.

FIG. 20 is an end perspective view of the positive terminal conductor fully wound around the end of the positive cable.

FIG. 21 is a side perspective view of the positive terminal conductor fully wound around and soldered to the end of the positive cable.

FIG. 22 is an opposite end perspective view of the positive terminal conductor fully wound around and soldered to the end of the positive cable.

FIG. 23 is a perspective view of the diode connector between sections of the positive cable.

FIG. 24 is a perspective view of a Schottky Diode used in the diode connector.

FIG. 25 is a perspective view of the diode connector insulated with a shrink wrap sleeve.

FIG. 27 is a graphical illustration showing a load test of the battery connection shown in FIGS. 5-10.

FIG. 28 is a graphical illustration showing a load test of the battery connection shown in FIGS. 13-25.

FIG. 29 is a front view of a further battery connector device for the battery jump starting device.

FIG. 30 is a front view of the battery connector device comprising a plurality of battery cells, separate tab, and conductors (e.g. plate conductors) prior to assembly.

FIG. 31 is a front view of the battery connector device comprising battery cells being prepared with separate tabs for lengthening the tabs.

FIG. 32 is a front view of the battery connector device comprising the plurality of battery cells, separate tab, and conductors shown in FIG. 30, after assembly.

FIG. 33 is a perspective view showing the battery connector device comprising the battery cell assembly shown in FIG. 32, after folding the battery cells.

FIG. 34 is an end perspective view of the battery connector device showing the separate tab being wrapped or wound around an exposed end of the positive cable, and soldered together.

FIG. 35 is an opposite end perspective view of the battery connector device showing a negative battery tab wrapped around the negative terminal conductor plate and welded and/or soldered together.

FIG. 36 is a perspective view of the battery connector device showing the flat separate tab connected to the battery and extending outwardly prior to connection to the positive cable.

FIG. 37 is a side view of the temperature sensor assembly with wires and connector.

FIG. 38 is a perspective view of the diode circuit board assembled connected inline or spliced into the positive cable.

DETAILED DESCRIPTION

A battery jump starter device 10 is shown in FIGS. 1 and 2. The battery jump starting device 10 comprises a casing 12 having a display 14 provided with an arrangement of light emitting diodes (LEDs) 16.

The battery jump starting device 10 further comprises a positive cable 18 having a positive clamp 20 and a negative cable 22 having a negative clamp 24. The positive cable 18 and negative cable 22 pass through openings 12a, 12b, respectively, in the casing 12.

The clamps 20, 24 are stowed away or docked in an un-deployed mode by clamping each to a respective side posts 26 extending outwardly on opposite sides of the casing 12, as shown in FIG. 1. The side posts 26 are shown in FIG. 2. The clamps 20, 24 are docked when the battery jump starter device 10 is in non-use, and then unclamped from the side post 26 during use.

The battery jump starting device 10 is configured to jump start a vehicle battery. For example, the battery jump starting device 10 can be the PORTABLE VEHICLE JUMP START APPARATUS WITH SAFETY PROTECTION disclosed in U.S. Patent No. 9,007,015, which is fully incorporated herein by reference, or a device or apparatus similar thereto.

The battery jump starting device 10 comprises electrical components or parts located inside the casing 12. For example, the battery jump starting device 10 comprises a battery connector device 100 shown in FIGS. 3 - 9.

The battery connector device 100 comprises a battery assembly 110 having a battery 112. For example, the battery 112 is a lithium ion rechargeable type battery. The

battery connector device 100 is configured to maximize conductivity from the battery 112 to the cables 18, 22 and clamps 20, 24 of the battery jump starter device 10. The battery 112 comprises a battery casing 112a, for example, a rectangular-shaped battery casing 112a.

The battery 112 comprises a positive tab at one end (e.g. width) of the battery 112, and a negative terminal tab at an opposite end (e.g. width) of the battery 112. For example, the battery 112 comprises one or more battery cells each having a positive and negative tab. For example, the positive tab from one battery cell is located at the one end of the battery 112 and the negative tab from one battery cell is located at the opposite end of the battery 112. A positive terminal conductor plate 114 is connected (e.g. soldered, welded, or sonically welded) at the one end of the battery 112 to the positive tab (i.e. contact) of the battery 112. The positive terminal conductor plate 114 extends along the one end (e.g. width) of the battery 112.

The positive cable 18 can be connected (e.g. directly connected by soldering) to the positive terminal conductor plate 114 and/or the positive tab of the battery 112. For example, the positive terminal conductor bar 114 can be provided with a conductive loop 116 wrapping around (e.g. entirely wrapping around) and connected (e.g. crimped and/or soldered) to an exposed end 18a of the positive cable 18. For example, the positive terminal conductor plate 114 is made from heavy gauge copper sheet (e.g. machined, cut, or stamped therefrom).

As shown in FIGS. 5 and 6, the positive terminal conductor sheet 114 can be configured (e.g. bent) to wrap around one of the square-shaped corners of the rectangular-shaped casing 112a of the battery 112 (e.g. L-shaped). The L-shaped

positive terminal conductor sheet 114 can extend along an end of the battery 112 and along at least a portion of the side of the battery 112, as shown in FIG. 5.

The positive terminal conductor plate 114 can also be mechanically coupled and/or adhered to the outer surface of the battery casing 112a to provide additional support and stability thereof (e.g. assembled to survive mechanical shock when drop testing the battery jump starter device 10). For example, the positive terminal conductor bar 114 can be mechanically connected to the battery casing 112 by adhesive (e.g. silicon adhesive), double sided tape, double sided foam tape, insulated plastic or ceramic connector with snap fit connection and/or adhesive connection, and/or the battery casing 112 can be formed (e.g. molded) to mechanically connect (e.g. snap fit or interference connection) with the positive terminal conductor plate 114.

The positive cable 18 can be a single piece of wire or a cable (e.g. twisted or braided wires) extending from the battery 110 to the positive clamp 20. Specifically, one end of the positive cable 18 is connected to the positive terminal conductor plate 114 connected to the battery 18, and the opposite end of the positive cable 18 is connected to the positive clamp 20.

More specifically, the positive cable 18 can comprise a flexible or bent cable portion 118 for changing the direction of the positive cable 18 within the casing 12. The positive cable 18 can be fitted with a flexible outer sleeve portion 120 transitioning into a flexible inner sleeve portion 122 to flexibly accommodate the positive cable 18 passing through the casing 12. The flexible outer sleeve portion 120 is externally located relative to the casing 12 of the battery jump starter device 10, and the flexible inner sleeve

portion 122 is internally located relative to the casing 12 of the battery jump starter device 10.

The flexible outer sleeve portion 120 is configured to reinforce the connection between the positive cable 18 and the casing 12 of the battery jump starter device while remaining flexible. For example, the flexible outer sleeve portion 120 is provided with one or more grooves 124 (e.g. three (3) shown in FIG. 5) exposing portions of the positive cable 18. The one or more grooves 124 act as hinges to ease bending of the positive cable 18 within the flexible outer sleeve portion 120.

The flexible sleeve 120 comprises an outer flange 124 spaced apart (e.g. a small distance equal to about a wall thickness of the casing 12 of the battery jump starter device 10) from an in inner flange 126. The flanges 124, 126 further anchor the positive cable 18 to the casing 12 of the battery jump starter device 10.

The flexible sleeve 120 comprises a sleeve portion 128 (FIG. 6) connecting together the outer flange 124 and inner flange 126. For example, the flexible outer sleeve portion 120 is molded or applied onto and around the positive cable 18 as a single unit (e.g. the flexible sleeve 120 is molded onto a portion of the positive cable 18 inserted within the mold during the molding process). Alternatively, the flexible sleeve 120 is made (e.g. molded) separately, and then installed or assembled onto a portion of the positive cable 18.

The positive cable 18 comprises an inner conductor 18b (e.g. single wire conductor, twisted wires, or braided wires) disposed within an outer insulating sheath 18c (e.g. extruded plastic sheath). The inner conductor 18b, for example, can be a solid wire conductor or a multi strand metal wire conductor comprising bundle of wires 18d.

The inner wire can be made of copper or aluminum. The flexible sleeve 120 can be applied (e.g. molded or installed or assembled) onto and surrounding the outer insulating sheath 18c of the positive cable 18.

The battery connector device 100 further comprises a negative terminal conductor plate 130 connected (e.g. soldered, welded, or sonically welded) at an opposite end of the battery 112 to the negative tab (i.e. contact) of the battery 112. The negative terminal conductor plate 130 can extend along the opposite end of the battery 112.

The other end of the negative terminal conductor plate 130 is provided with a negative terminal conductor plate connector portion 132, as shown in FIGS. 5 and 6.

The negative terminal conductor plate 130 can be configured to wrap around one of the corners of the rectangular-shaped battery 112 (e.g. L-shaped). The L-shaped negative terminal conductor plate 130 can extend along an end of the battery 112 and along at least a portion of the side of the battery 112, as shown in FIGS. 5 and 6.

The negative terminal conductor bar 130 can also be mechanically coupled and/or adhered to the outer surface of the battery casing 112a to provide additional support and stability thereof (e.g. to survive mechanical shock when drop testing the battery jump starter device 10). For example, the negative terminal conductor bar 114 can be mechanically connected to the battery casing 112a by adhesive (e.g. silicon adhesive), double sided tape, double sided foam tape, insulating plastic or ceramic connector with snap fit connection and/or adhesive connection, and/or the battery casing 112 can be formed (e.g. molded) to mechanically connect (e.g. snap fit or interference connection) with the positive terminal conductor plate 114.

The battery connector device 100 further comprises a smart switch battery interface 134. The smart switch battery interface 134 comprises a relay printed circuit board (PCB) 136 having a first circuit board conductor bar 138 spaced apart from a second circuit board conductor bar 140 located on one side of the circuit board 136, as shown in FIGS. 5 and 6.

A pair of relays 142 are mounted on an opposite side of the circuit board 136. The relays 142 include relay anchoring pins 142a located in through holes 136a in the relay printed circuit board 136 (FIGS. 5 and 7). The relays 142 further comprise relay connector pins 142b extending through the through holes 136b provided in the circuit board 136 and slots 138a provided in the first conductor bar 138. The relays 142 even further comprise relay connector pins 142c located in the through holes 136c provided in the circuit board 136 and through holes 140a provided in the second conductor bar 140. The relay anchoring pins 136a are soldered in place to mechanically connect the relays 142 to the circuit board 136. The relay connecting pins 142b and 142c are soldered in place to mechanically and electrically connect the relays 142, respectively, to the circuit board conductor plates 138, 140.

The through holes 136a in the circuit board 136 are rectangular-shaped (FIGS. 5 and 7) and accommodate the relay anchoring pins 142a. Specifically, a base portion of the relay anchoring pins 142a are rectangular-shaped with square-shaped ends. The square-shaped ends are dimensionally less wide verses the base portions creating transverse edges oriented flush with the outer surface of the circuit board 136. When solder is applied to the exposed ends of the relay anchoring pins 142a, the solder

connects to the sides of the square-shaped ends and transverse edges to anchor and lock the relay anchoring pins to the circuit board 136.

The slots 132a provided in negative terminal conductor bar connector portion 132 are rectangular-shaped and the through holes138a in the first circuit board conductor bar 138 (FIG. 3) are T-shaped to accommodate the three (3) horizontally oriented relay connector pins 142b, as shown in FIG. 3. The ends of the relay connector pins 142b are shown flush with the outer surface of the negative terminal conductor bar connector portion 132. When solder is applied to the exposed ends of the relay connector pins 142b, the solder fills in the slots 132a in the negative terminal conductor bar connector portion 132 and the through holes 138a of the first circuit board conductor bar 138, and connects the sides of the connector pins 142b with inner edges of the slots 132a and through holes 138a to anchoring the relays 142 to the circuit board 136 and negative terminal conductor bar connector portion 132. This applied solder also electrically connects the negative terminal conductor bar connector portion 132 to the first circuit board conductor bar 138.

The through holes 140a provided in the second circuit board conductor bar 140 are T-shaped to accommodate the three (3) vertically oriented relay connecting pins 142c, as shown in FIG. 3. The relay connector prongs 140a extend outwardly from the outer surface of the circuit board 136 to connect with the exposed conductor end 144a of the negative cable 144, and shown in FIG. 7. When solder is applied to the exposed conductor end 144a and the ends of the relay connector prongs 140a, the solder fills in the T-shaped slot and electrically connects the relay connector prongs 140a, second

circuit board conductor 140, and exposed conductor end 144a of the negative cable 144.

The negative terminal conductor bar connector portion 132 of the negative terminal conductor bar 130 is connected (e.g. by soldering) to the first circuit board conductor bar 138 of the circuit board 136. The exposed conductor end 22a (i.e. with the insulating sheath removed) of the negative cable 22 is connected (e.g. by soldering) to the second circuit board conductor bar 140, as shown in FIG. 9.

The battery connector device 100 can be modified by providing the positive cable 18 with a diode connection 150, as shown in FIG. 10. For example, a diode connection is installed (e.g. spliced) into the positive cable 18. The diode connection 150 comprises a diode printed circuit board (PCB) 152 provided with a set of back-charge diodes 154 (e.g. Schottky Diodes) located on one side thereof, and a conductor bar 156 provided on an opposite side of the circuit board 152.

ASSEMBLY

The battery jump starting device 10 comprises the casing 12 having an upper casing portion 12a and a lower casing portion 12b, as shown in FIG. 11. The upper casing portion 12a and the lower casing portion 12b are configured to be connected together when assembling the battery jump starting device 10.

The battery jump starting device 10 further comprises the battery connection device 100 and controller assembly 210 both disposed within the casing 12. The

controller assembly 210 comprises a circuit board 212 located adjacent to another circuit board 214.

The positive terminal of the battery assembly 110 (FIG. 12) is connected to the circuit board 212 via a positive power wire 216. For example, the positive power wire 216 is soldered to the positive conductor bar 114 (FIG. 5). The negative terminal of the battery assembly 110 is connected to the circuit board 214 via a negative power wire 218.

The relay circuit board 136 is provided with a wire set 220 having a connector 222. The connector 222 is configured to connect with the relay board connector 224 located on the circuit board 212 of the controller assembly 210 during assembly of the battery jump starting device 10.

The battery assembly 110 further comprises a wire set 226 having a connector 228. The connector 228 is configured to connect with the battery cell charging/monitoring connector 230 located on the circuit board 212 of the controller assembly 220.

The battery assembly 110 also comprises a battery temperature sensor having a wire set 232 having a connector 234. The connector 234 is configured to connect with the temperature sensor connector 236 located on the circuit board 212 of the controller assembly 220.

The circuit board 212 is provided with in charge power resistors 240 and an out relay 242, as shown in FIG. 11. Further, the lower casing portion 12a is provided with a main user out connector 244 having a wire set 246 connected to the circuit board 214,

and a main user in connector 248 having a wire set 250 connected to the circuit board 214.

The battery assembly 110 is connected to battery jump starting device 10, as shown in FIG. 11. The battery connector device 110 is installed within the casing 12 of the battery jump starting device 10 when assembled.

ENHANCED CONDUCTIVITY

An enhanced conductivity battery connector device 400 is shown in FIGS. 13 – 25. The enhanced conductivity battery connector device 400 provides a significantly increased conductivity compared to the battery connector device 100, as shown in FIGS. 5 – 10.

The amount of power to be conducted from the battery 412 to the clamps can be enhanced as follows:

1) Increase Wire Gauge

e.g. change 4AWG (American Wire Gage) positive cable 18 and negative cable 22 (FIG. 9) to a 2AWG positive cable 318 and negative cable 322 (FIGS. 13 and 15).

2) Increase Conductivity of Negative Cable Connection

e.g. negative cable end 322a (FIG. 15) connection to the relays will extend all the way across the connector pins 422c of the relays 422.

3) Increase Conductivity of Positive Cable Connection

e.g. the positive battery tab 414 is lengthened so that the positive cable 318 can be rolled up (FIGS. 17-22) in the positive battery tab 414 and soldered together thoroughly;

4) Increase Conductivity of Diode Connection

e.g. replace the diode connection 150 (FIG. 5) with the diode connection 450 (FIG. 23).

5) Redesign Resistor/Diode Printed Circuit Board (PCB)

e.g. replace the diode printed circuit board (PCB) 152 (FIG. 10) with the diode printed circuit board (PCB) 452 (FIG. 23).

6) Reconnect Resistors

e.g. reconnect resistors R134A&B, R135A&B located on the diode printed circuit board (PCB) 152 (FIG. 10) to be connected again.

A detailed description of each of these enhanced conductivity features or arrangement is set forth below.

1) Increase Wire Gauge

The gauge of the positive cable 18 and negative cable 22 (FIG. 9), for example, can be increased from 4AWG (American Wire Gage) cable to a 2AWG cable for positive cable 318 and negative cable 322 (FIGS. 13 and 15). The comparative specifications of the 4AWG cable and 2AWG cable are as follows:

	2AWG	4AWG
Diameter	0.2576 in	0.2294 in
	(6.544 mm)	(5.189 mm)
Turns of wire	3.88/in	4.89/in
	(1.53/cm)	(1.93/cm)
Area	66.4 kcmil	41.7 kcmil
	(33.6 mm^2)	(21.2 mm^2)
Resistance/length	0.5127 mΩ/m	0.8152 mΩ/m
	(0.1563 mΩ/ft)	(0.2485 mΩ/m)
Ampacity	95 (60° C)	70 (60° C)
	115 (75° C)	85 (75° C)
	130 (90° C)	95 (90° C)
Fusing current	1.3 kA (10 s)	946 A (10 s)
	10.2 kA (1s)	6.4 kA (1 s)
	57kA (32 ms)	36 kA (32 ms)

The 2AWG cable provides a significant increase of conductivity (i.e. ampacity) compared to the 4AWG cable (i.e. approximately 36%).

2) Increase Conductivity of Negative Cable Connection

The negative cable 322 (FIG. 15) can be connected to the battery 412 (FIG. 13) in a manner to increase the conductivity (i.e. ampacity) between the battery 412 and negative cable 322. For example, the negative cable end 322a can be directly connected (e.g. soldered) to the connector prongs 442c (FIG. 15) of the relays 442. Specifically, the negative cable end 322a can extend across and directly connect to all relays 342 of the smart switch battery interface 434, as shown in FIGS. 14 and 15. Further, the negative cable end 322a can be connected to a conductor loop 441 of the circuit board conductor bar 440.

The negative cable 322, for example, can be stranded wire comprising an inner electrical wire conductor 322b composed of an untwisted or twisted bundle of wires 322d disposed within an outer electrical insulating sheath 322c. The electrical insulating sheath 322c of the negative cable 322 can be removed from the negative cable end 322a exposing the inner electrical conductor 322b at the negative cable end 322a.

The exposed bundle of wires 322d of the electrical conductor 322b can be forced over the ends of the exposed connector pins 442c of the relays 442 so that strands of wires 322d are captured between the adjacent connector pins 442c. The exposed bundles of wires 332d can be further forced into contact with the conductor bar 440 (e.g. made of copper). Solder 423 is applied to this assembly so that the solder flows between the exposed bundles of wires 422d to the connector pins 442c and the conductor bar 440 to complete the electrical connection between the negative cable 322 and the smart switch battery interface 434 connected to the battery 412.

The length of the exposed bundle of wires 322d is selected so that exposed bundle of wires 322d directly connects with each set of connector pins 442c of each and every relay 442 to provide the maximum electrical conductivity (i.e. maximum ampacity) between the negative cable 322 and the battery 412.

3) Increase Conductivity of Positive Cable Connection

The positive cable 318 can be connected to the battery 412 in a manner to increase the conductivity (i.e. ampacity) between the battery 412 and positive cable 318. For example, the positive cable 318 can be rolled up in the positive battery tab 414 and soldered together thoroughly. The connection between the positive cable 318 and battery 412 is shown in FIGS. 16-22.

The positive cable 318, for example, can be stranded wire comprising an inner electrical wire conductor 318b composed of an untwisted or twisted bundle of wires 318d disposed within an outer electrical insulating sheath 318c. The electrical insulating sheath 318c of the positive cable 318 can be removed from the positive cable end 318a exposing the inner electrical conductor 318b at the positive cable end 318a.

The battery 412 is provided with a positive battery tab 414. The positive battery tab 414 is a metal sheet (e.g. copper sheet) connected to the positive terminal tab 414 of the battery 412.

The exposed bundle of wires 318d of the inner electrical conductor 318b can be soldered with tin, and then rolled up within the positive battery tab 312a. Solder 415 (FIG. 21) is applied to the exposed bundle of wires 318d and the positive battery tab 312a.

The length of the exposed bundle of wires 318d is selected so that exposed bundle of wires 318d directly connects with the full width of the positive battery tab 414 to provide the maximum electrical conductivity (i.e. maximum ampacity) between the battery 312 and the positive cable 318.

4) Increase Conductivity of Diode Connection

The positive cable 318 can be provided with a diode connection 450 configured to increase the conductivity along the positive cable 318, as shown in FIGS. 23 – 25.

The diode connection 450 comprises a plurality of diodes 454 connected between positive cable sections 318e and 318f (FIG. 25). For example, the diode connection 450 comprises six (6) back-charge type diodes (e.g. Schottky barrier diodes).

The diodes 454 are soldered between the positive cable sections 318e and 318f. Specifically, the diode conductor tabs 454a are soldered to the positive cable section 318e and the diode conductor prongs 454b are soldered to the positive cable section 318f. More specifically, the diode conductor prongs 454b of the diodes 354 extend through the diode circuit board 452, extend into the bundle of wires 318b, and then are soldered in place completing assembly of the diode connection 450.

The diode connection 450 is then insulated, for example, using a shrink wrap insulator 455 (FIG. 25), which is applied around the diode connection 450, and then shrunk by applying heat (e.g. using heat gun).

5) Redesign Resistor/Diode Printed Circuit Board (PCB)

e.g. redesign of resistor/diode PCB to eliminate the diodes extending therefrom;

6) Reconnect Resistors

e.g. reconnect resistors R134A&B, R135A&B that are on the Resistor/Diode PCB to be connected again.

TEST #1

The battery connection device 100 shown in FIG. 5 was subjected to a 1250A Load Test. The results are shown in FIG. 27, and as follows:

Pulse #1 Average Power of 4799.01W

Pulse #2 Average Power of 5528.99W

Pulse #3 Average Power of 6101.63W

TEST #2

The battery connection device 400 shown in FIG. 13 was subjected to a 1250A Load Test. The results are shown in FIG. 28, and as follows:

Pulse #1 Average Power of 6584.61W

Pulse #2 Average Power of 7149.60W

Pulse #3 Average Power of 7325.91W

This results in a significant increase of approximately twenty percent (20%) for peak power compared to the results of TEST #1.

Another enhanced conductivity battery conductor device 500 is shown in FIGS. 29 - 37. The enhanced conductivity battery connector device 500 provides a significantly increased conductivity compared to the battery connector device 100, as shown in FIGS. 5 – 10.

The battery conductor device 500 comprises the battery assembly 410, including the battery 512 connected to the positive cable 518 and the negative terminal conductor plate 530. A positive wire 519 is connected directly or indirectly to the positive tab or positive cable 518 of the battery 530, and a negative wire 523 is connected directly or indirectly to the negative tab or negative terminal conductor plate 530. The battery conductor device 500 can further include a bundle of wires 570 connected to or associated with the operation of the battery 512 (e.g. battery temperature sensor, power supply, etc.).

The battery 512 can comprise a single battery cell 512c (FIG. 30), or multiple battery cells 512C connected end-to-end in series. Three (3) separate battery cells 512c are shown in FIG. 30.

The battery cells 512c each have positive and negative tabs 512d located at opposite ends of each battery cell 512c. The battery cells 512c are connected together in series by welding (e.g. sonically and/or thermally welding) and/or soldering respective positive and negative tabs 512d together. For example, the tabs 512d are positioned so as to overlap each other (e.g. edges overlapping opposite tab 512d, or edge-to-edge).

The tabs 512d are metal plates (e.g. relative thin metal foils) extending outwardly from the body and opposite edges of each battery cell 512c. As shown in FIG. 30, the tabs 512d extend along opposite edges at the width of each battery cell 512c. The tabs

512d are each centered and extend most of the width of each opposite edge of each battery cell 512c.

As shown in FIGS. 30 and 31, a separate tab 512e is added or connected to the right side of the battery cell 512c to extend the length of the tab 512d. The separate tab 512e is shown as having the same width as the tab 512d; however, this width can be different. To assemble the separate tab 512e to the tab 512d, for example, the separate tab 512e is positioned to overlap over the tab 512d, and then welded (e.g. sonically and/or thermally welded) and/or soldered together. The exposed end of the positive cable 518 is then wound up inside the separate tab, as shown in FIGS. 32 and 34. For example, the initially flat separate tab 512e is wrapped around the exposed end of the positive cable 518, and then connected to the exposed end by welding (e.g. sonically and/or thermally welding) and/or soldering. For example, a layer of solder is applied to one or both sides of the separate tab 512e, and then after wrapping the separate tab 512e around the exposed end of the positive wire 518, the assembly is heated to melt the layered solder and solder the assembly together.

The three (3) battery cells 512c once connected together, as shown in FIG. 32, are then folded over each other into the layered battery cell arrangement shown in FIG. 33. The layered battery cell arrangement can be packaged (e.g. the three (3) battery cells can be taped or shrink wrapped together), or placed within a battery cover or casing, as shown in FIG. 34.

As shown in FIG. 35, the negative tab 512d can be attached to the negative terminal conductor plate 530. For example, the negative tab 512d can be wrapped partially or fully, as shown, around the negative terminal conductor plate 530. The

negative tab 512d can be provided with a plurality of through holes 512f to facilitate welding and/or soldering the negative tab 512d to the negative terminal conductor plate 530. For example, the through holes 512f can be square-shaped through holes arranged into a matrix, as shown in FIG. 35. The negative wire 523 is shown connected (e.g. soldered) to the negative tab 512d.

A separate tab 512e (see FIG. 30) can be connected to the negative tab 512d to lengthen same, so that the lengthened negative tab can be wrapped or wound around the negative terminal conductor plate 530 more than one time (e.g. 2, 3, 4, or more times). In this manner, the electrical connection between the negative tab 512d and the negative terminal conductor plate 530 can be enhanced. The separate tab 512e can be provided with a layer of solder on one or both sides, so that after the separate tab 512e is wrapped or wound around the negative terminal conductor plate 530, this assembly can be heated up to solder the separate tab 512e onto the negative terminal conductor plate 530.

The completed assembly of the battery conductor device 500 with the connected separate positive tab 512d ready to be wrapped or wound an exposed end of the positive cable 518 (FIG. 29) can be seen in FIG. 36. The bundle of wires 570 shown in FIG. 36, includes wires 572 for a temperature sensor embedded within the battery 512 (e.g. temperature sensor located near battery tab or between battery cells. The temperature sensor 574 having two (2) wires 572a, 572b is shown in FIG. 37.

The battery conductor device 500 can comprise a diode connector 550 connected inline or splice into the positive cable 518, as shown in FIG. 38.

The battery conductor device 500 comprises a diode circuit board 552 having a plurality of diodes 454 assembled thereon. The diodes 454 each have a diode conductor tab 454a connected (e.g. soldered) to an exposed end of the positive cable 518. The prongs of the diodes 454 extend through holes in the diode circuit board 552, and are soldered to both the conductive traces and exposed end of the positive cable 518 along with a resistor 576 to complete the assembly.

2017217661 31 Oct 2018

CLAIMS:

1. A battery connector device for a battery jump starting device having a smart switch, the device comprising:

a battery comprising a positive terminal tab and a negative terminal tab;

a positive terminal conductor sheet connected to the positive terminal tab of the battery;

a negative terminal conductor bar connected to the negative terminal tab of the battery;

a positive cable connected to the positive terminal conductor sheet of the battery;

a smart switch interface connectable to the smart switch of the jump starting device, the smart switch interface comprising a circuit board having a first circuit board conductor bar spaced apart from a second circuit board conductor bar, the first circuit board conductor bar electrically connected to the negative terminal conductor bar of the battery, the smart switch interface further comprising one or more relays connected between the first circuit board conductor bar and the second circuit board conductor bar for providing isolation between the negative terminal tab of the battery and a battery being jump started; and

a negative cable connected to the second circuit board conductor bar.

2. The device according to claim 1, wherein the one or more relays is multiple relays connected in parallel between the first circuit board conductor bar and the second circuit board conductor bar.

3. The device according to claim 1, wherein the negative terminal conductor bar is configured to mechanically and electrically connect the battery to the smart switch battery interface.

4. The device according to claim 3, wherein the negative terminal conductor bar is configured to position the smart switch interface above and adjacent to the battery.

5. The device according to claim 1, wherein the positive terminal conductor sheet wraps around one end of the positive cable to electrically connect the battery to the positive cable.

6. The device according to claim 1, wherein the positive terminal conductor sheet is ultrasonically welded to the positive terminal tab of the battery and the negative terminal conductor bar is ultrasonically welded to the negative terminal tab of the battery.

7. The device according to claim 1, wherein the battery is rectangular-shaped and a width of the positive terminal conductor sheet of the battery is equal to the width of the battery, and the negative terminal conductor bar is L-shaped and configured to wrap around a respective corner of the battery.

8. The device according to claim 7, wherein the battery tabs are mounted flush with a casing of the battery.

9. The device according to claim 1, wherein a diode connection is provided between a first section of the positive cable and a second section of the positive cable.

10. The device according to claim 9, wherein the diode connection comprises one or more diodes connected between the first section of the positive cable and the second section of the positive cable.

11. The device according to claim 10, wherein the diode connection comprises multiple diodes each connected between the first section of the positive cable and the second section of the positive cable.

12. The device according to claim 11, wherein conductor tabs of the multiple diodes are connected to the first section of the positive cable and conductor prongs of the multiple diodes are connected to the second section of the positive cable.

13. The device according to claim 12, wherein the multiple diodes are connected to a printed circuit board.

14. The device according to claim 13, wherein the conductor prongs of the multiple diodes extend through the printed circuit board and electrically connect with the second section of the positive cable.

15. The device according to claim 14, wherein the multiple diodes are arranged abutting each other along a single axis.

16. The device according to claim 11, wherein the diode connector is insulated with a heat shrink insulator.

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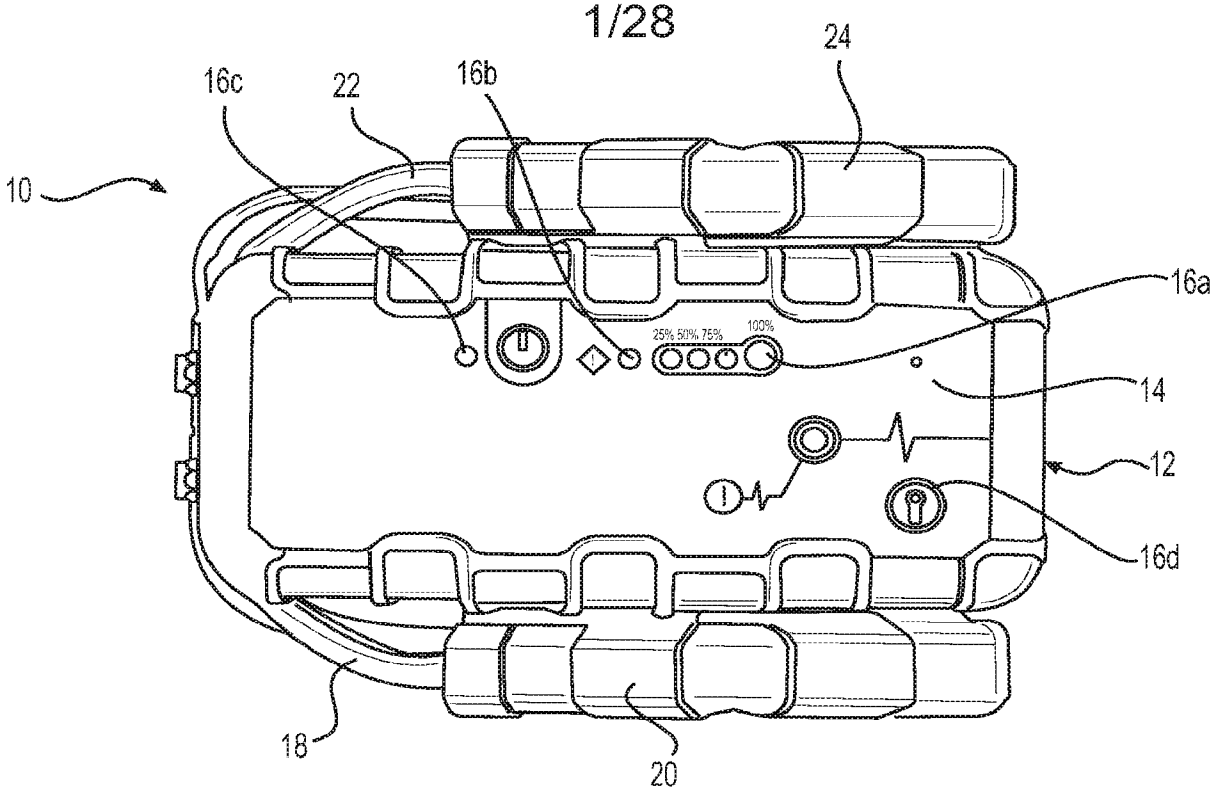


FIG. 1

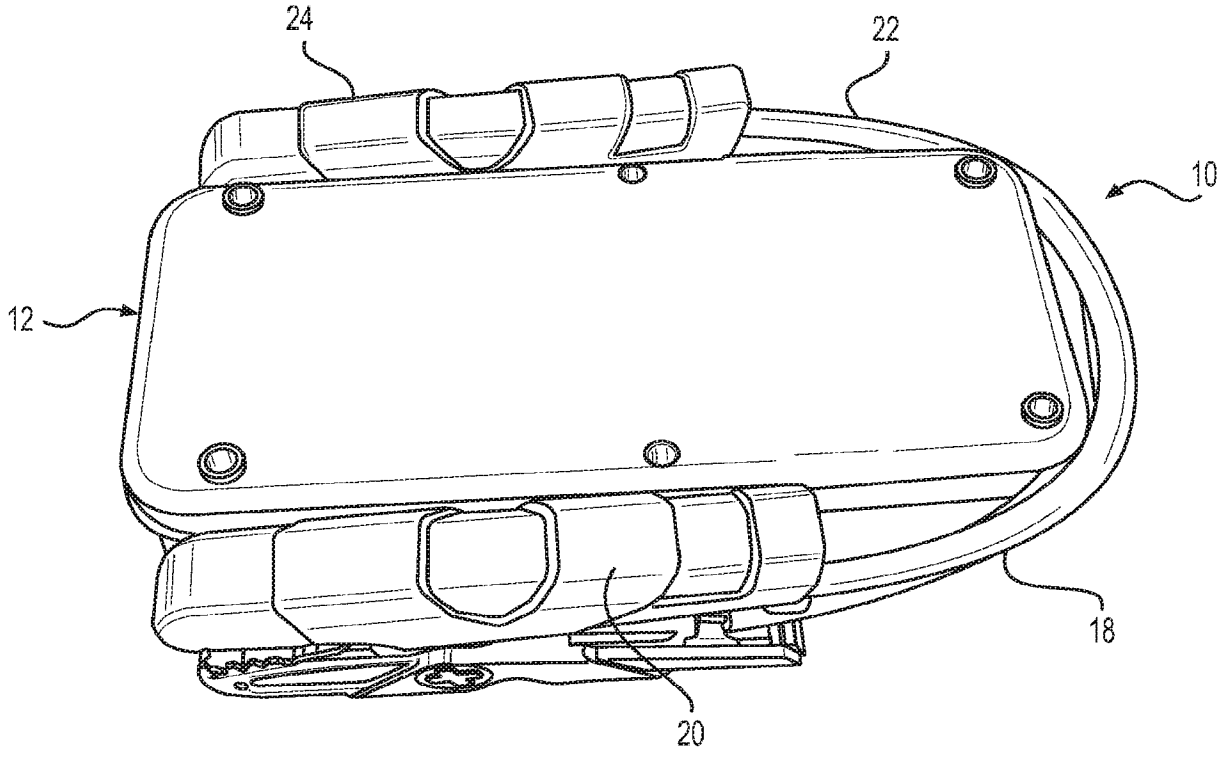


FIG. 2

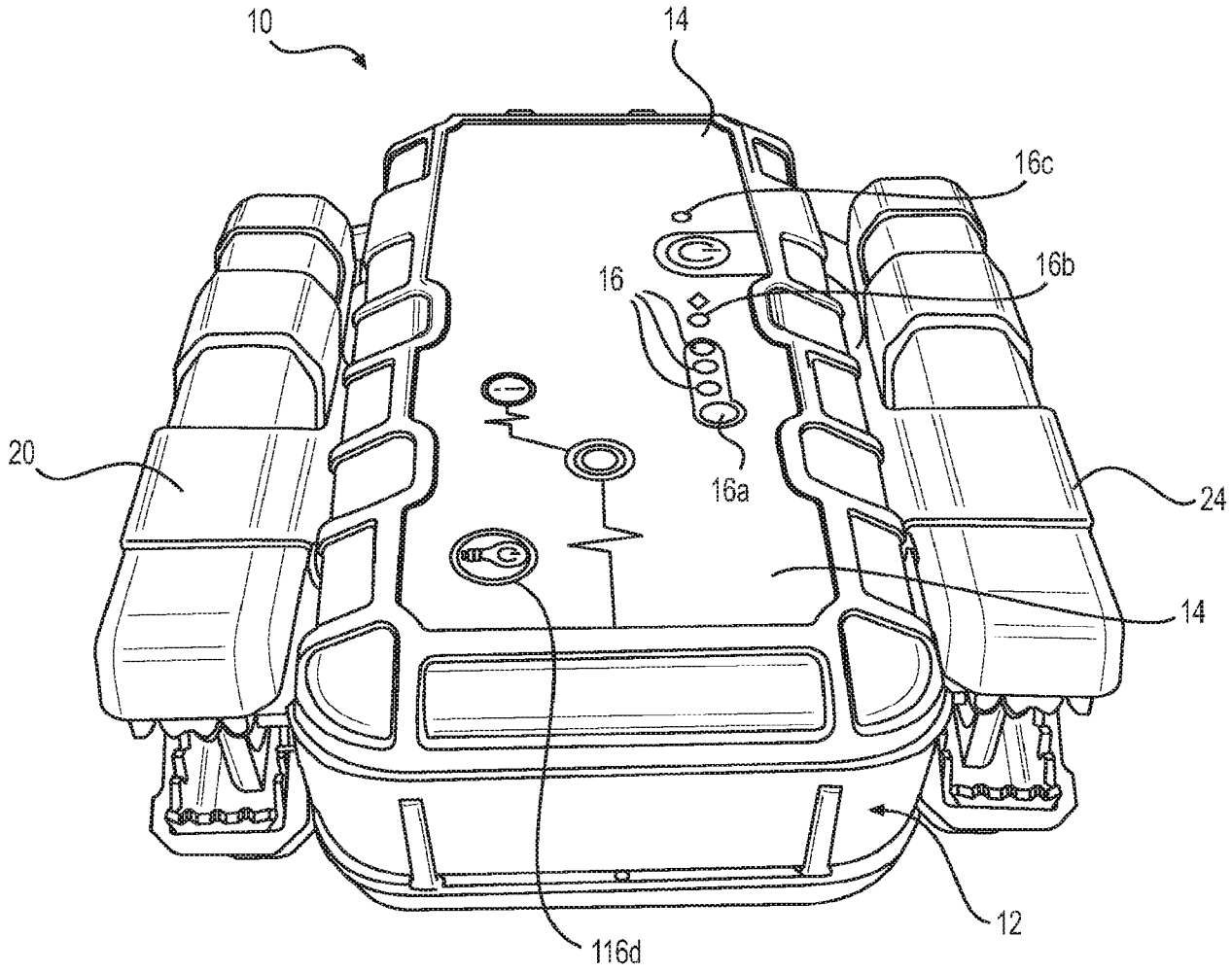


FIG. 3

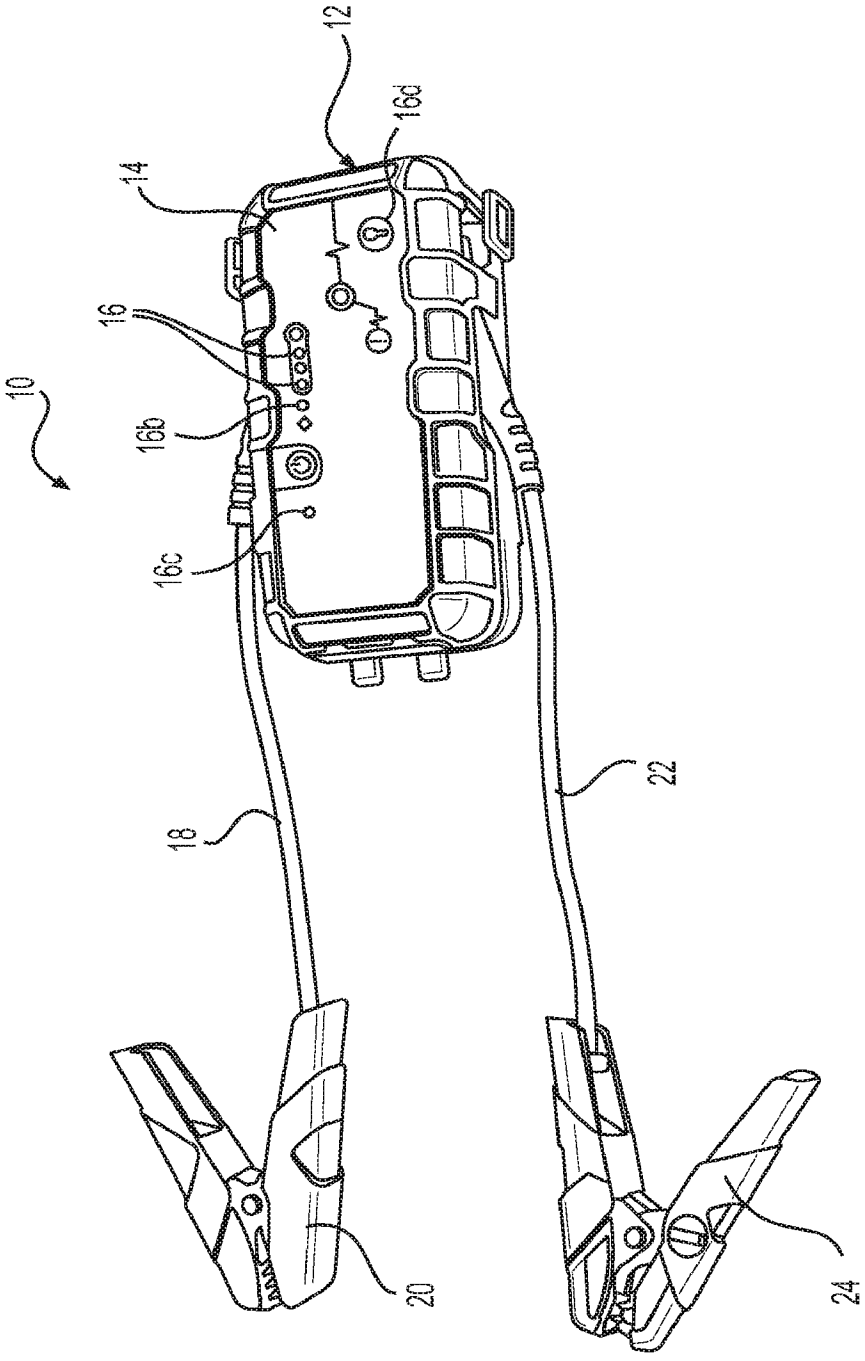
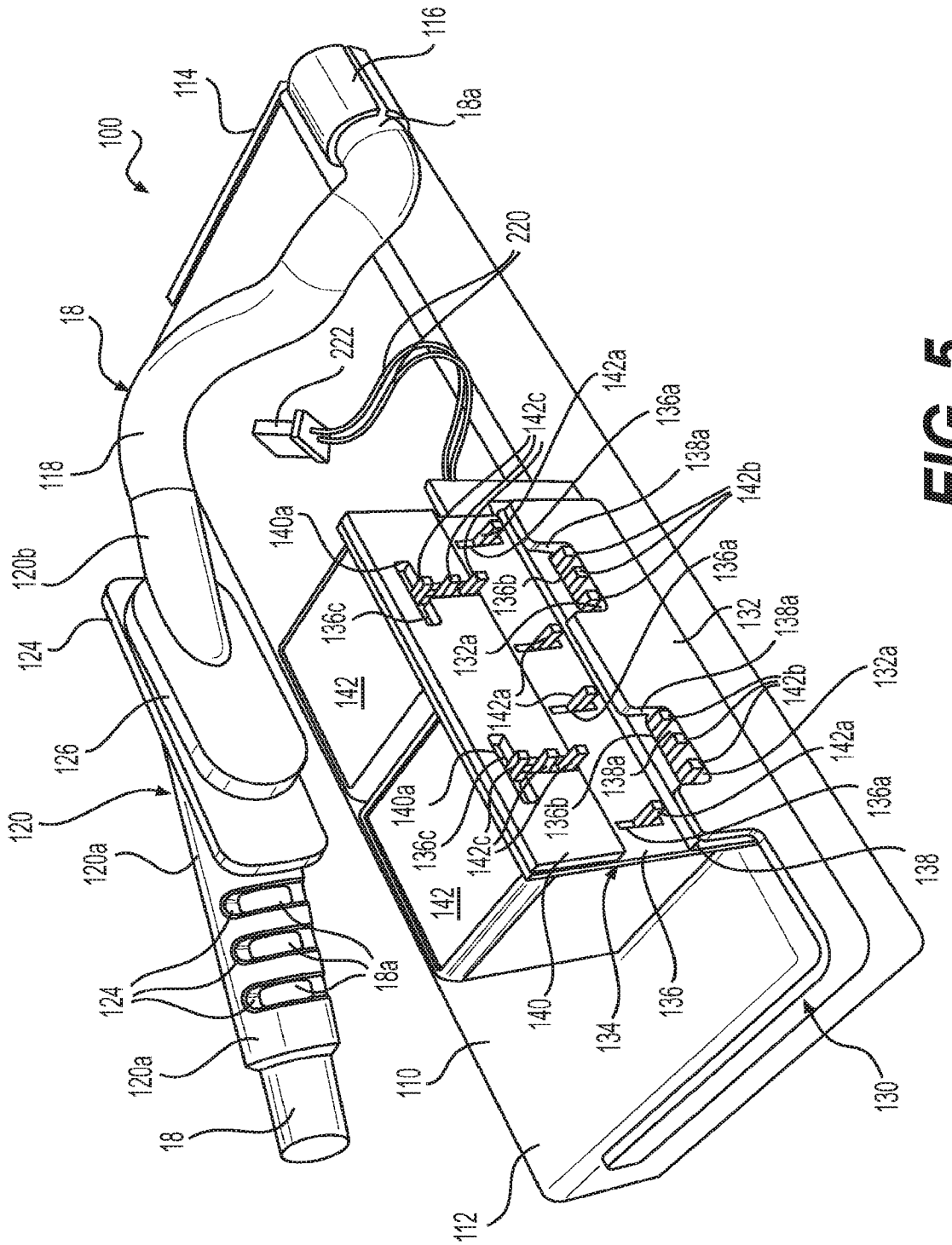


FIG. 4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120a
142a
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136c
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132a
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112

FIG. 5

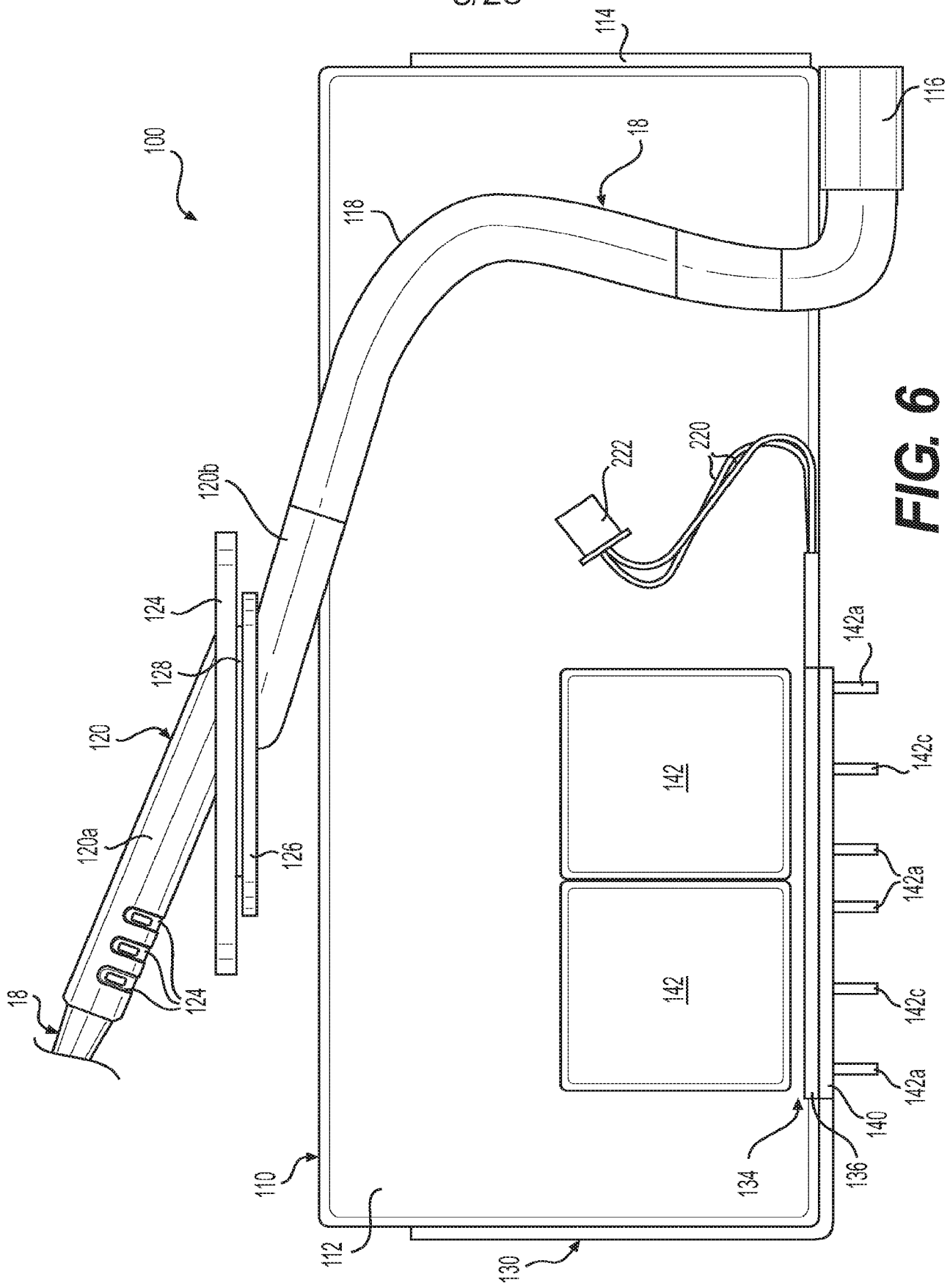
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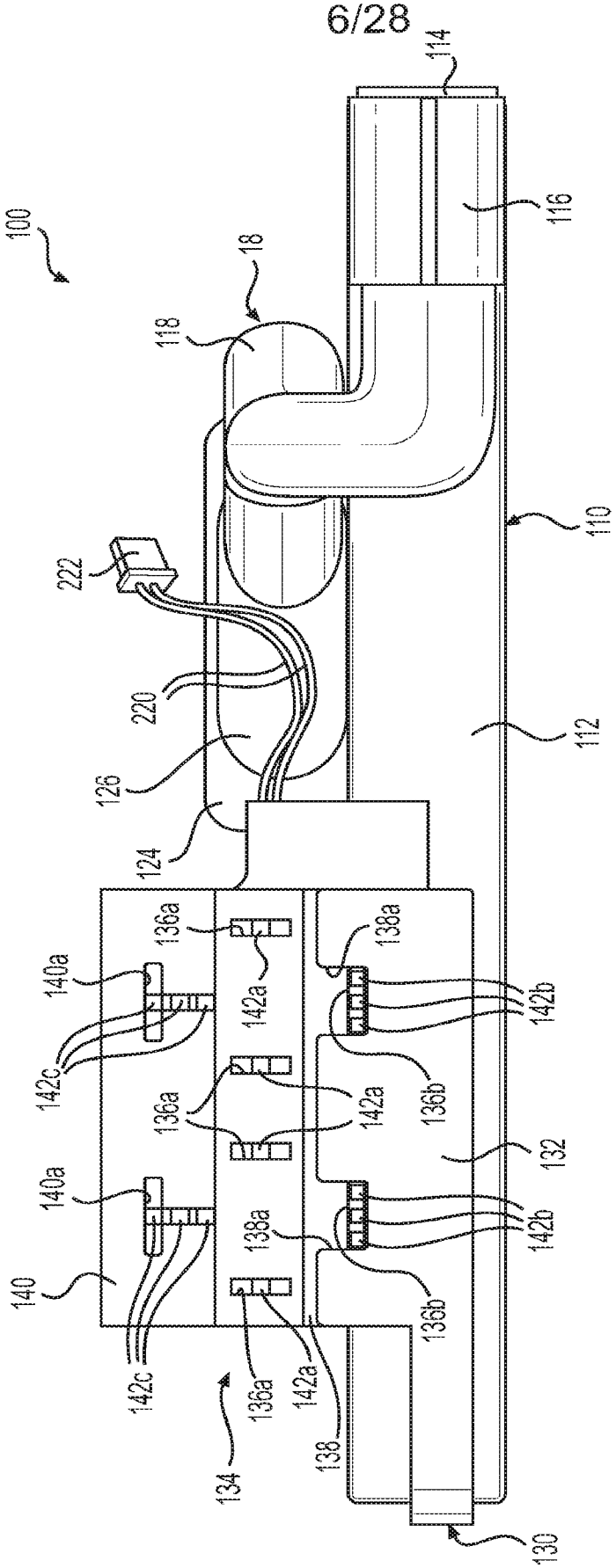
FIG. 6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130

FIG. 7

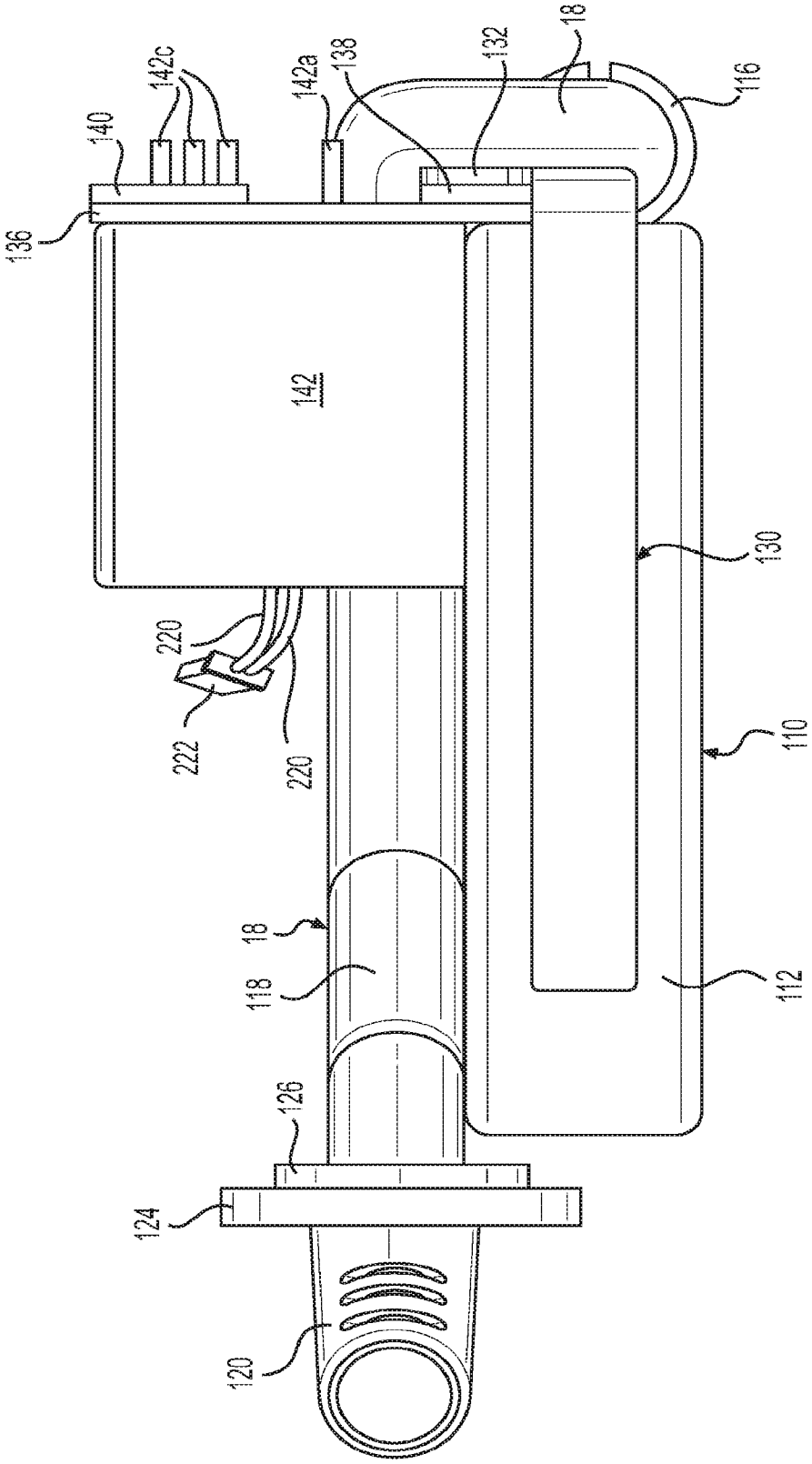
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FIG. 8

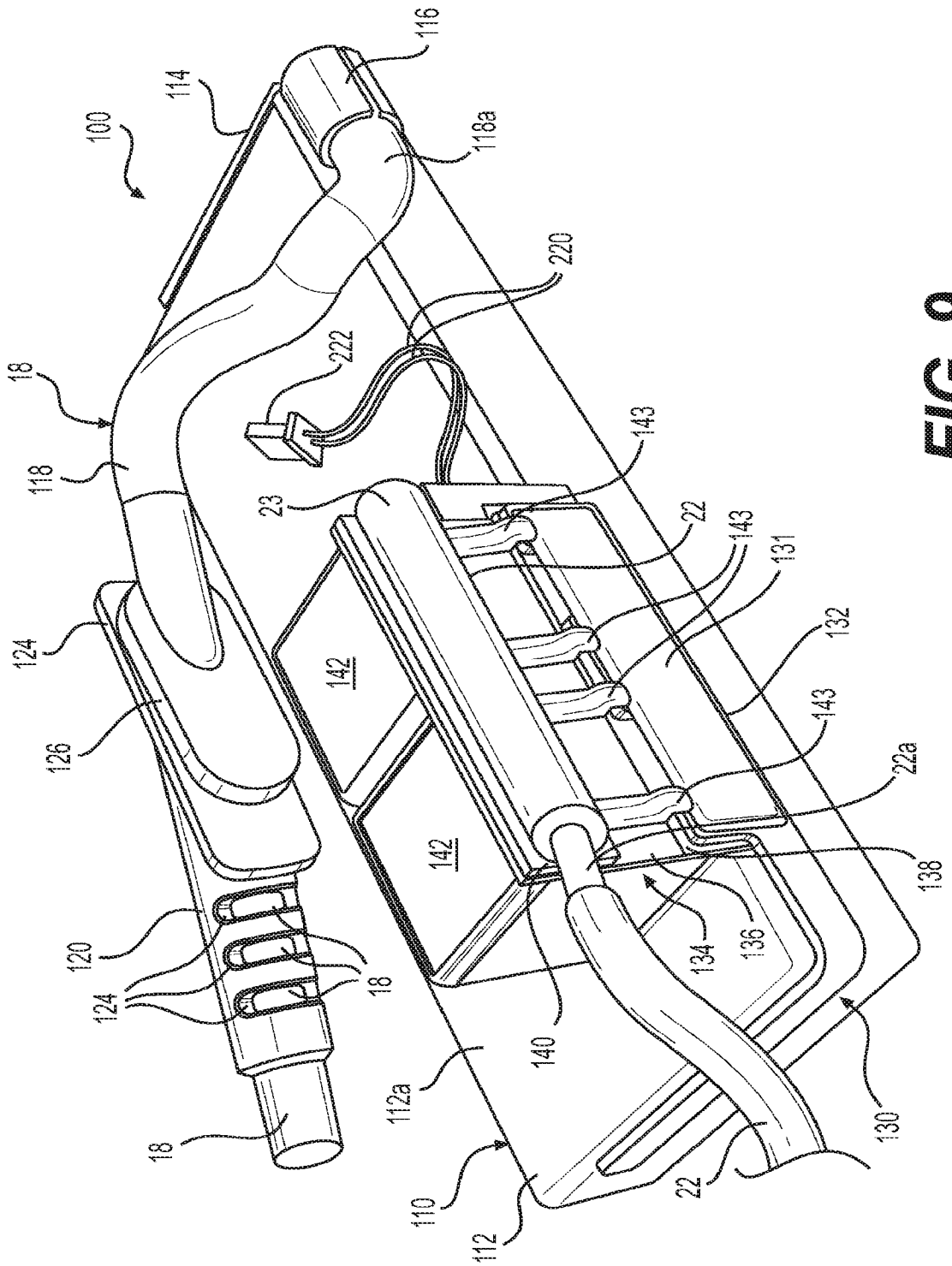
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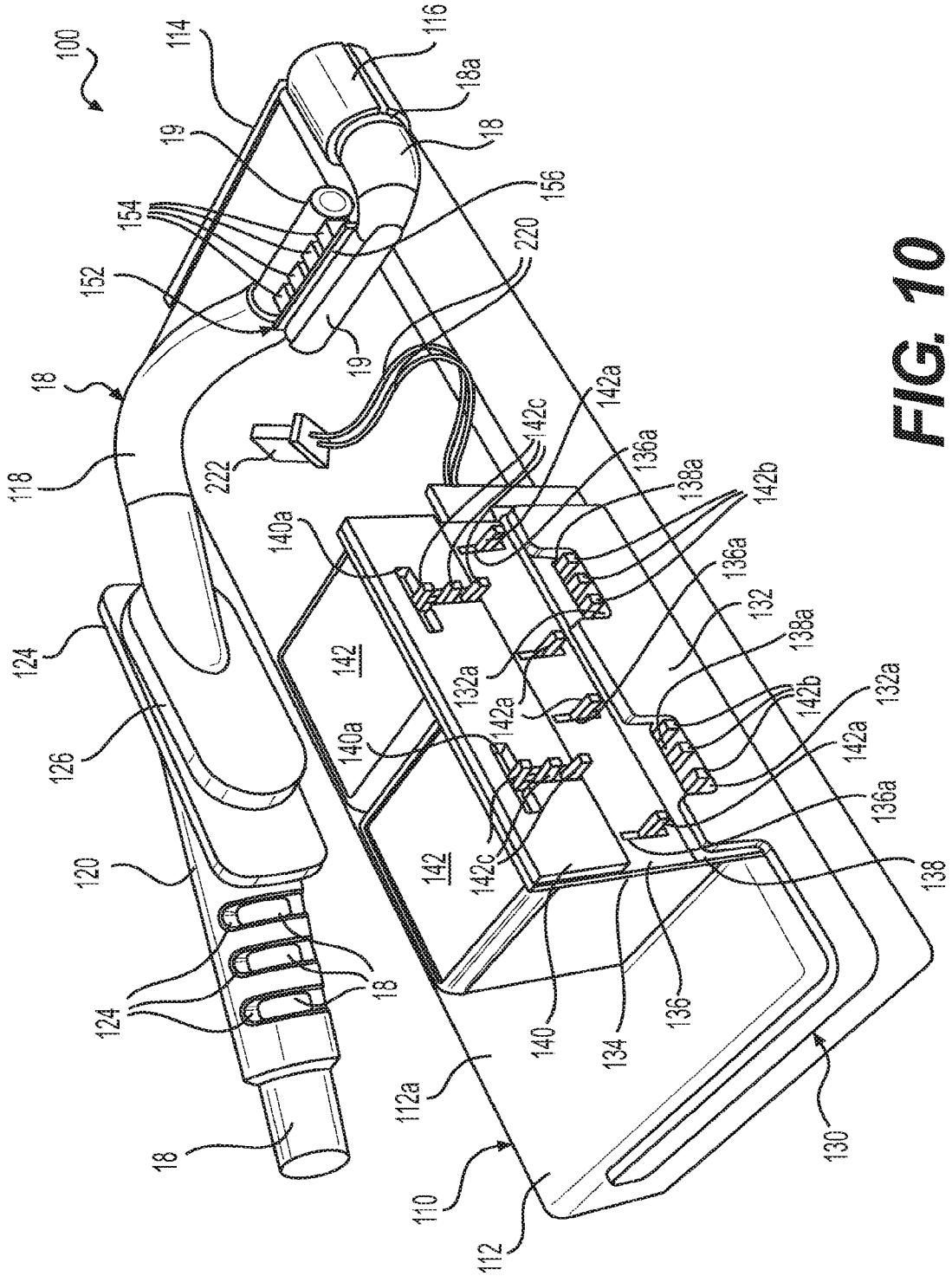
FIG. 9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136a
132
138a
124
142
132a
142a
142b
132a
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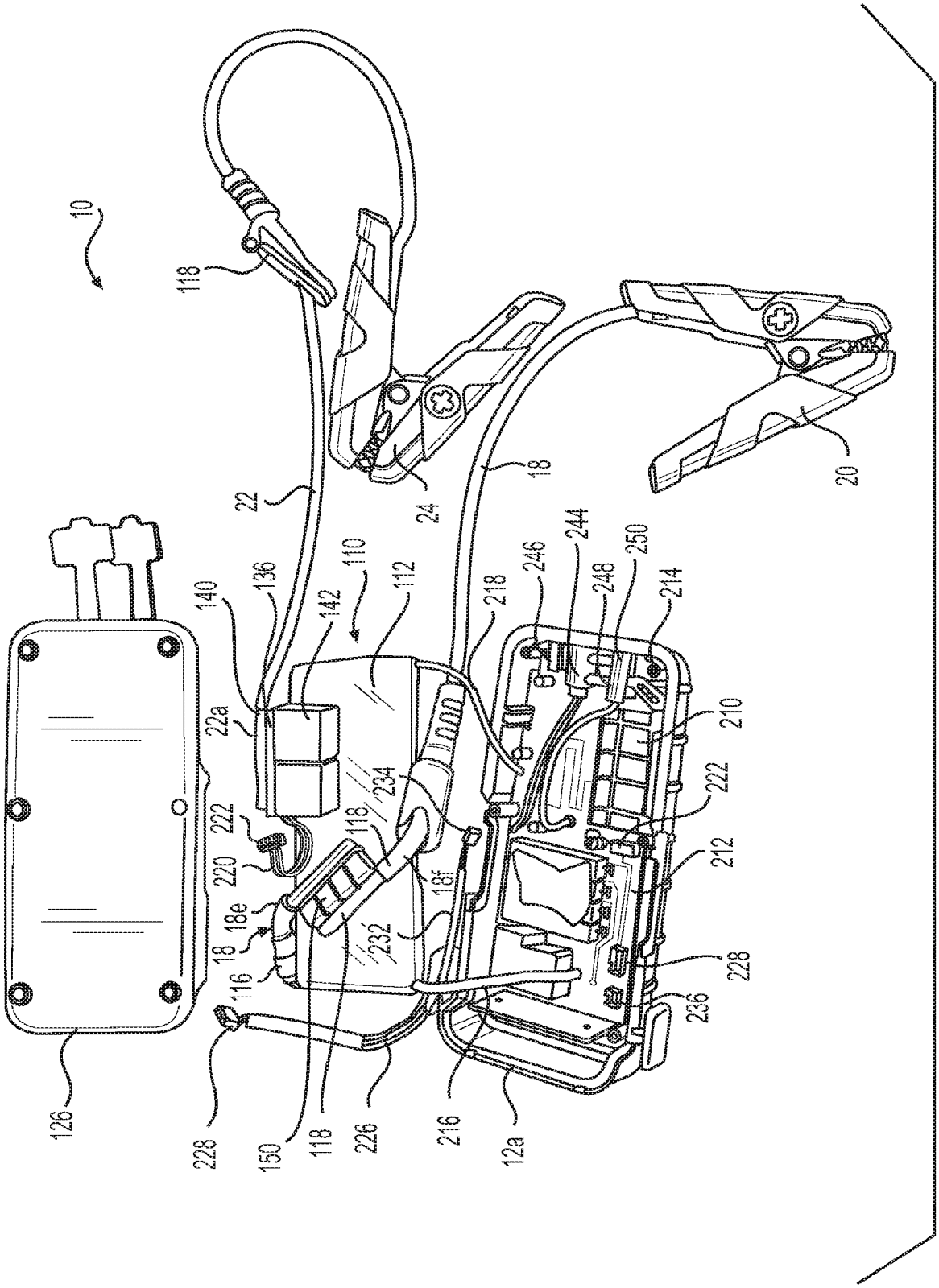
FIG. 10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112
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142
22a
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248
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222
212
228
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222
220
18e
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116
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228
150
118
226
216
12a

FIG. 11

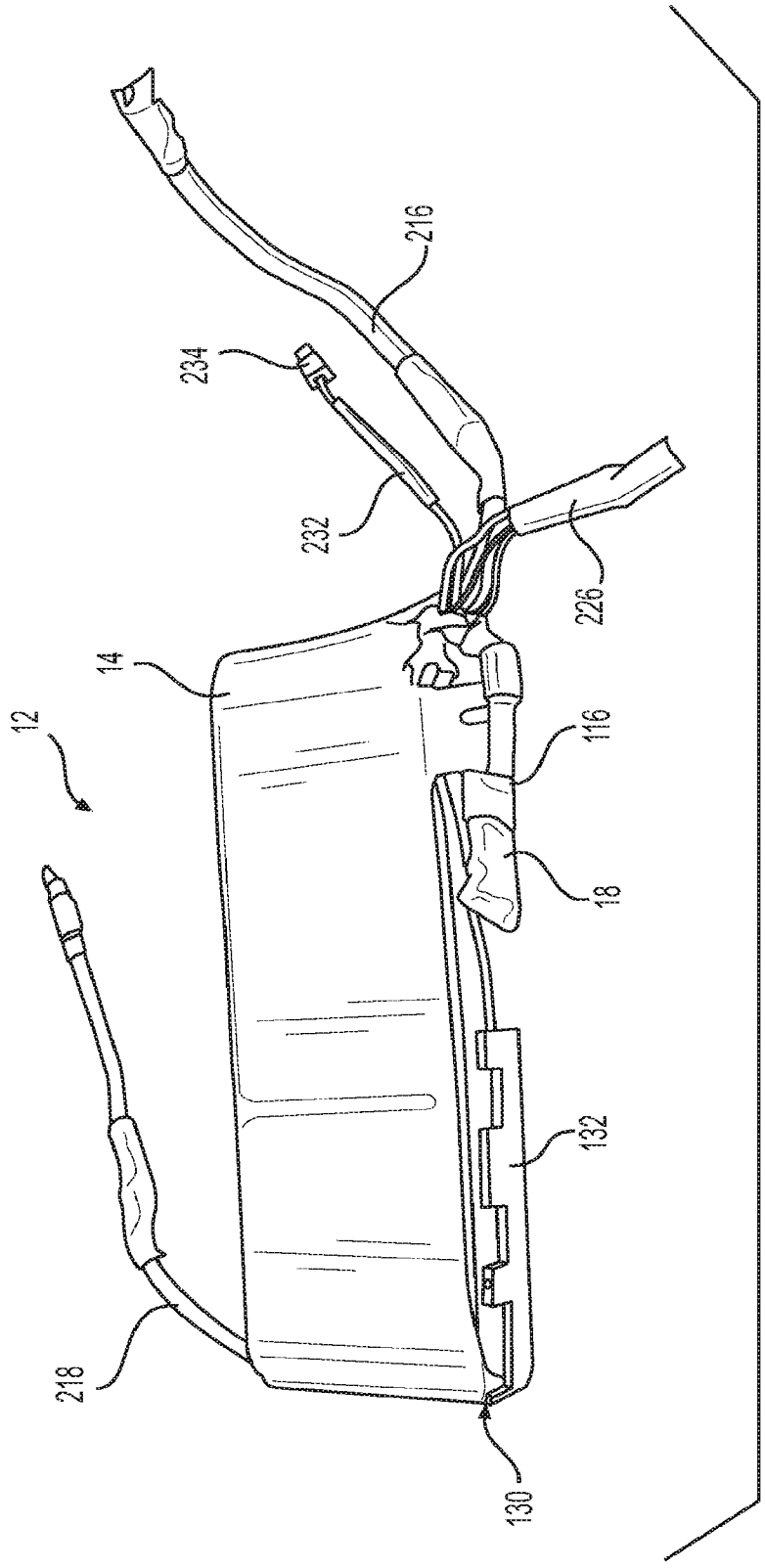
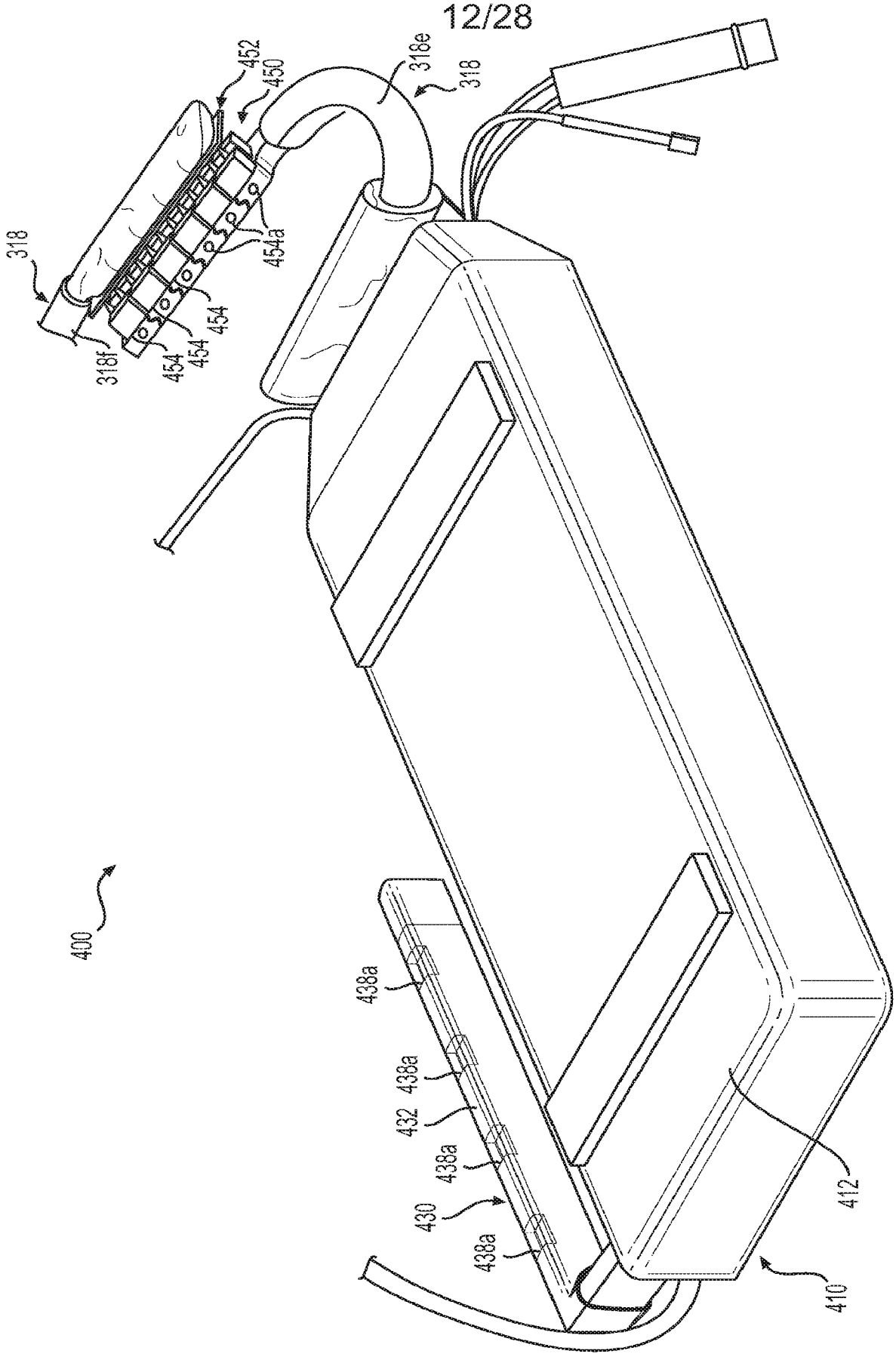


FIG. 12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318
318f
454
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454
454a
452
450
318e
318
438a
438a
432
438a
430
438a
412
410

FIG. 13

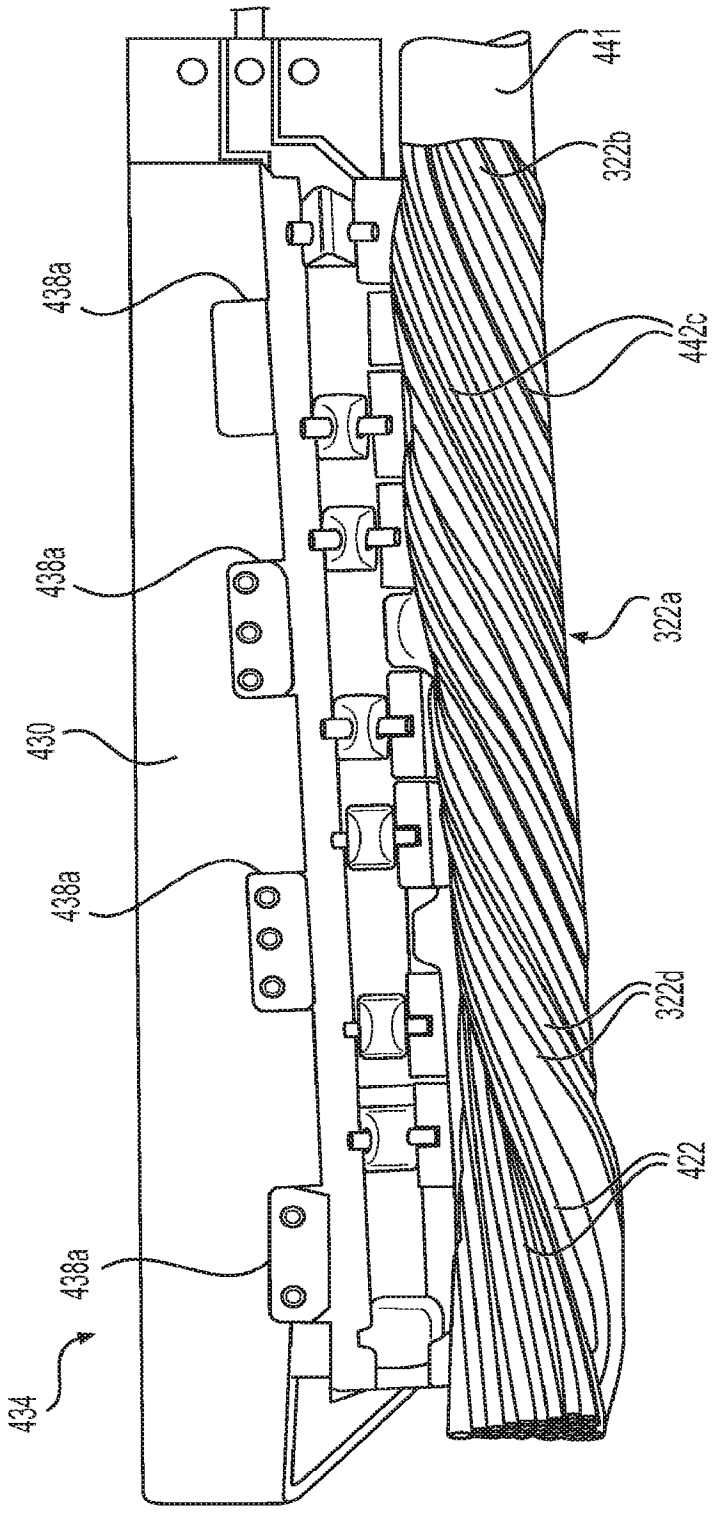
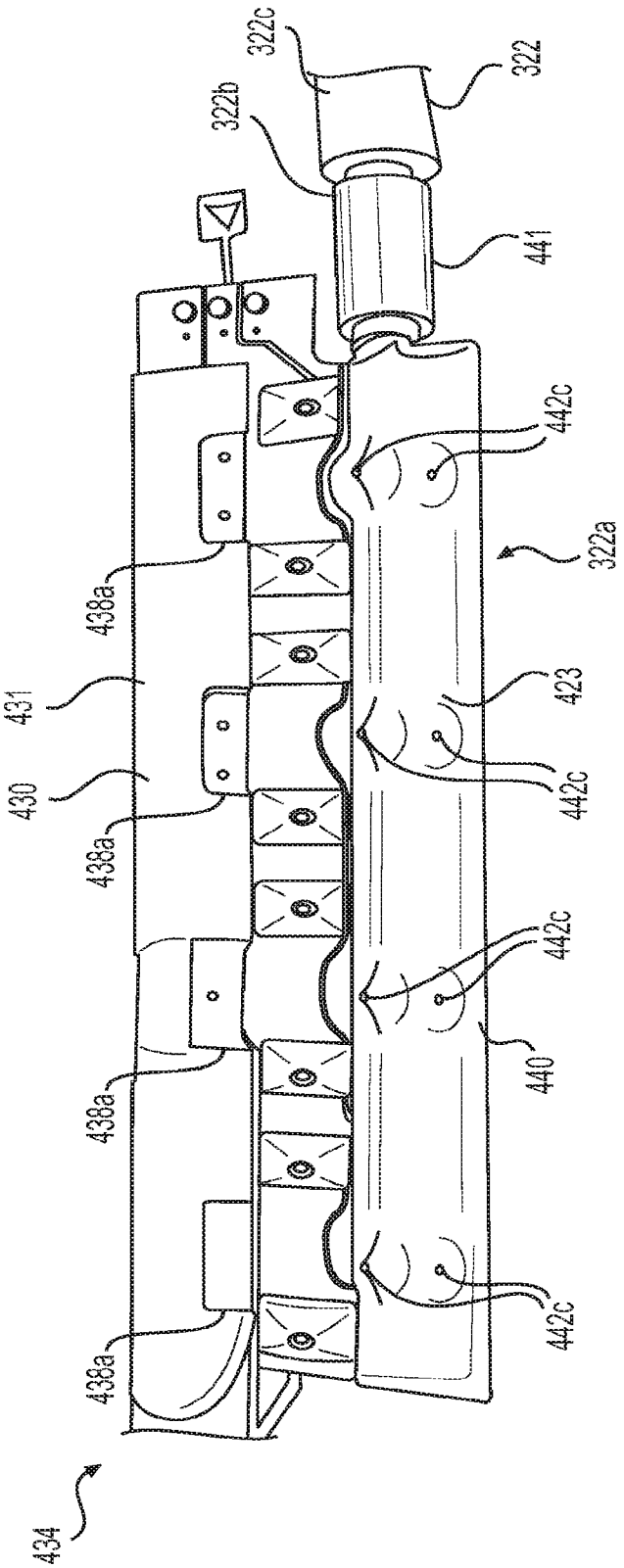


FIG. 14


322c
322
322b
441
442c
322a
438a
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440
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442c
438a
434

FIG. 15

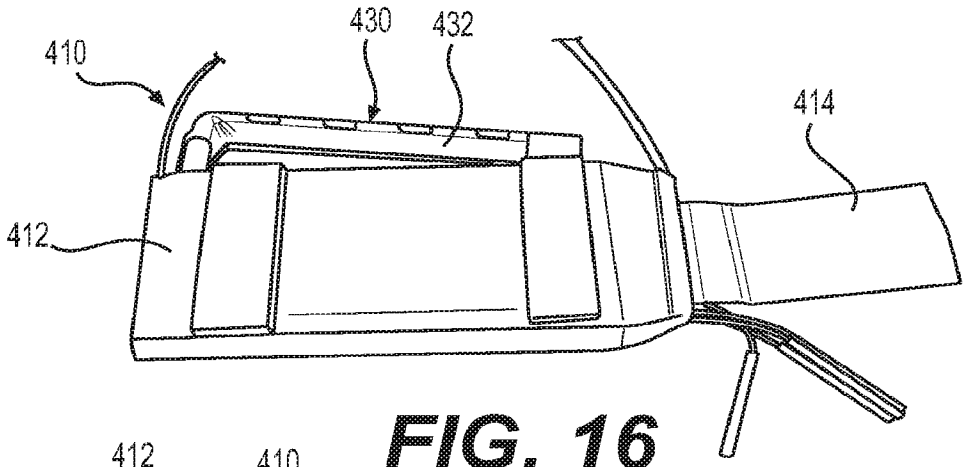


FIG. 16

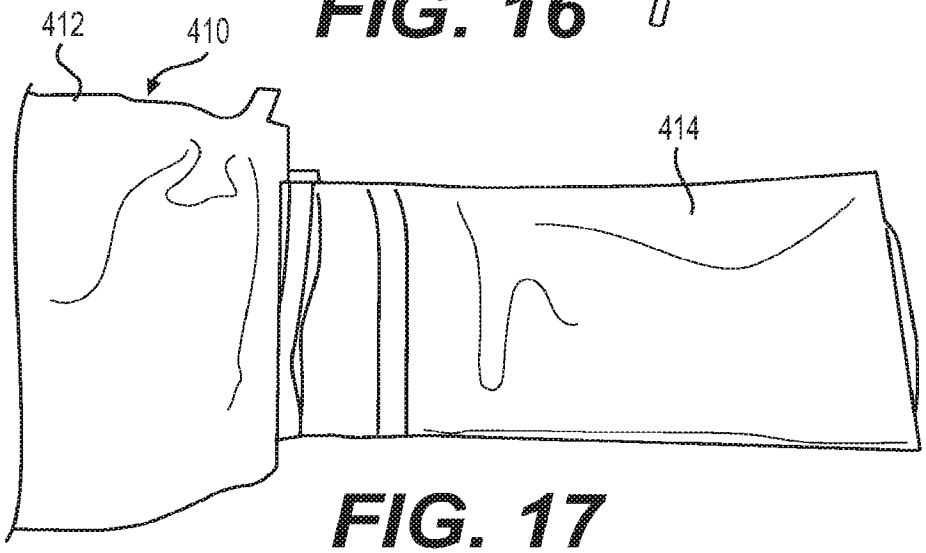


FIG. 17

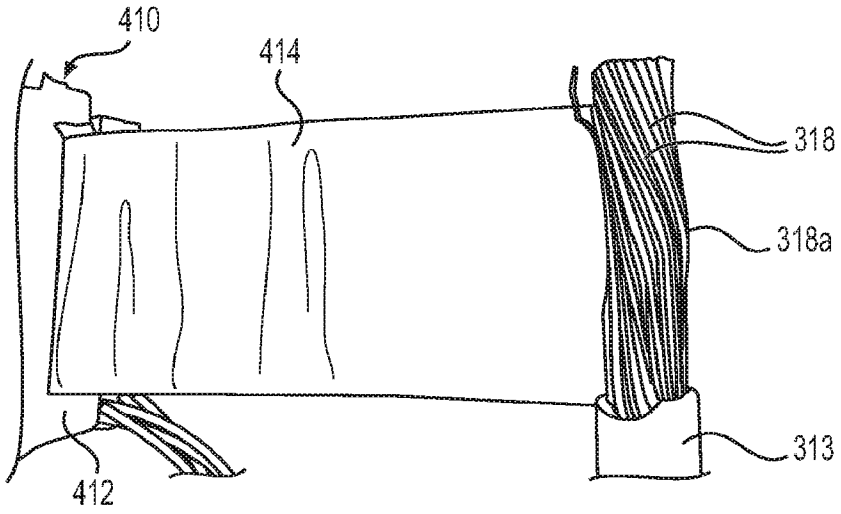


FIG. 18

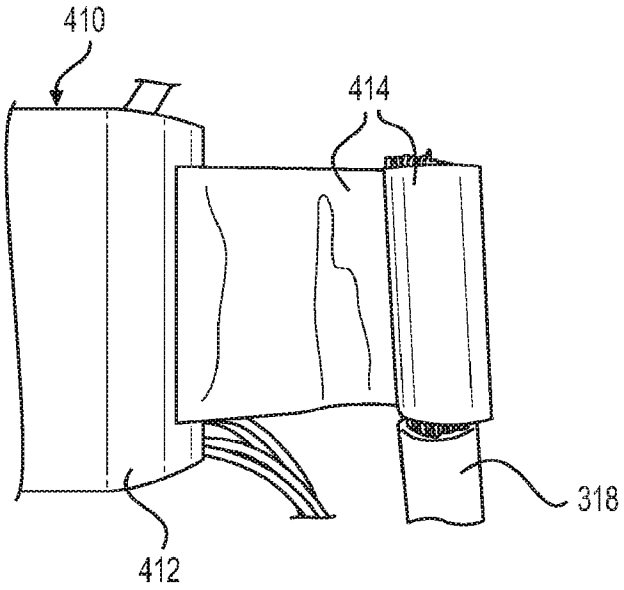


FIG. 19

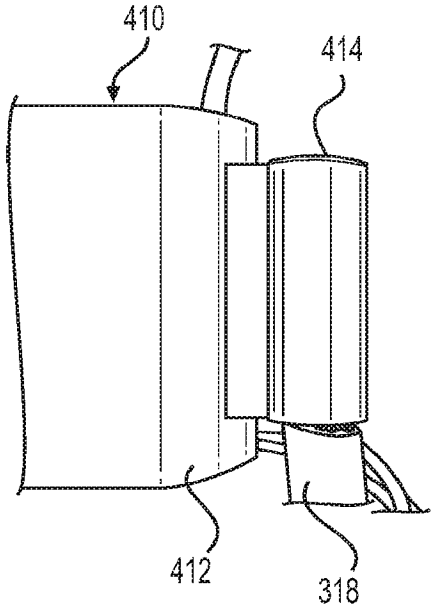


FIG. 20

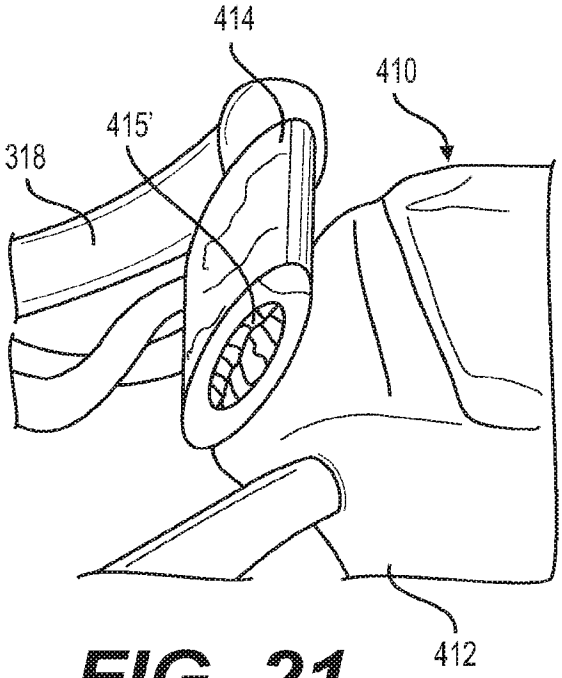


FIG. 21

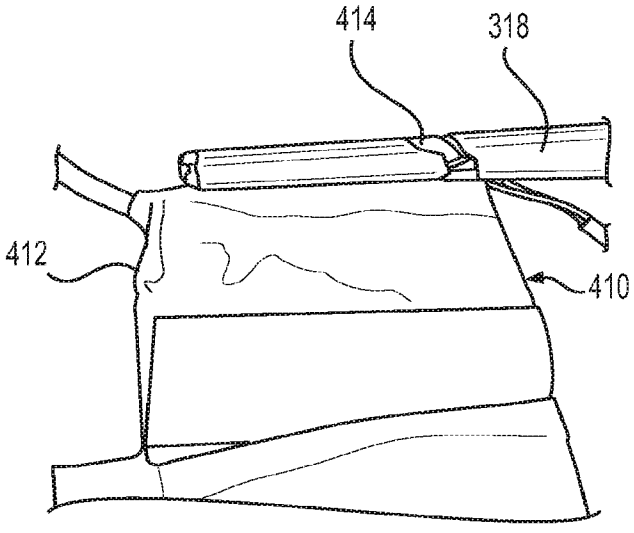


FIG. 22

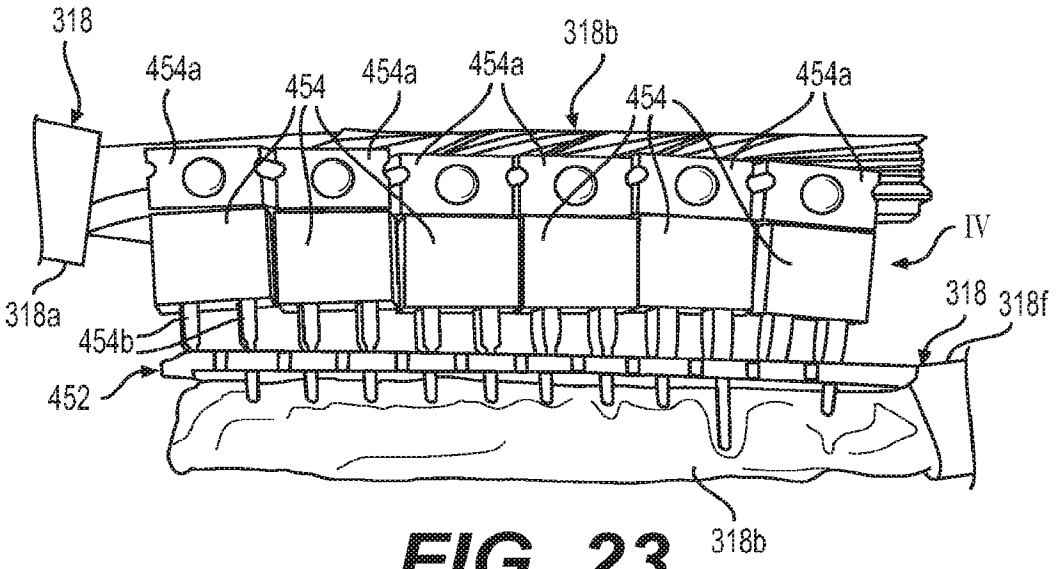


FIG. 23

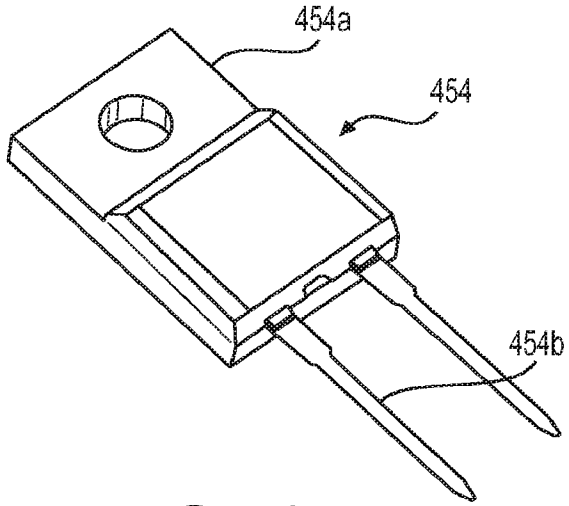


FIG. 24

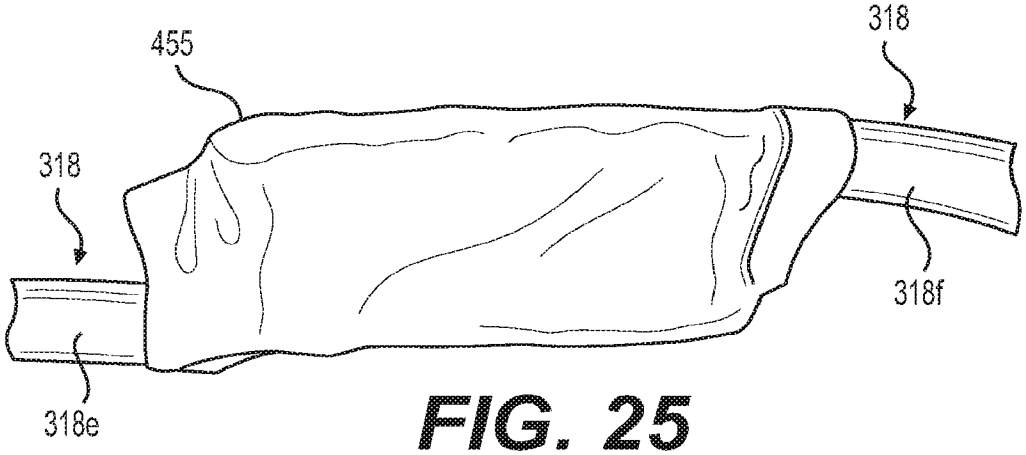


FIG. 25

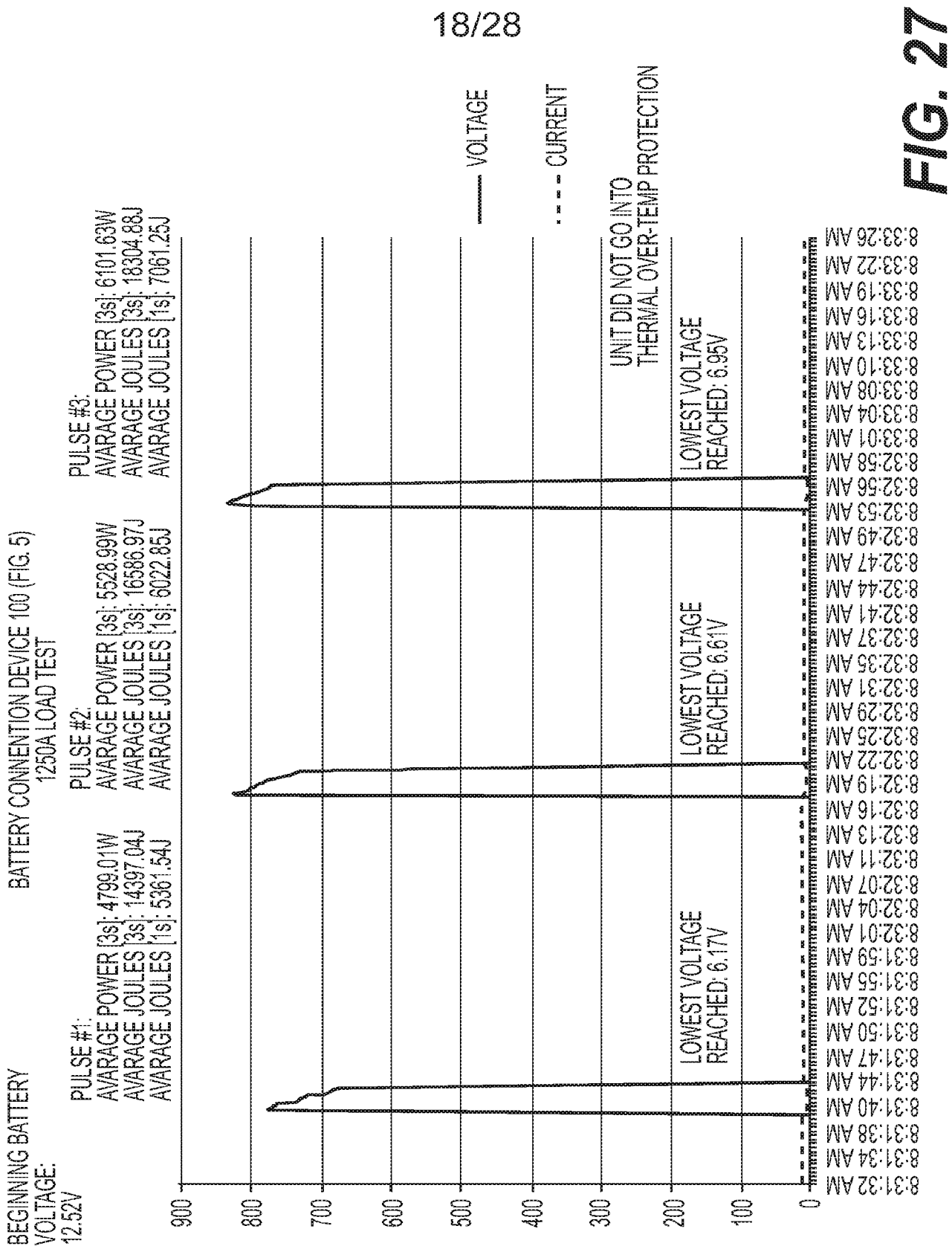
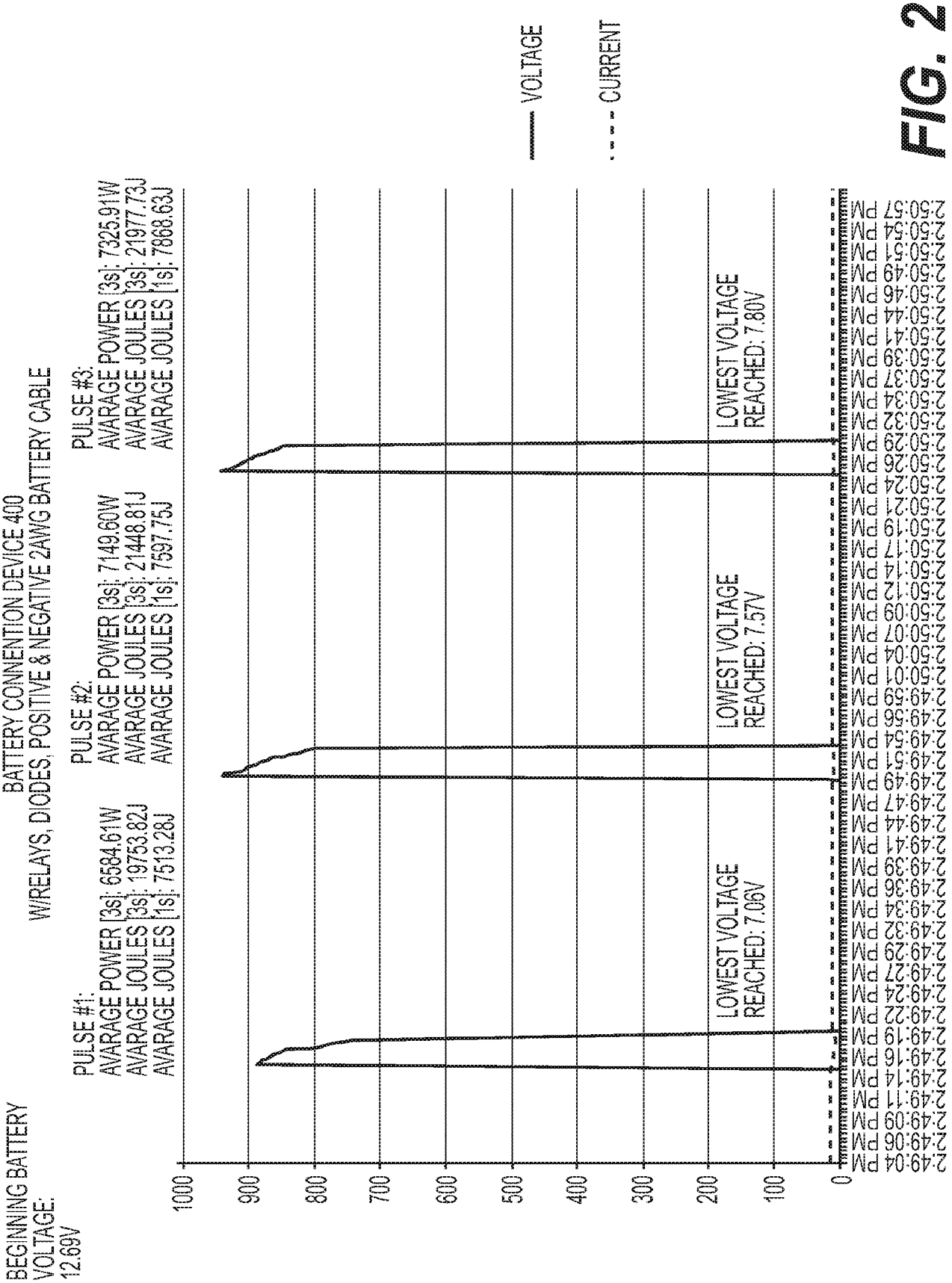

BEGINNING BATTERY VOLTAGE: 12.52V
BATTERY CONNENTION DEVICE 100 (FIG. 5)
1250A LOAD TEST
PULSE #1:
AVARAGE POWER [3s]: 4799.01W
AVARAGE JOULES [3s]: 14397.04J
AVARAGE JOULES [1s]: 5361.54J
PULSE #2:
AVARAGE POWER [3s]: 5528.99W
AVARAGE JOULES [3s]: 16586.97J
AVARAGE JOULES [1s]: 6022.85J
PULSE #3:
AVARAGE POWER [3s]: 6101.63W
AVARAGE JOULES [3s]: 18304.88J
AVARAGE JOULES [1s]: 7061.25J
VOLTAGE
CURRENT
UNIT DID NOT GO INTO THERMAL OVER-TEMP PROTECTION
LOWEST VOLTAGE REACHED: 6.17V
LOWEST VOLTAGE REACHED: 6.61V
LOWEST VOLTAGE REACHED: 6.95V
900
800
700
600
500
400
300
200
100
0
8:31:32 AM
8:31:34 AM
8:31:38 AM
8:31:40 AM
8:31:44 AM
8:31:47 AM
8:31:50 AM
8:31:52 AM
8:31:55 AM
8:31:59 AM
8:32:01 AM
8:32:04 AM
8:32:07 AM
8:32:11 AM
8:32:13 AM
8:32:16 AM
8:32:19 AM
8:32:22 AM
8:32:25 AM
8:32:29 AM
8:32:31 AM
8:32:35 AM
8:32:37 AM
8:32:41 AM
8:32:44 AM
8:32:47 AM
8:32:49 AM
8:32:53 AM
8:32:56 AM
8:32:58 AM
8:33:01 AM
8:33:04 AM
8:33:08 AM
8:33:10 AM
8:33:13 AM
8:33:16 AM
8:33:19 AM
8:33:22 AM
8:33:26 AM

FIG. 27


BEGINNING BATTERY VOLTAGE: 12.69V
BATTERY CONNENTION DEVICE 400
W/RELAYS, DIODES, POSITIVE & NEGATIVE 2AWG BATTERY CABLE
PULSE #1:
AVARAGE POWER [3s]: 6584.61W
AVARAGE JOULES [3s]: 19753.82J
AVARAGE JOULES [1s]: 7513.28J
PULSE #2:
AVARAGE POWER [3s]: 7149.60W
AVARAGE JOULES [3s]: 21448.81J
AVARAGE JOULES [1s]: 7597.75J
PULSE #3:
AVARAGE POWER [3s]: 7325.91W
AVARAGE JOULES [3s]: 21977.73J
AVARAGE JOULES [1s]: 7868.63J
VOLTAGE
CURRENT
LOWEST VOLTAGE REACHED: 7.06V
LOWEST VOLTAGE REACHED: 7.57V
LOWEST VOLTAGE REACHED: 7.80V
1000
900
800
700
600
500
400
300
200
100
0
2:49:04 PM
2:49:06 PM
2:49:09 PM
2:49:11 PM
2:49:14 PM
2:49:16 PM
2:49:19 PM
2:49:22 PM
2:49:24 PM
2:49:27 PM
2:49:29 PM
2:49:32 PM
2:49:34 PM
2:49:36 PM
2:49:39 PM
2:49:41 PM
2:49:44 PM
2:49:47 PM
2:49:49 PM
2:49:51 PM
2:49:54 PM
2:49:56 PM
2:49:59 PM
2:50:01 PM
2:50:04 PM
2:50:07 PM
2:50:09 PM
2:50:12 PM
2:50:14 PM
2:50:17 PM
2:50:19 PM
2:50:21 PM
2:50:24 PM
2:50:26 PM
2:50:29 PM
2:50:32 PM
2:50:34 PM
2:50:37 PM
2:50:39 PM
2:50:41 PM
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2:50:46 PM
2:50:49 PM
2:50:51 PM
2:50:54 PM
2:50:57 PM

FIG. 28

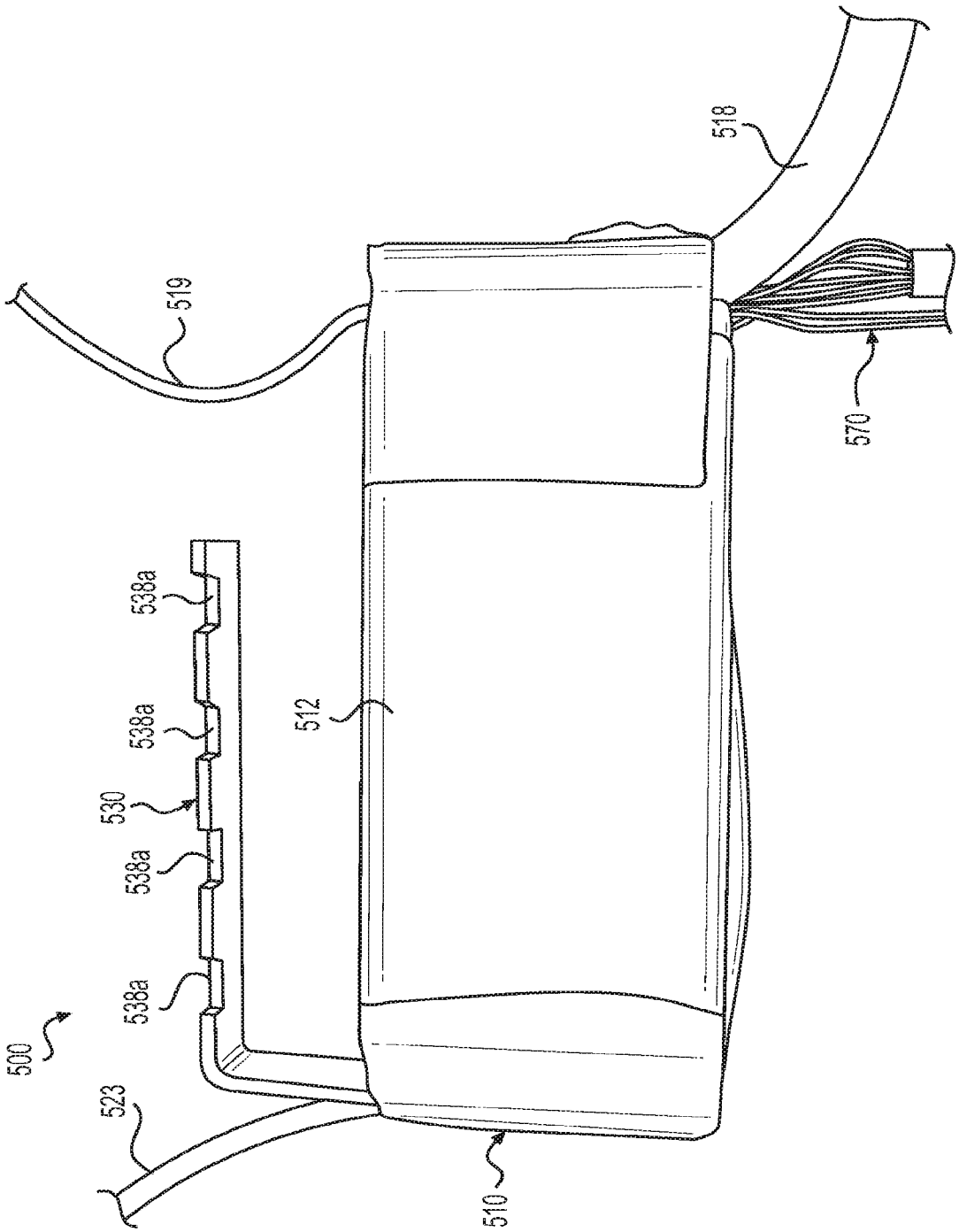

FIG. 29

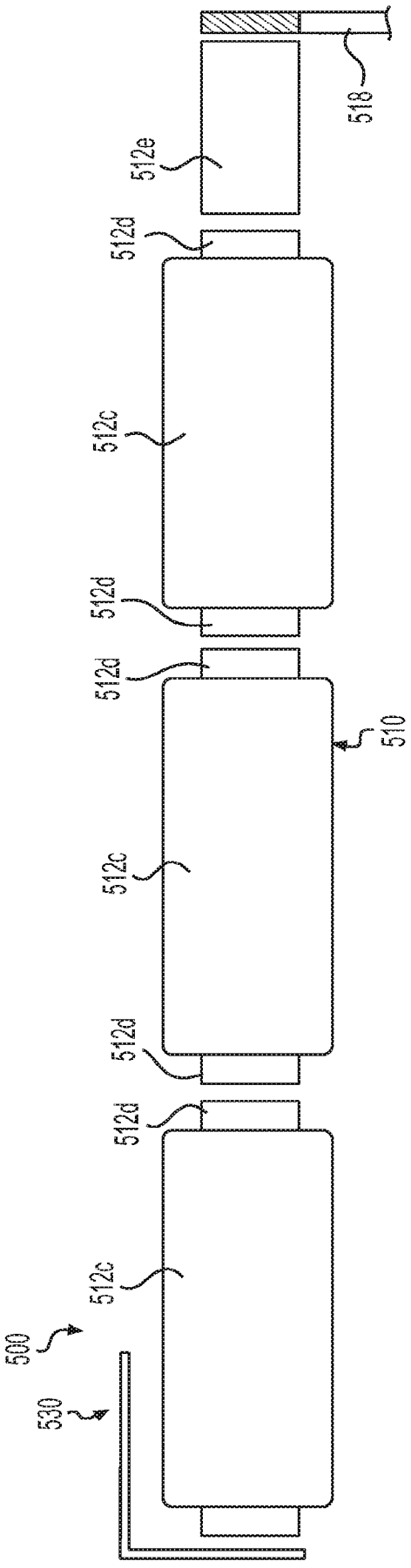
518
512e
512d
512c
512d
512d
510
512c
512d
512d
512c
500
530

FIG. 30

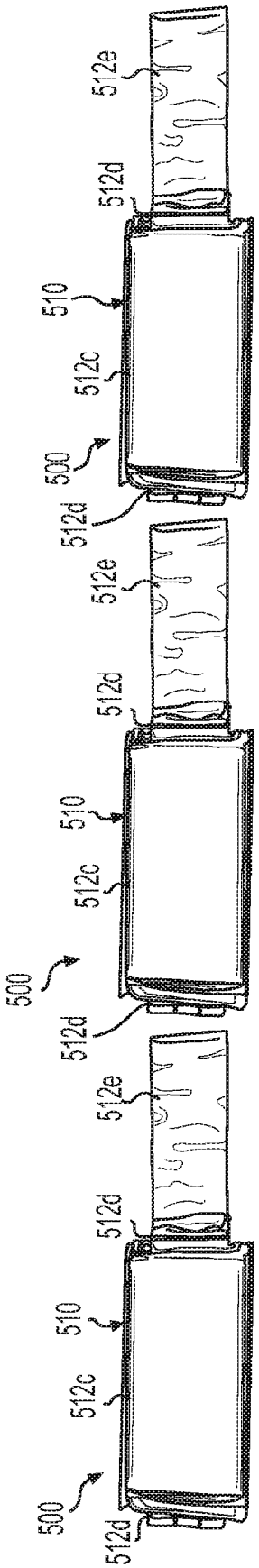
512e
512d
510
512c
500
512d
512e
512d
510
512c
500
512d
512e
512d
510
512c
500
512d

FIG. 31

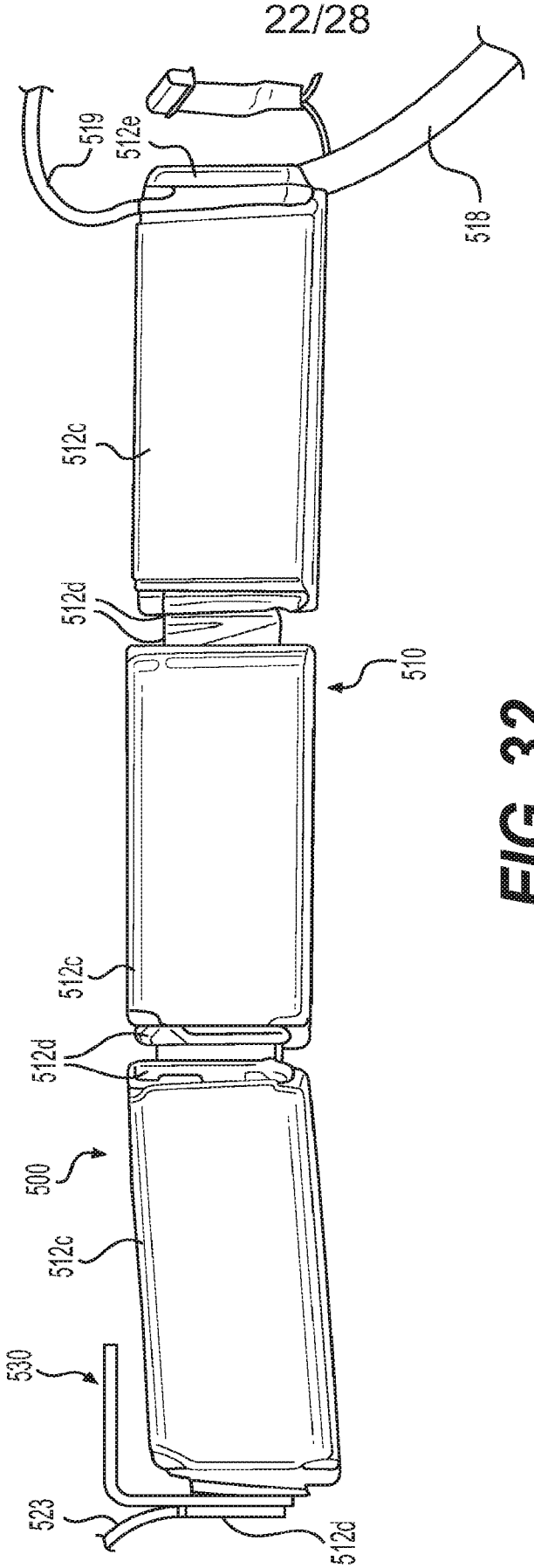

FIG. 32

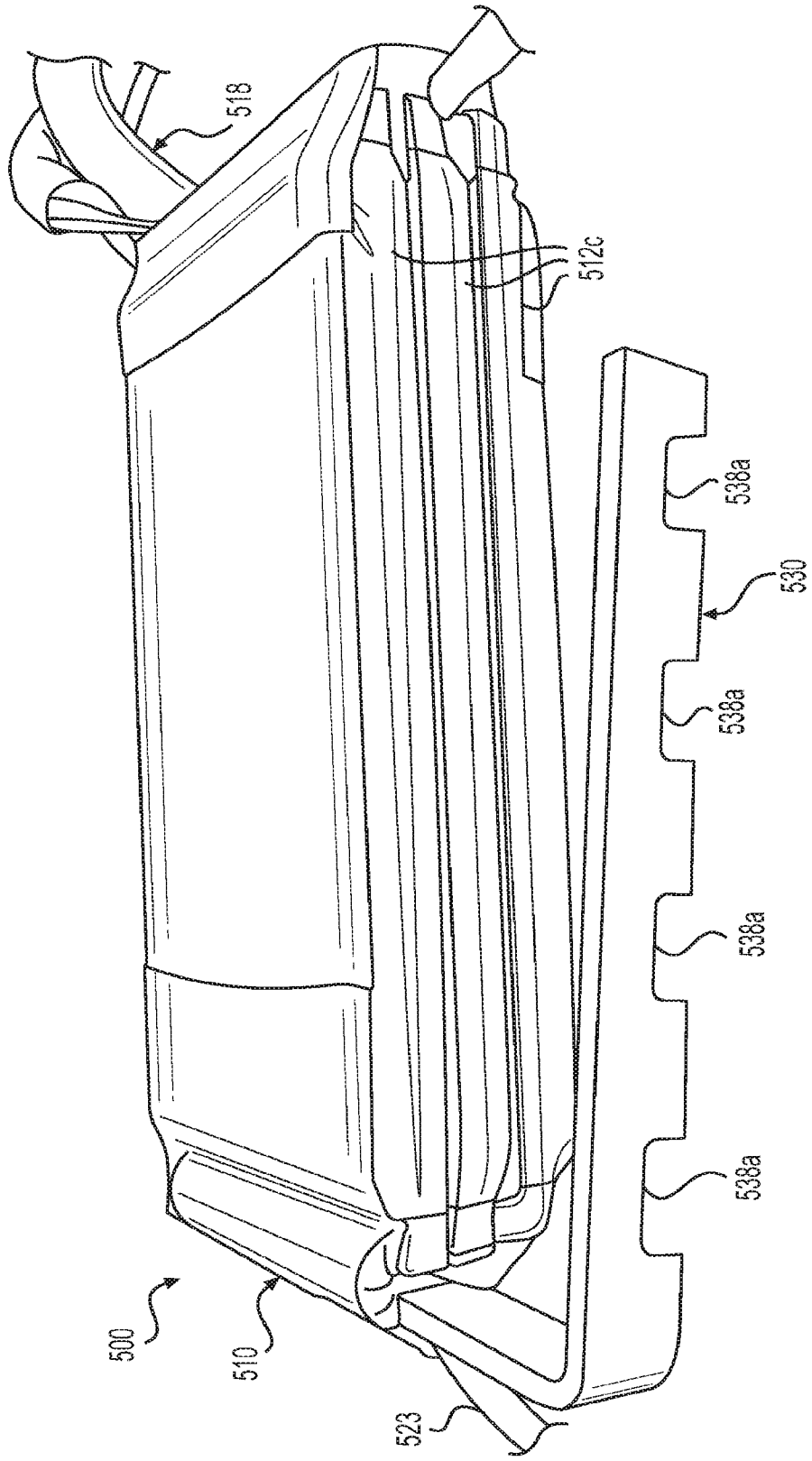

FIG. 33

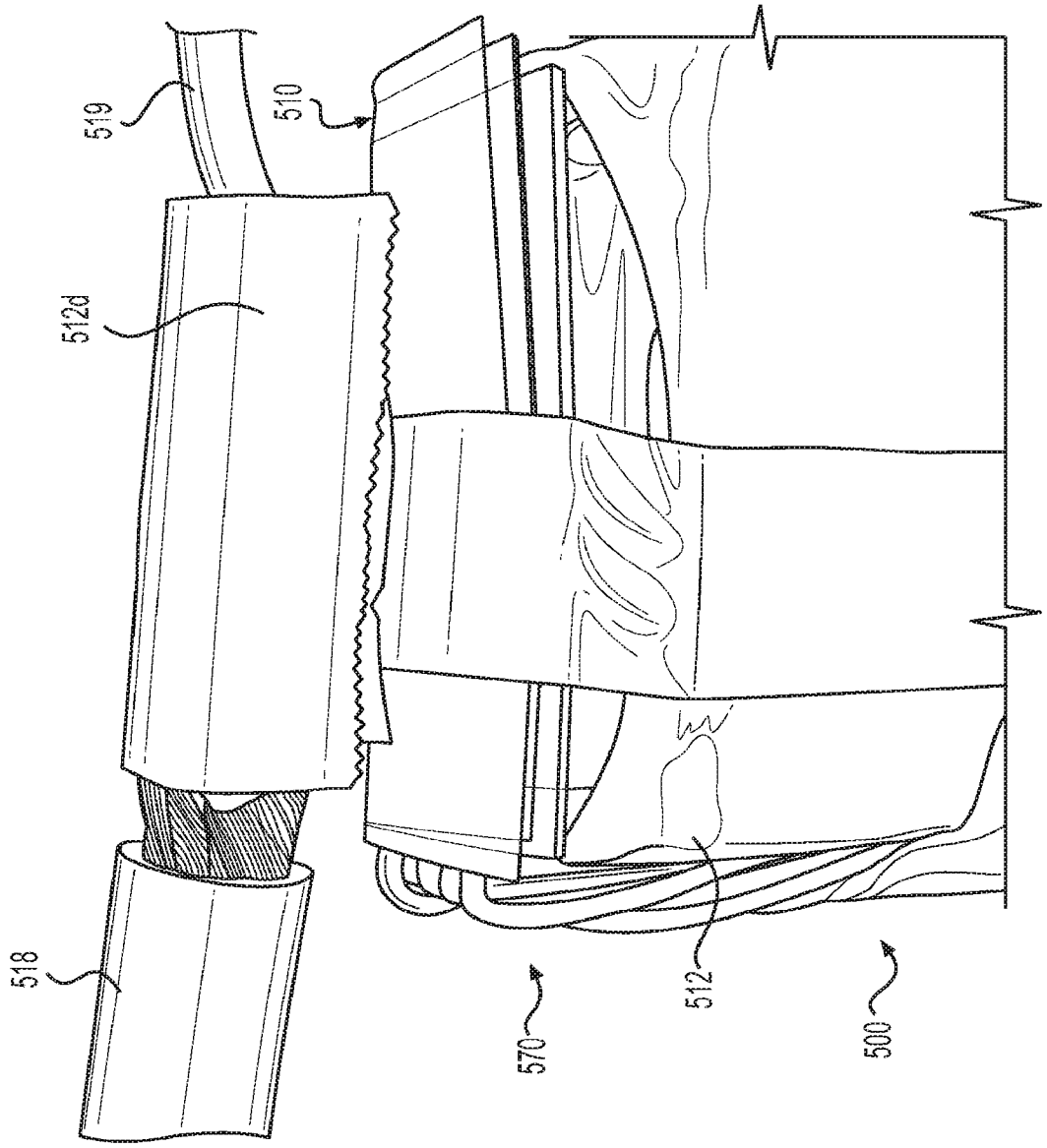

FIG. 34

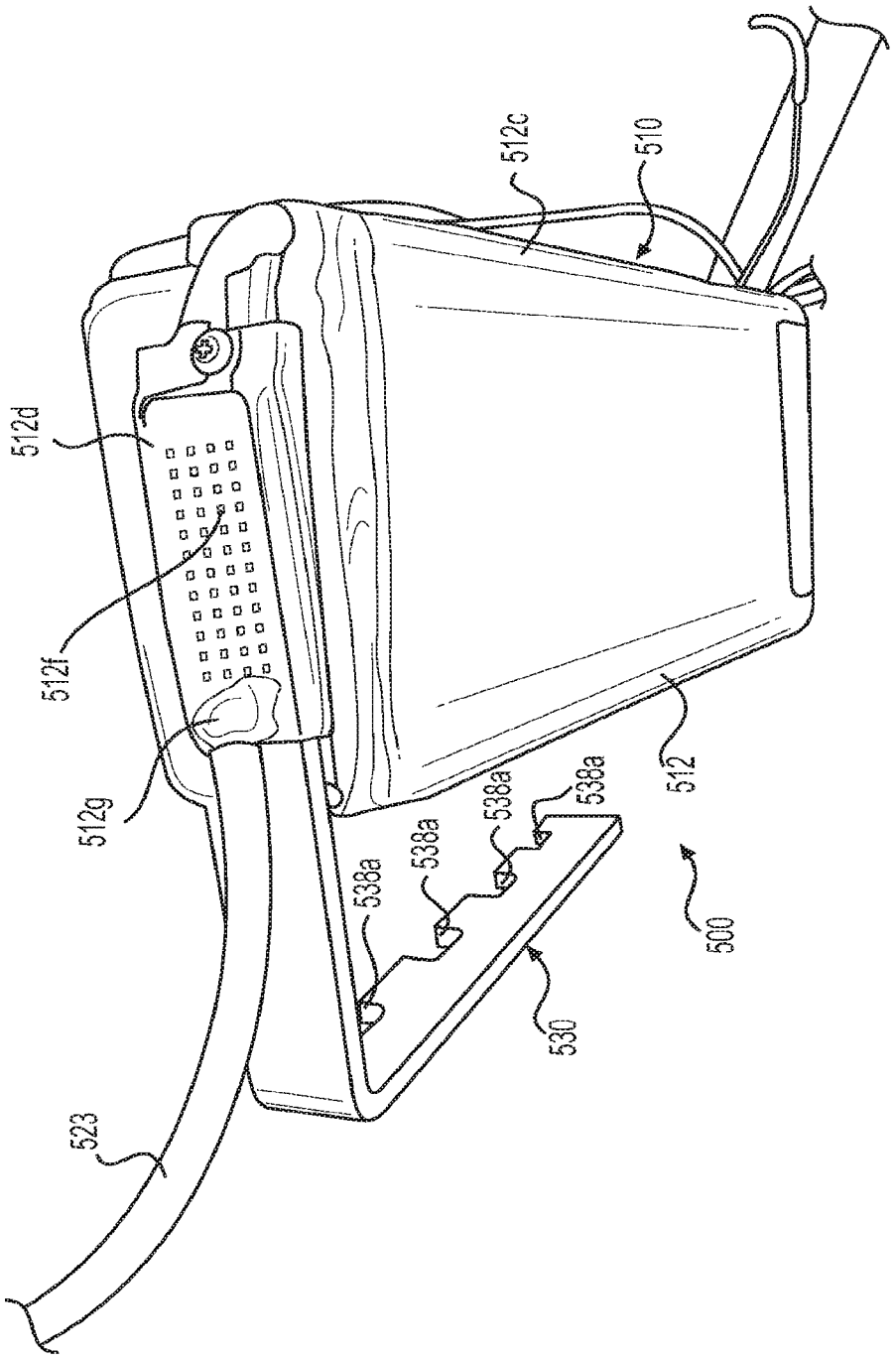

FIG. 35

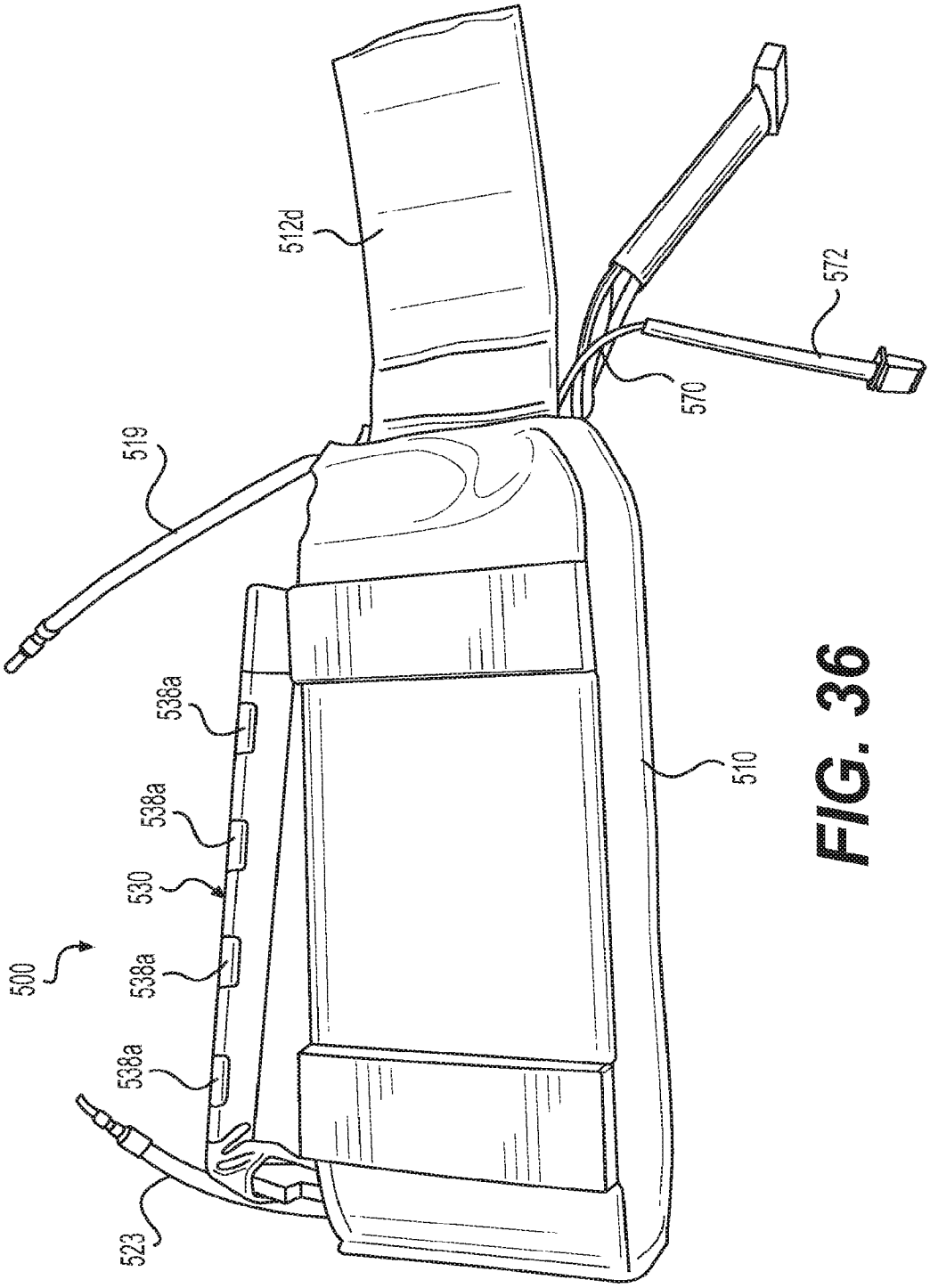

FIG. 36

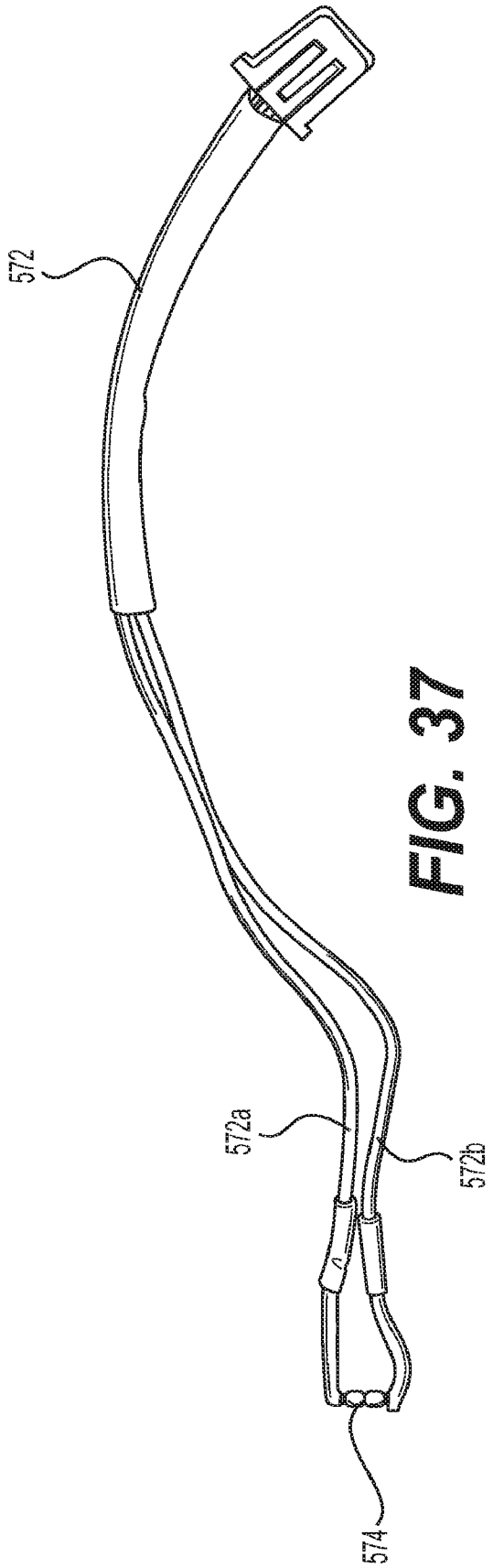

FIG. 37

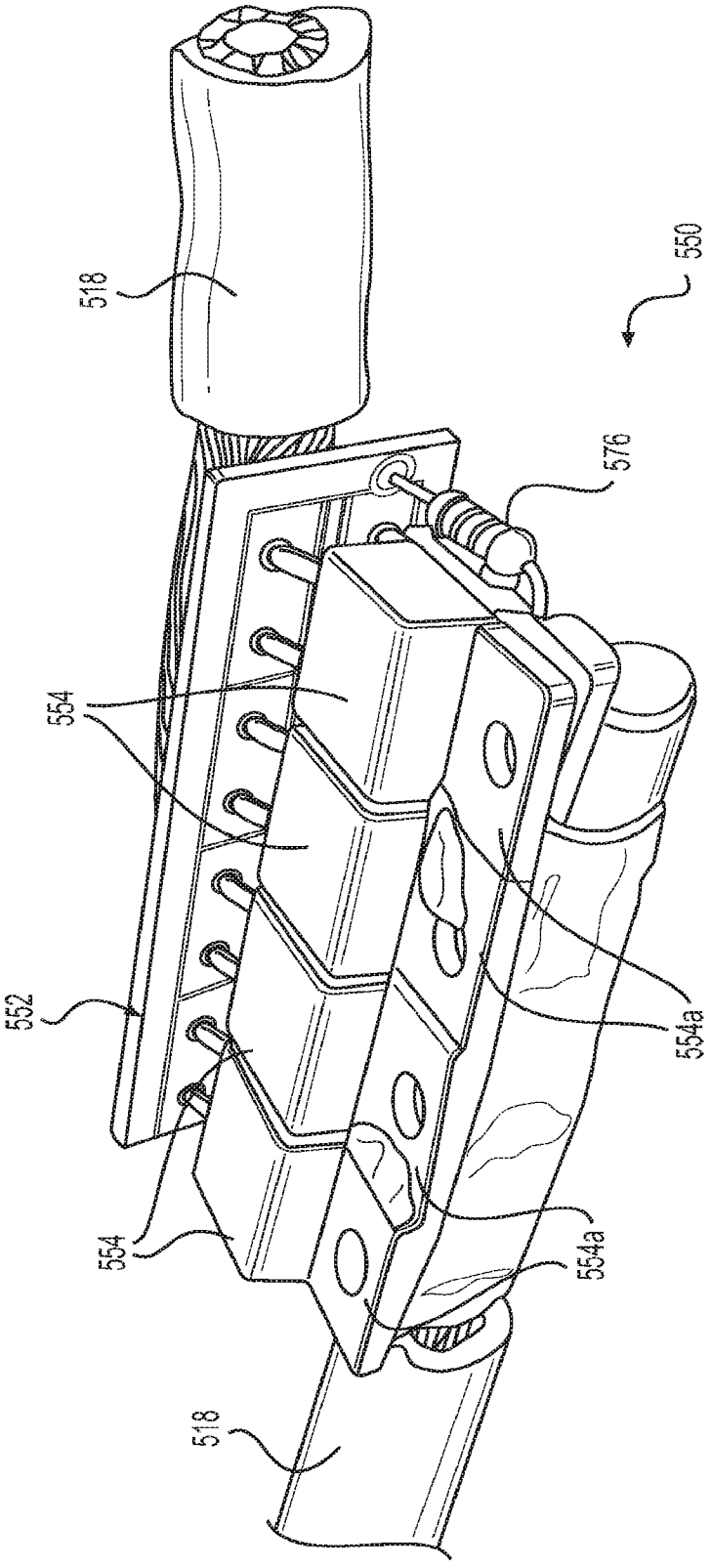

FIG. 38

Espacenet

Bibliographic data: AU2016392707 (A1) — 2017-11-30

Battery assembly device

Inventor(s): NOOK JONATHAN LEWIS; NOOK WILLIAM KNIGHT; STANFIELD JAMES RICHARD; UNDERHILL DEREK MICHAEL ± (Nook, Jonathan Lewis, ; Nook, William Knight, ; Stanfield, James Richard, ; Underhill, Derek Michael)

Applicant(s): NOCO CO ± (The NOCO Company, ; THE NOCO COMPANY)

Classification: - international: ***H02J7/00; H02J7/14***
- cooperative: **H01M2/30 (US); H01R11/24 (US); H02J1/122 (EP); H02J7/14 (EP, GB, US); H02J7/342 (GB);** F02N11/12 (EP); F02N11/14 (EP); H02J1/122 (US)

Application number: AU20160392707 20160329

Priority number (s): US201662294067P 20160211 ; WO2016US24680 20160329

Also published as: AU2016392707 (B2) AU2020200268 (A1) CA2957431 (A1) CN107852004 (A) DE112016002206 (T5) more

Abstract of AU2016392707 (A1)

The subject matter relates to a battery assembly device for use with an apparatus for jump starting a vehicle, and an apparatus for jump starting a vehicle comprising the battery assembly device. A battery assembly device for a battery jump starting device. The battery assembly is configured to maximize electrical conductivity from a battery pack of the battery jump starting device to a battery to be recharged.

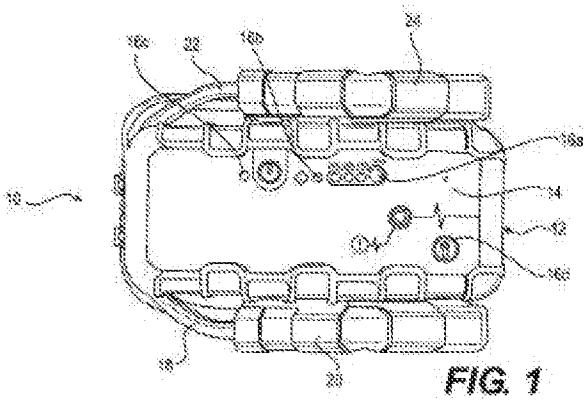

FIG. 1

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(74) Agent: **KLIMA, William, L.**; Vorys, Sater, Seymour and Pease LLP, 1909 K St., NW #900, Washington, DC 20006 (US).

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

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(54) **Title**: BATTERY ASSEMBLY DEVICE

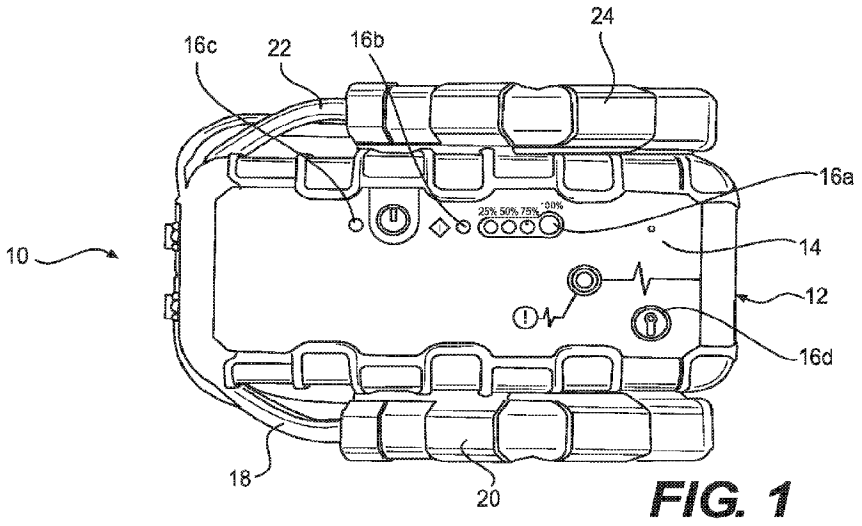


FIG. 1

(57) **Abstract**: The subject matter relates to a battery assembly device for use with an apparatus for jump starting a vehicle, and an apparatus for jump starting a vehicle comprising the battery assembly device. A battery assembly device for a battery jump starting device. The battery assembly is configured to maximize electrical conductivity from a battery pack of the battery jump starting device to a battery to be recharged.

WO 2017/138963 A1

TITLE

BATTERY ASSEMBLY DEVICE

FIELD

A battery assembly device, for example, for use in a battery jump starting device.

BACKGROUND

The exists a portable vehicle battery jump start apparatus as disclosed in U.S. Patent No. 9,007,015 to Nook et al. The apparatus utilizes a lithium ion battery pack. In this type of apparatus, there exists a need to maximize conductivity from the battery pack of the apparatus to the vehicle battery of the vehicle being jump started.

For successful car jump-starts, there are two main factors dictating the results. The first factor is the amount of power provided by the lithium ion battery pack, and the second factor is the maximum conductivity. You need both factors to have the best chance to jump-start big engines. One factor without the other factor is not enough.

SUMMARY

The subject matter relates to a battery assembly device for use with an apparatus for jump starting a vehicle, and an apparatus for jump starting a vehicle comprising the battery assembly device.

The subject matter relates to the following objects.

A battery assembly device comprising or consisting of a battery having at least one battery conductor connected to a terminal of the battery.

A battery assembly device comprising or consisting of a battery having at least one battery conduct connected to a terminal tab of the battery.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery, the battery conductors being soldered to the respective terminal contacts of the battery.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery, and a relay connected to one of the battery conductors of the battery.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery, and a relay connected to the negative battery conductor.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery, and a relay connected to the negative battery conductor.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative

battery conductor connected to a negative terminal contact of the battery, and multiple relays connected to the negative battery conductor.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery, and a positive cable connected to the positive battery conductor.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a front perspective view of the battery jump starting device with the clamps undeployed.

FIG. 2 is a rear perspective view of the battery jump starting device shown in FIG. 1.

FIG. 3 is an end perspective view of the battery jump starting device shown in FIGS. 1 and 2.

FIG. 4 is a front perspective view of the battery jump starting device shown in FIG. 1, however, with the clamps deployed.

FIG. 5 is a perspective view of a battery assembly device contained within the battery jump starting device shown in FIG. 1 when installed therein , however, with the negative cable not yet installed.

FIG. 6 is a top planer view of the battery assembly device shown in FIG. 5.

FIG. 7 is a front elevational view of the battery assembly device shown in FIG. 5.

FIG. 8 is a side view of the bent cable connector for the positive cable.

FIG. 9 is a perspective view of the battery assembly device shown in FIG. 5, with the negative cable connected to the battery assembly device.

FIG. 10 is a perspective view of the battery assembly device shown in FIG. 5 with a diode device installed on the positive cable.

FIG. 11 is a perspective view of the battery assembly device connected to other components or devices of the battery jump starting device.

FIG. 12 is a perspective view of the battery pack device contained within the battery jump starting device shown in FIG. 1 when installed therein.

DETAILED DESCRIPTION

A battery jump starter device 10 is shown in FIGS. 1 and 2. The battery jump starting device 10 comprises a casing 12 having a display 14 provided with an arrangement of light emitting diodes 16 (LEDs). The battery jump starting device 10 further comprises a positive cable 18 having a positive clamp 20 and a negative cable 22 having a negative clamp 24. The positive cable 18 and negative cable 22 pass through openings 12a, 12b in the casing 12, and are wired to an internally located component (i.e. battery assembly device) to be described in detail below.

The clamps 20, 24 are stowed away or docked in an undeployed mode by clamping each to a respective side posts 26 extending outwardly on opposite sides of the casing 12, as shown in FIG. 1. The side posts 26 are shown in FIG. 2. The clamps 20, 24 are docked when the battery jump starter device 10 is in non-use, and unclamped from the side post 26 during use.

The battery jump starting device 10 is configured for jump starting a vehicle battery. For example, the battery jump starting device 10 can be the PORTABLE VEHICLE JUMP START APPARATUS WITH SAFETY PROTECTION disclosed in U.S. Patent No. 9,007,015, which is fully incorporated herein by reference, or an apparatus similar thereto.

The battery jump starting device 10 comprises a variety of electrical components or parts located inside the casing 12. For example, the battery jump starting device 10 comprises the battery assembly 110 shown in FIGS. 5-10 and internal electrical components shown in FIG. 11.

As shown in FIGS. 5-10, the battery assembly 110 comprises a battery 112. For example, the battery 112 is a lithium ion rechargeable type battery. The battery assembly 110 is configured to maximize electrical conductivity from the battery 112 to the cables 18, 22 and clamps 20, 24 of the battery jump starter device 10. The battery 112 comprises a casing, for example, a rectangular-shaped casing 112a.

The battery assembly 110 further comprises a positive terminal conductor bar 114 connected (e.g. soldered) at one end to the positive terminal tab (i.e. contact) of the battery 112. The other end of the positive terminal conductor bar 114 is provided with a conductive loop 116 wrapping around and connected (e.g. crimped and/or soldered) to an exposed conductor end 18a of a cable conductor for the positive cable 18.

As shown in FIGS. 5 and 6, the positive terminal conductor bar 114, for example, can be L-shaped so as to wrap around a square-shaped corner of the rectangular-shaped casing 112a of the battery 112 (e.g. when viewing the battery 112 in plan view).

The L-shaped positive terminal conductor bar 114 extends along an end of the battery 112 and along at least a portion of the side of the battery 112, as shown in FIG. 6.

The positive terminal conductor bar 114 can also be mechanically coupled and/or adhered to the outer surface of the battery casing 112a to provide additional structural support and stability thereof (e.g. to survive mechanical shock in the event of accidentally dropping battery jump starter device 10). For example, the positive terminal conductor bar 114 can be mechanically connected to the battery casing 112a by adhesive (e.g. silicone adhesive), double sided tape, double sided foam tape, insulating plastic or ceramic connector with snap fit connection and/or mechanical fastener.

The positive cable 18 comprises a bent cable portion 118 connecting the positive cable 18 to the positive terminal conductor bar 114. The bent cable portion 118 comprises an outer sleeve portion 118a transitioning into flexible sleeve 120. The flexible sleeve 120 comprises an outer sleeve portion 120a located externally relative to the casing 112 of the battery jump starter device 10, and a flexible inner sleeve portion 120b located internally relative to the casing 112 of the battery jump starter device 10.

The flexible sleeve 120 is configured to reinforce the connection between the positive cable 18 and the casing 12 of the battery jump starter device 10 while remaining flexible. For example, the flexible sleeve 120 is provided with one or more grooves 124 (three (3) shown in FIG. 3) exposing the outer sleeve 18a of the positive cable 18. The one or more grooves 124 act as hinges to ease bending of the positive cable 18 at the location of the flexible outer sleeve portion 120.

The flexible sleeve 120 further comprises an outer flange 124 spaced apart from an inner flange 126 defining a groove 125 therebetween. For example, the outer flange

124 is spaced apart a distance equal to the wall thickness of the casing 12 from the inner flange 126. The flanges 124, 126 are configured to anchor the flexible connector 120 along with the positive cable 18 to the casing 12 of the battery jump starter device 10. A sleeve portion 128 (FIG. 6) of the flexible connector 120 connects together the outer flange 126 and inner flange 128. For example, the flexible sleeve 120 is molded separately and assembled onto the positive cable 18, or molded onto the positive cable 18 to form a single unit. For example, the flexible outer sleeve portion 120 is insert injection molded with a portion of the positive cable 18 inserted within the mold during the molding process. Alternatively, the flexible outer sleeve portion 120 is made (e.g. molded) separately, and then installed or assembled onto a portion of the positive cable 18. For example, the positive cable 18 comprises an inner conductor (e.g. solid wire conductor or multi-strand metal wire conductor, e.g. made of copper, aluminum) and an outer insulating sleeve 18a (e.g. molded plastic sleeve). The flexible sleeve 120 can be applied (e.g. molded or installed or assembled) onto and surrounding the outer sleeve 18a of the positive cable 18.

The battery assembly 110 further comprises a negative terminal conductor bar 130 connected (e.g. soldered) at one end to the negative terminal tab (i.e. contact) of the battery 112. The other end of the negative terminal conductor bar 130 is provided with a negative terminal conductor bar connector portion 132, as shown in FIG. 5.

The negative terminal conductor bar 130 can be L-shaped to wrap around a corner of the rectangular-shaped battery 112, as shown in FIG. 6. The L-shaped negative terminal conductor bar 130 extends along an end of the battery 112 and along at least a portion of the side of the battery 112.

The negative terminal conductor bar 130 can also be mechanically coupled and/or adhered to the outer surface of the battery casing 112a to provide additional support and stability thereof (e.g. to survive mechanical shock in the event of accidental dropping battery jump starter device 10). For example, the negative terminal conductor bar 114 can be mechanically connected to the battery casing 112a by adhesive (e.g. silicon adhesive), double sided tape, double sided foam tape, insulating plastic or ceramic connector with snap fit connection and/or mechanical fastener.

The battery assembly 110 further comprises a smart switch battery interface 134, as shown in FIG. 5. The smart switch battery interface 134 comprises a circuit board 136 having a first circuit board conductor bar 138 spaced apart from a second circuit board conductor bar 140 both located on one side of the circuit board 136, as shown in FIG. 5.

A pair of relays 142 are mounted on an opposite side of the circuit board 136. The relays 142 include relay anchoring pins 142a extending through the slots 136a in the circuit board 136 (FIG. 5). The relays 142 further include first relay connector pins 142b extending through the slots located in both in the circuit board 136 and through slots 132a in the negative terminal conductor bar connector portion 132. The relays 142 even further include second relay connector pins 142c extending through the slots located in both the circuit board 136, windows 138a of the first circuit board conductor bar 138, and the slots 132a provided in the first conductor bar 138. The relay anchoring pins 136a are soldered in place to mechanically connect the relays 142 to the circuit board 136. The relay connecting pins 142b and 142c are soldered in place to

mechanically and electrically connect the relays 142, respectively, to the circuit board conductor plates 138, 140.

The slots 136a in the circuit board 136, for example, are rectangular-shaped (FIG. 5), and accommodate the rectangular-shaped relay anchoring pins 142a. Specifically, a base portion of the relay anchoring pins 142a are rectangular-shaped transitioning to square-shaped ends. The square-shaped ends are dimensionally less wide verses the base portions creating transverse edges oriented flush with the outer surface of the circuit board 136. When solder is applied to the exposed ends of the relay anchoring pins 142a, the solder connects to the sides of the square-shaped ends and transverse edges to anchor and lock the relay anchoring pins 142a to the circuit board 136.

The slots 132a are provided in negative terminal conductor bar connector portion 132, and the slots 138a in the first circuit board conductor bar 138 are rectangular-shaped. The slots140a in the second circuit board conductor bar 140 (FIG. 5) are T-shaped to accommodate the three (3) horizontally oriented relay connector pins 142b. The ends of the relay connector pins 142b are shown flush with the outer surface of the negative terminal conductor bar connector portion 132. When solder is applied to the exposed ends of the relay connector pins 142b, the solder fills in the slots 132a in the negative terminal conductor bar connector portion 132 and the slots 138a of the first circuit board conductor bar 138, and connects the sides of the connector pins 142b with inner edges of the slots 132a and slots 138a to anchoring the relays 142 to the circuit board 136 and negative terminal conductor bar connector portion 132. This applied

solder also electrically connects the negative terminal conductor bar connector portion 132 to the first circuit board conductor bar 138.

The slots 140a provided in the second circuit board conductor bar 140 are T-shaped to accommodate the three (3) vertically oriented second relay connecting pins 142c. The second relay connector prongs 142c extend outwardly from the outer surface of the circuit board 136 to connect with the exposed cable end 14a of the negative cable 14, as shown in FIG. 9. When solder is applied to the ends of the second relay connector prongs 142c, the solder fills in the T-shaped slots 140a (FIG. 5) and electrically connects the second relay connector prongs140c to the second circuit board conductor bar 140. The exposed cable end 22a of the negative cable 22 is soldered to the second relay connector prongs 142c (FIG. 5), as shown in FIG. 9.

The negative terminal conductor bar connector portion 132 of the negative terminal conductor bar 130 is connected (e.g. by soldering) to the first circuit board conductor bar 138 of the circuit board 136. Again, the exposed cable end 22a (i.e. with the insulating sleeve removed) of the negative cable 22 is connected (e.g. by soldering) to the second circuit board conductor bar 140, as shown in FIG. 9. The negative cable 22 is fitted with a flexible sleeve 118, as shown in FIG. 11.

As an alternative to the arrangement of the bent cable connector 118 (FIG. 5), a diode device 150 is installed onto (i.e. spliced into) the flexible cable connector 118, as shown in FIG. 10. The diode device 150 comprises a circuit board 152 provided with a set of back-charge diodes 154 located on one side thereof, and a conductor bar 156 provided on an opposite side of the circuit board 152.

ASSEMBLY

The battery jump starting device 10 comprises the casing 12 having an upper casing portion 12a and a lower casing portion 12b, as shown in FIG. 11. The upper casing portion 12a and the lower casing portion 12b are configured to be connected together when assembling the battery jump starting device 10.

The battery jump starting device 10 further comprises the battery assembly 110 and controller assembly 210 both disposed within the casing 12 when assembling the battery jump starting device 10, as shown in FIG. 11. The controller assembly 210 comprises a circuit board 212 located adjacent to another circuit board 214.

The positive terminal of the battery assembly 110 is connected to the circuit board 212 via a positive power wire 216, as shown in FIG. 11. For example, the positive power wire 216 is soldered to the positive conductor bar 114 (FIG. 5). The negative terminal of the battery assembly 110 is connected to the circuit board 214 via a negative power wire 218.

The relay circuit board 136 is provided with a wire set 220 having a connector 222, as shown in FIG. 11. The connector 222 is configured to connect with the relay board connector 224 located on the circuit board 212 of the controller assembly 210 during assembly of the battery jump starting device 10, as shown in FIG. 11.

The battery assembly 110 further comprises a wire set 226 having a connector 228, as shown in FIG. 11. The connector 228 is configured to connect with the battery cell charging/monitoring connector 230 located on the circuit board 212 of the controller assembly 220.

The battery assembly 110 also comprises a battery temperature sensor having a wire set 232 having a connector 234, as shown in FIG. 11. The connector 234 is configured to connect with the temperature sensor connector 236 located on the circuit board 212 of the controller assembly 220.

The circuit board 212 is provided with in charge power resistors 240 and an out relay 242, as shown in FIG. 11. Further, the lower casing portion 12a is provided with a main user out connector 244 having a wire set 246 connected to the circuit board 214, and a main user in connector 248 having a wire set 250 connected to the circuit board 214.

The battery assembly 110 is connected to battery jump starting device 10, as shown in FIG. 11. The battery connector device 110 is installed within the casing 12 of the battery jump starting device 10 when assembled.

CLAIMS

1. A battery assembly device for a battery jump starting device having a smart switch, the device comprising:

a battery comprising a positive terminal tab and a negative terminal tab;

a positive terminal conductor bar connected to the positive terminal tab of the battery;

a negative terminal conductor bar connected to the negative terminal tab of the battery;

a positive cable connected to the positive terminal conductor bar; and

a smart switch interface connectable to the smart switch of the jump starting device, the smart switch interface comprising a circuit board having a first circuit board conductor bar and a second circuit board conductor spaced apart from each other on the circuit board, the smart switch interface further comprising one or more relays connected between the first circuit board conductor bar and the second circuit board conductor bar for providing isolation between the negative terminal tab of the battery and a battery being jump started.

2. A battery assembly device for a battery jump starting device having a smart switch, the device comprising:

a rectangular-shaped battery comprising a positive terminal tab and a negative terminal tab;

a positive terminal conductor bar connected to the positive terminal tab of the battery;

a negative terminal conductor bar connected to the negative terminal tab of the battery;

a positive cable connected to the positive terminal conductor bar by a flexible cable connector; and

a smart switch interface connectable to the smart switch of the jump starting device, the smart switch interface comprising a circuit board having a first circuit board conductor bar and a second circuit board conductor spaced apart from each other on the circuit board, the smart switch interface further comprising one or more relays connected between the first circuit board conductor bar and the second circuit board conductor bar for providing isolation between the negative terminal tab of the battery being jump started.

3. A battery assembly device for a battery jump starting device having a smart switch, the device comprising:

a rectangular-shaped battery comprising a positive terminal tab and a negative terminal tab each located at opposite ends of the battery;

an L-shaped positive terminal conductor bar connected to the positive terminal tab of the battery, the L-shaped positive terminal bending around a corner of the battery and extending along at least a portion of a side of the battery;

an L-shaped negative terminal conductor bar connected to the negative terminal tab of the battery, the L-shaped negative terminal bending around a corner of the battery and extending along at least a portion of a side of the battery;

a positive cable connected to the positive terminal conductor bar; and

a smart switch interface connectable to the smart switch of the jump starting device, the smart switch interface comprising a circuit board having a first circuit board conductor bar and a second circuit board conductor spaced apart from each other on the circuit board, the smart switch interface further comprising one or more relays connected between the first circuit board conductor bar and the second circuit board conductor bar for providing isolation between the negative terminal tab of the battery being jump started.

4. The device according to claim 1, wherein the relay is multiple relays connected in parallel between the first circuit board conductor bar and the second circuit board conductor bar.

5. The device according to claim 1, wherein the negative terminal conductor bar mechanically and electrically connects the battery to the smart switch battery interface.

6. The device according to claim 5, wherein the smart switch battery interface is positioned above and adjacent to the battery by the negative terminal conductor bar.

7. The device according to claim 1, wherein one end of the positive cable is configured to at least partial wrap around an exposed cable conductor end of the positive cable.

8. The device according to claim 1, wherein the positive terminal conductor bar is ultrasonically welded to the positive terminal tab of the battery and the negative terminal conductor bar is ultrasonically welded to the negative terminal tab of the battery.

9. The device according to claim 1, wherein the battery is rectangular-shaped, and the positive terminal conductor bar and the negative terminal conductor bar are L-shaped and wrap around a respective corner of the battery.

10. The device according to claim 9, wherein the battery tabs aremounted flush with a casing of the battery.

11. The device according to claim 1, wherein the positive cable is connected to the positive terminal conductor bar by a flexible cable connector.

12. The device according to claim 11, wherein the flexible cable connector comprises a flexible outer sleeve portion and a flexible inner sleeve portion.

13. The device according to claim 12, wherein the flexible outer sleeve portion comprises an outer flange, and the flexible inner sleeve portion comprises an inner flange, the outer flange and inner flange sandwiching a casing wall of the battery jump starting device.

14. The device according to claim 11, wherein the flexible cable connector comprises an inner serpentine cable portion.

15. The device according to claim 14, wherein the flexible cable connector is configured to accommodate the positive cable oriented at an angle relative to a casing wall of the battery jump starting device, and the inner serpentine cable portion is configured to accommodate a misalignment between the angle relative to the casing wall and an angle of attachment of the inner serpentine cable portion with the positive terminal conductor bar.

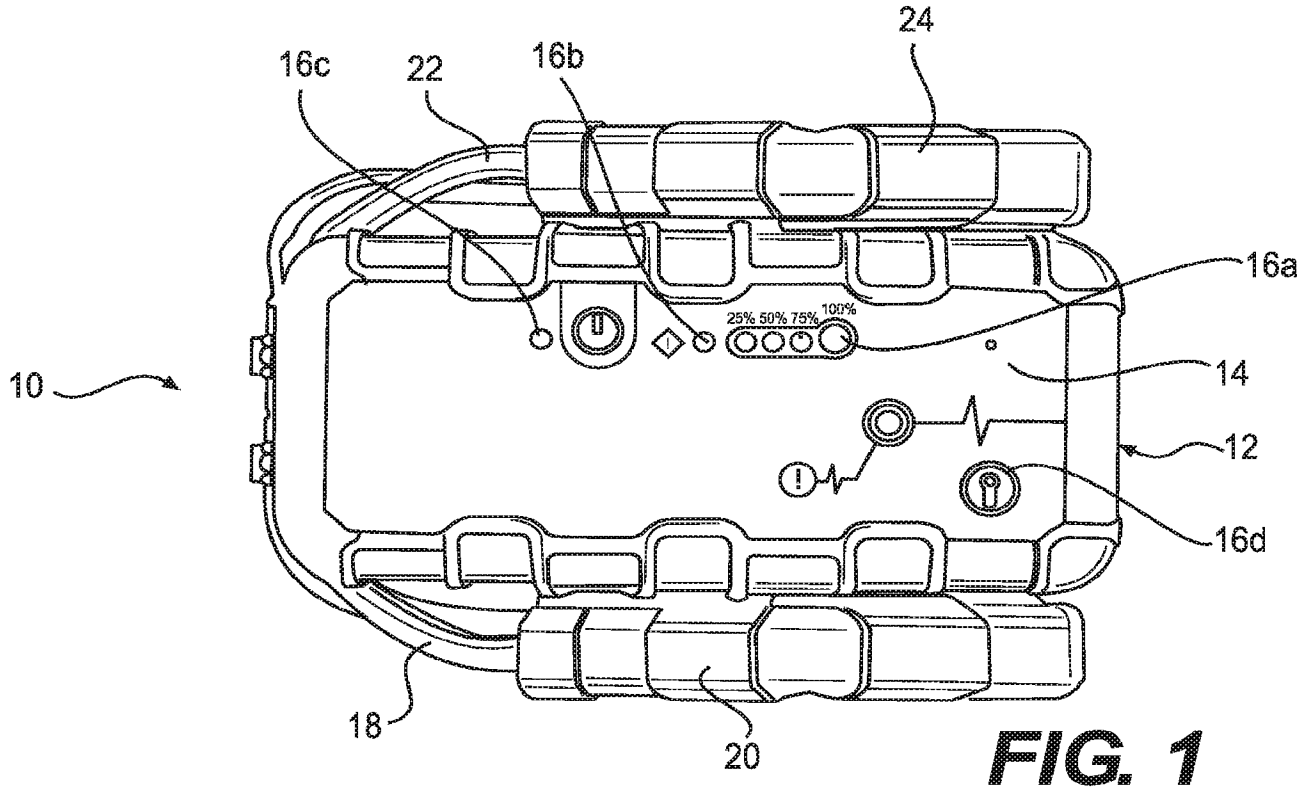


FIG. 1

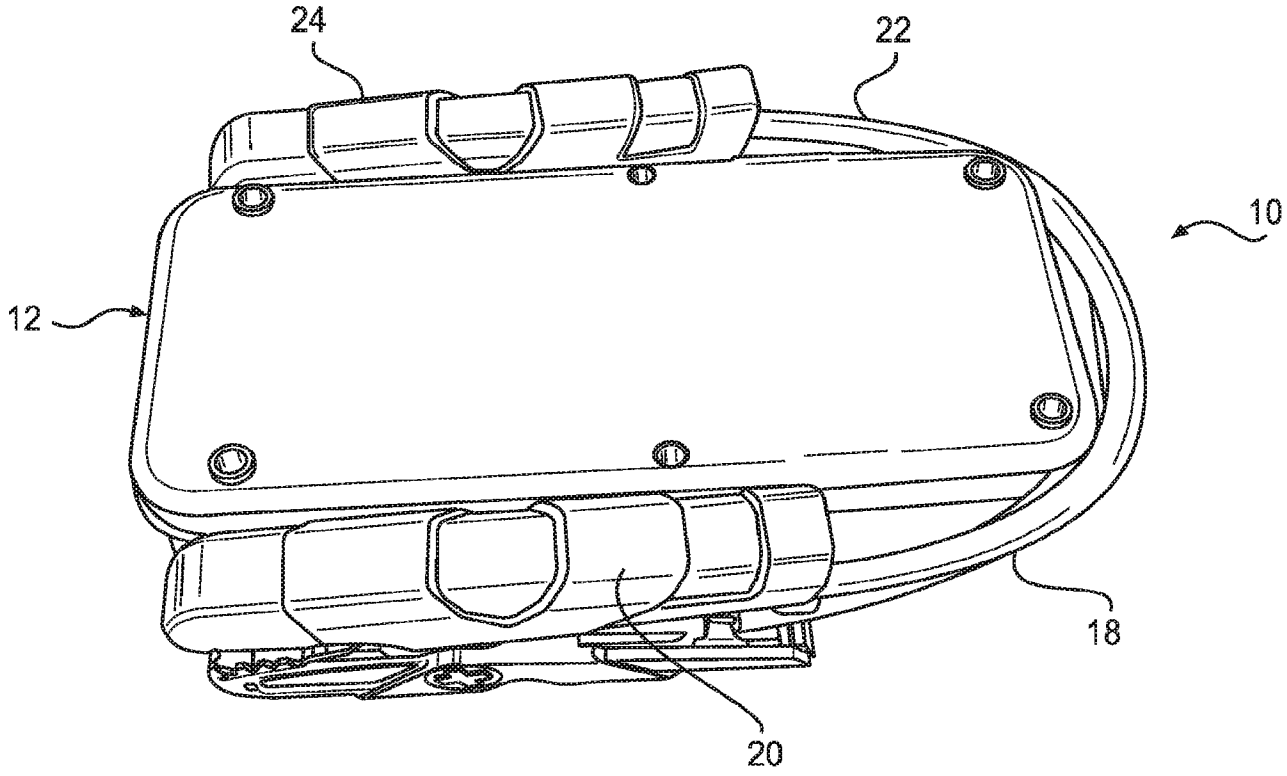


FIG. 2

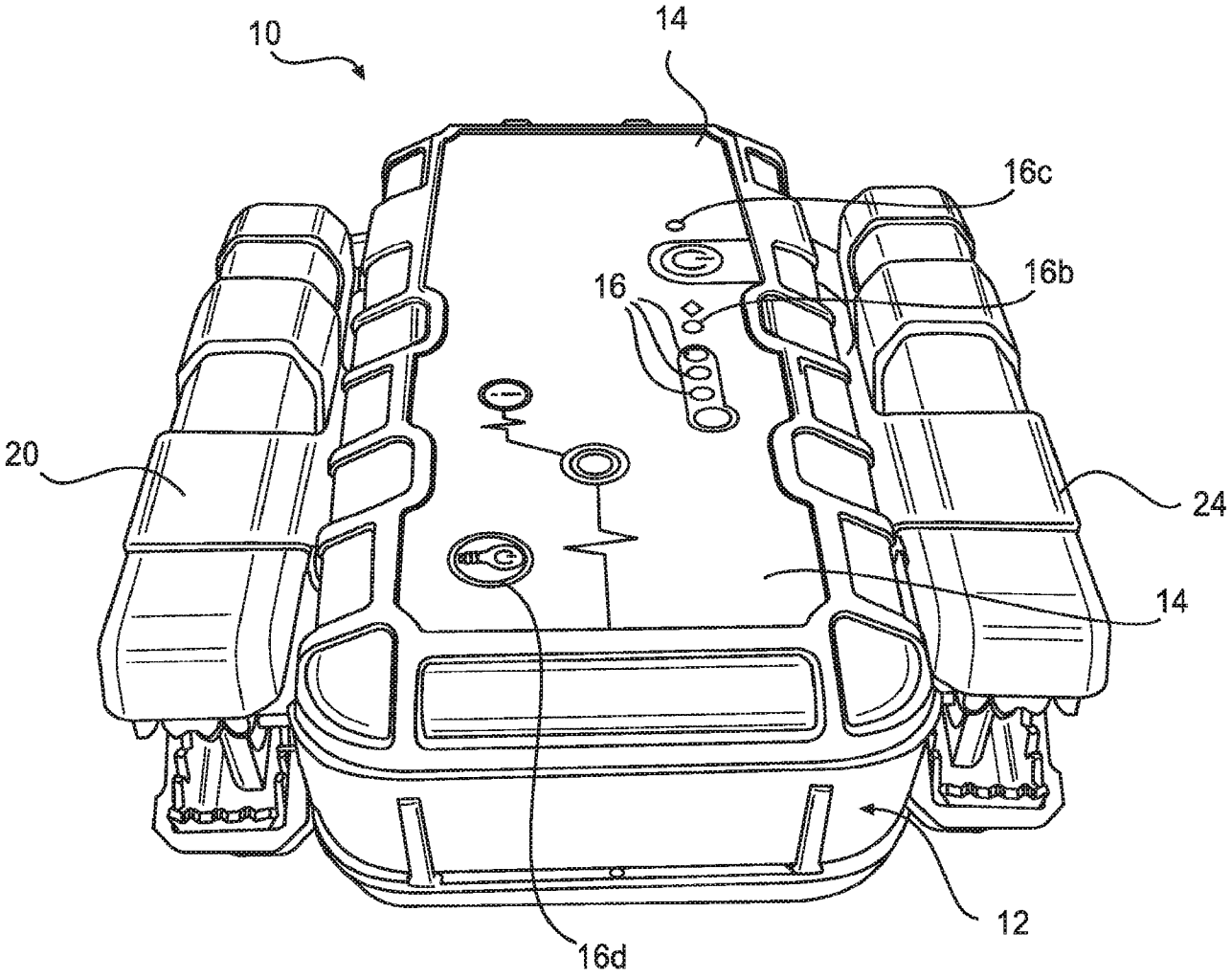


FIG. 3

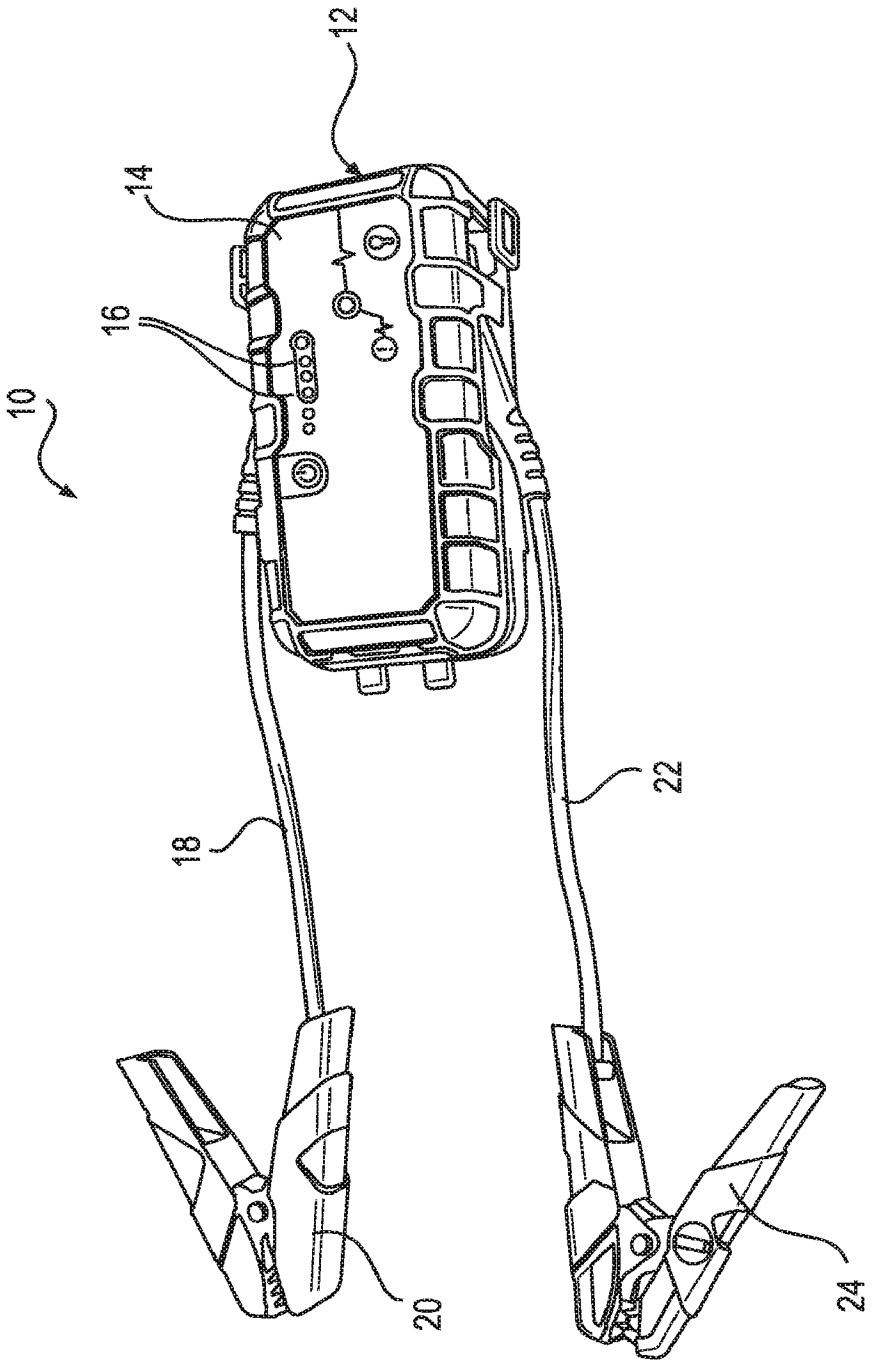


FIG. 4

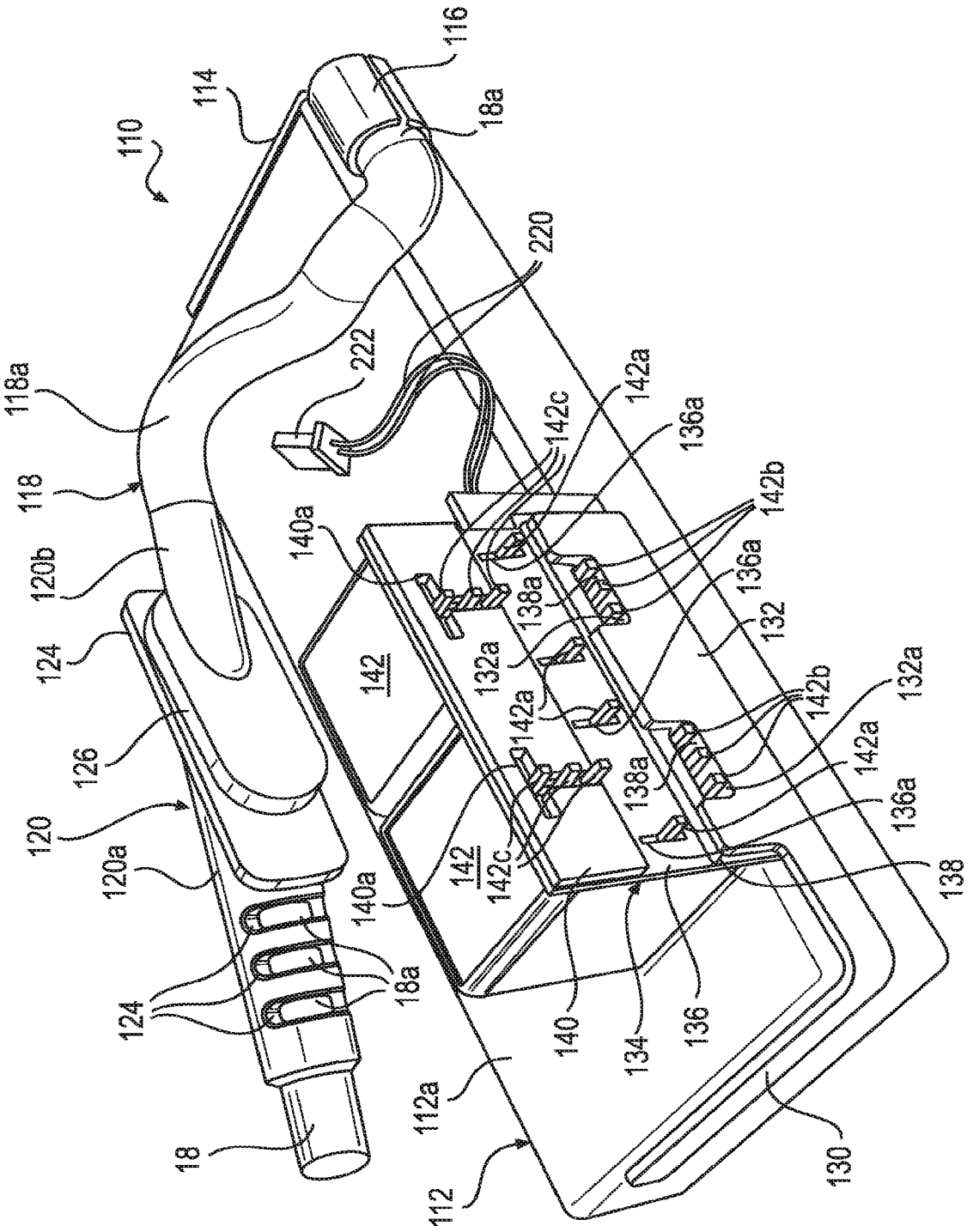
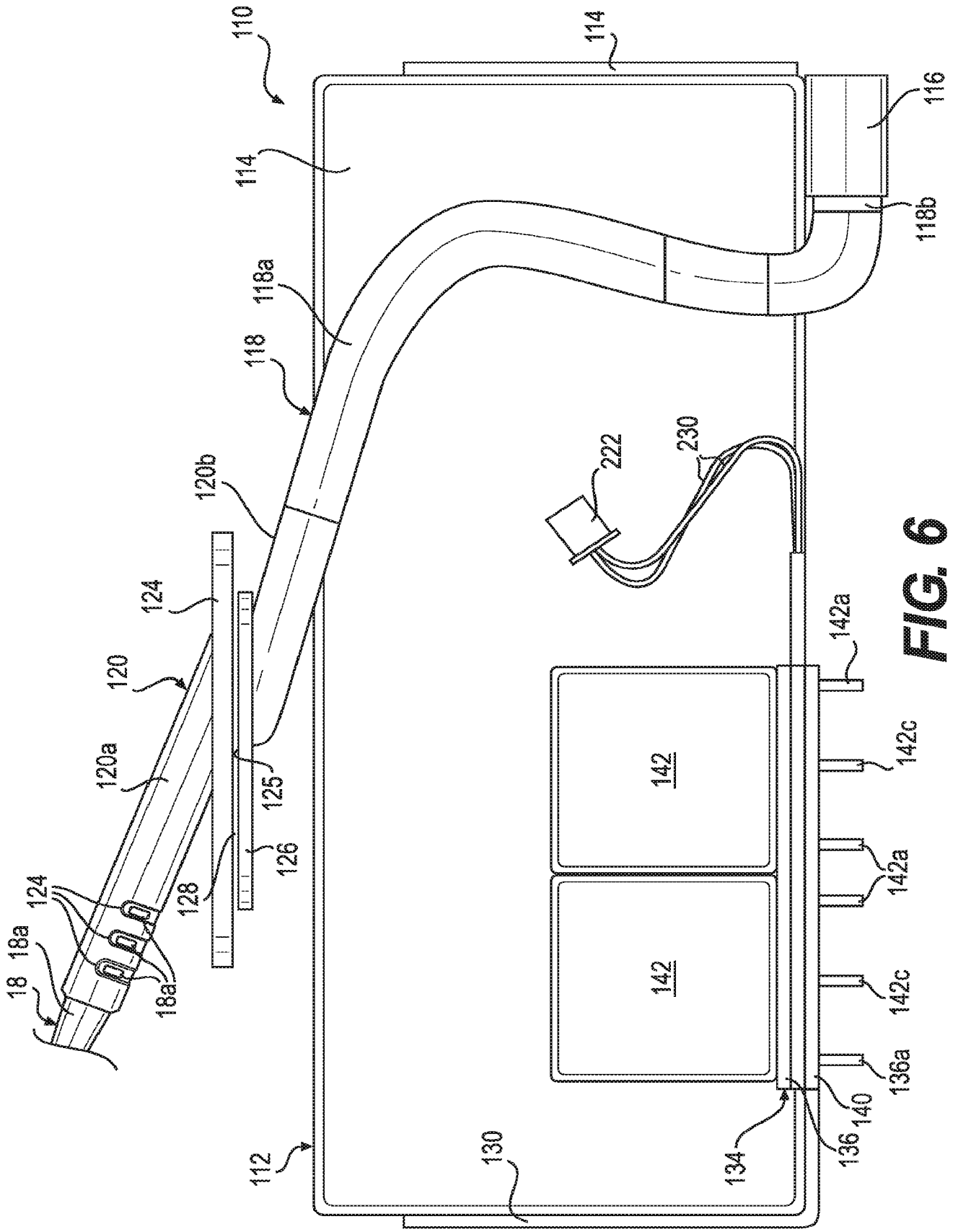

110
114
116
18a
220
222
118a
118
120b
124
126
120
120a
124
18a
18
112a
112
130
140
134
136
138
136a
142a
142b
142c
132
132a
138a
140a
142

FIG. 5


110
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116
118b
118a
118
120b
222
230
124
120
120a
125
126
128
124
18a
18
18a
142a
142c
142
142a
142
142c
136a
140
136
134
112
130

FIG. 6

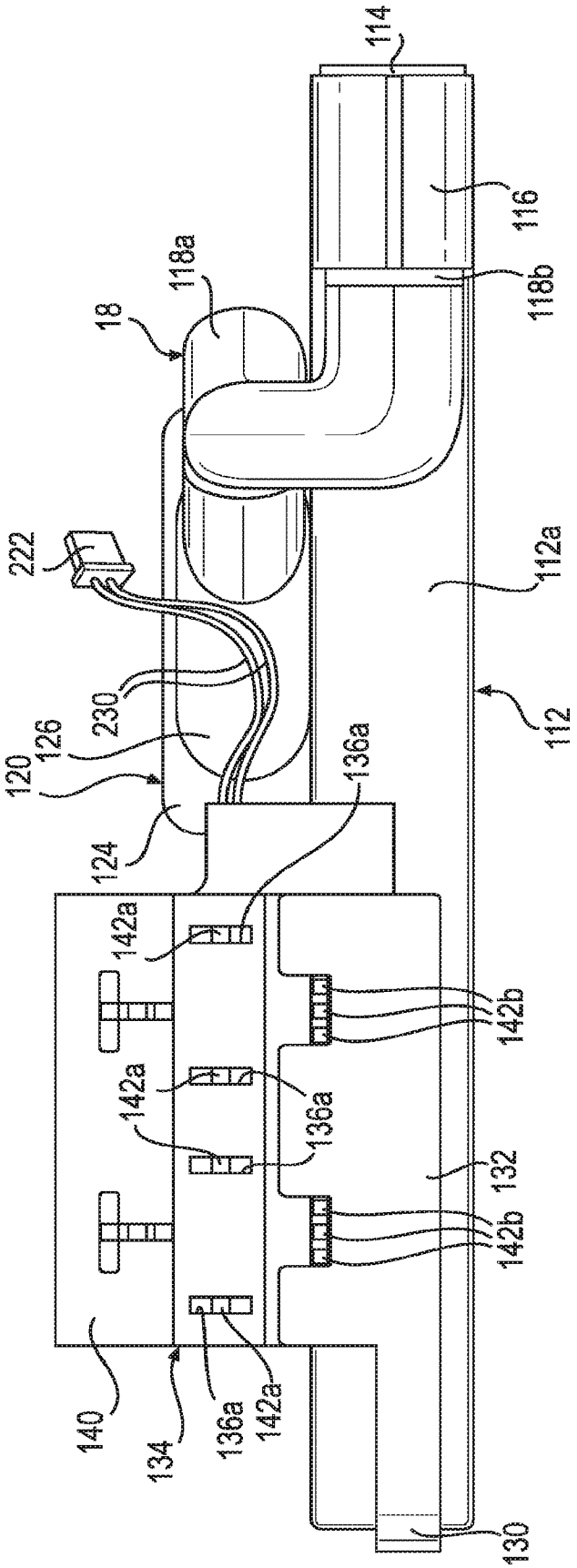

114
116
118a
118b
18
222
112a
230
126
120
112
136a
124
142a
142b
142a
136a
132
142b
140
134
136a
142a
130

FIG. 7

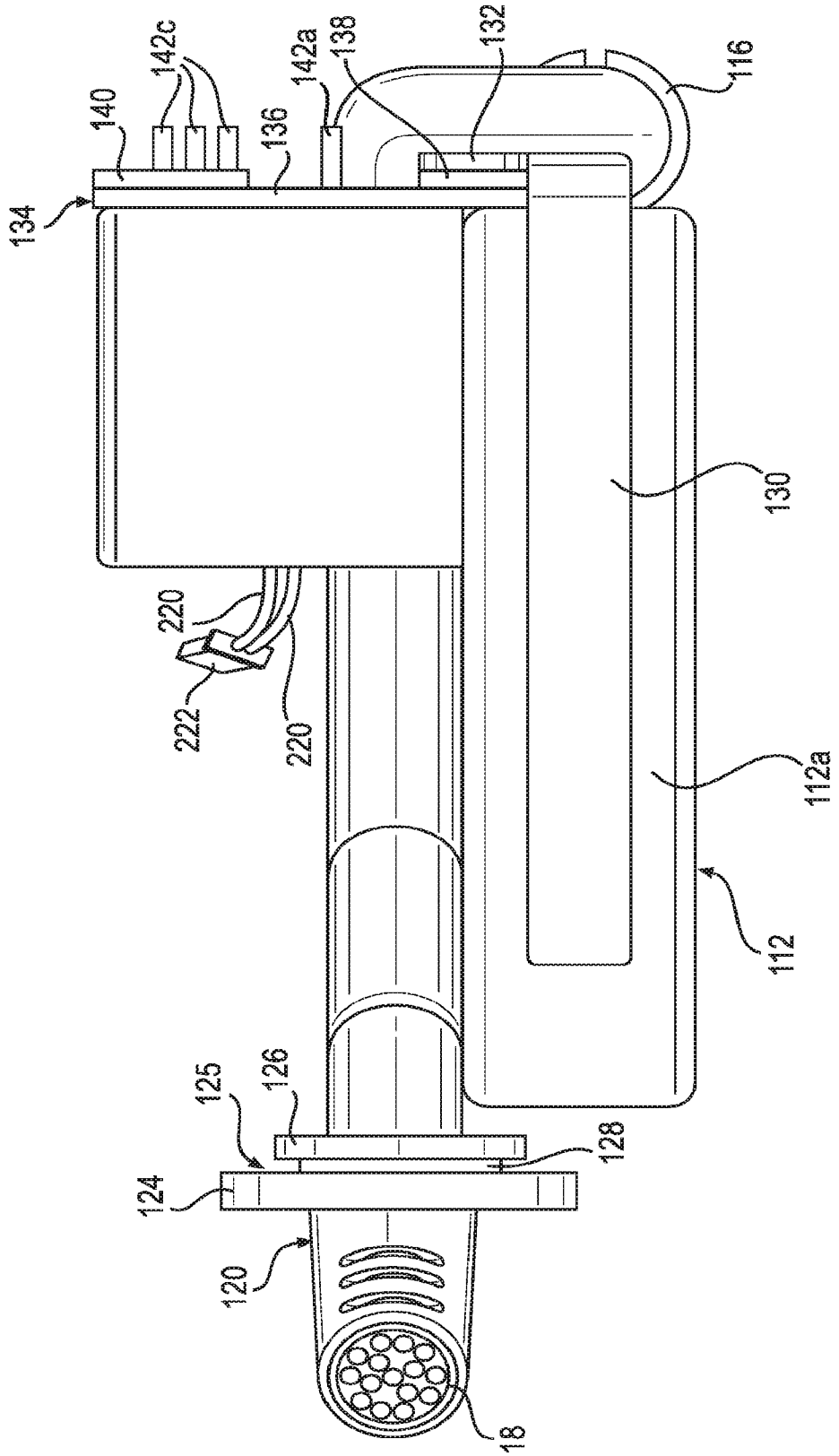

142c
142a
138
132
116
140
136
134
130
220
222
220
112a
112
125
126
128
124
120
18

FIG. 8

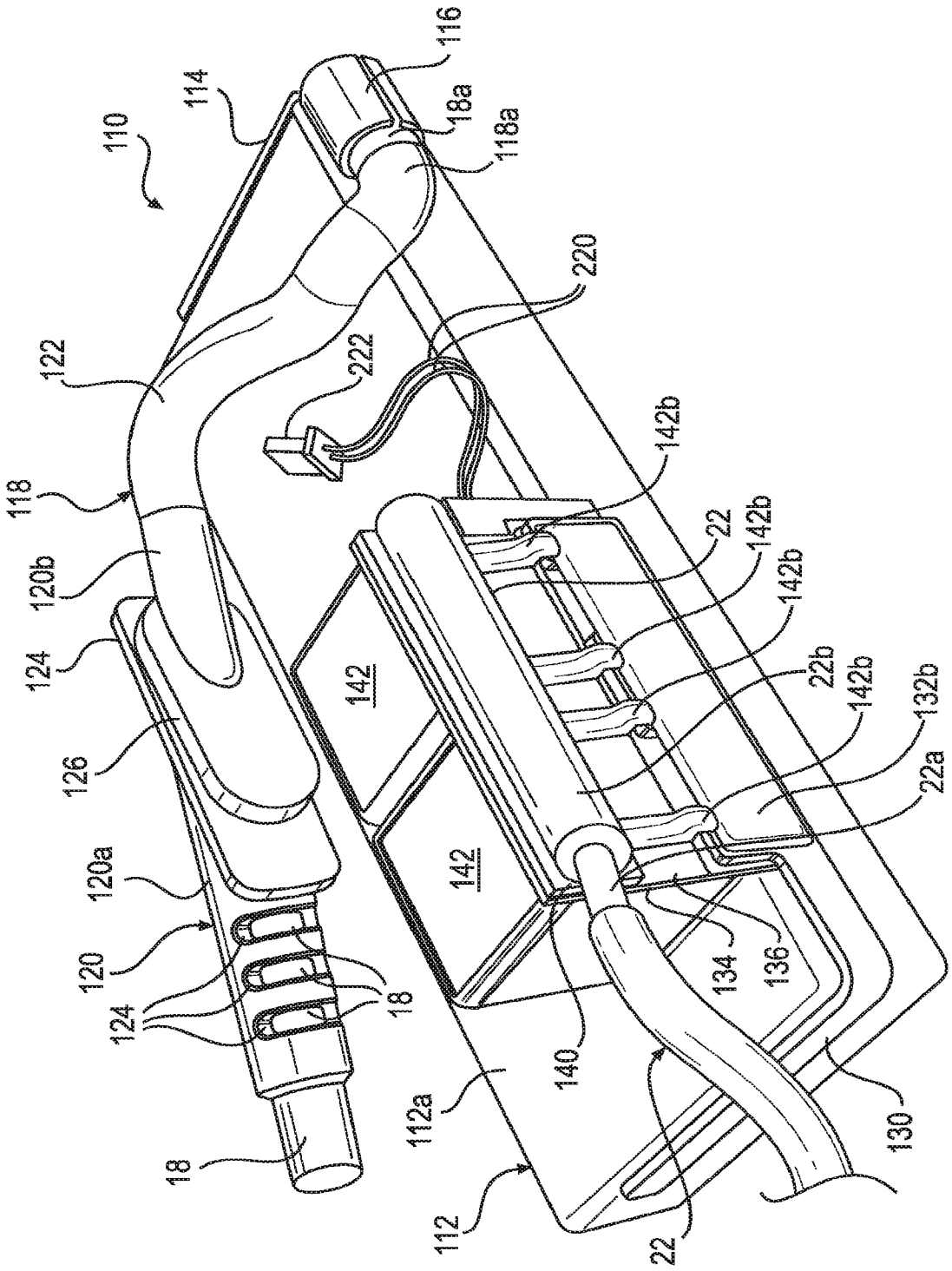
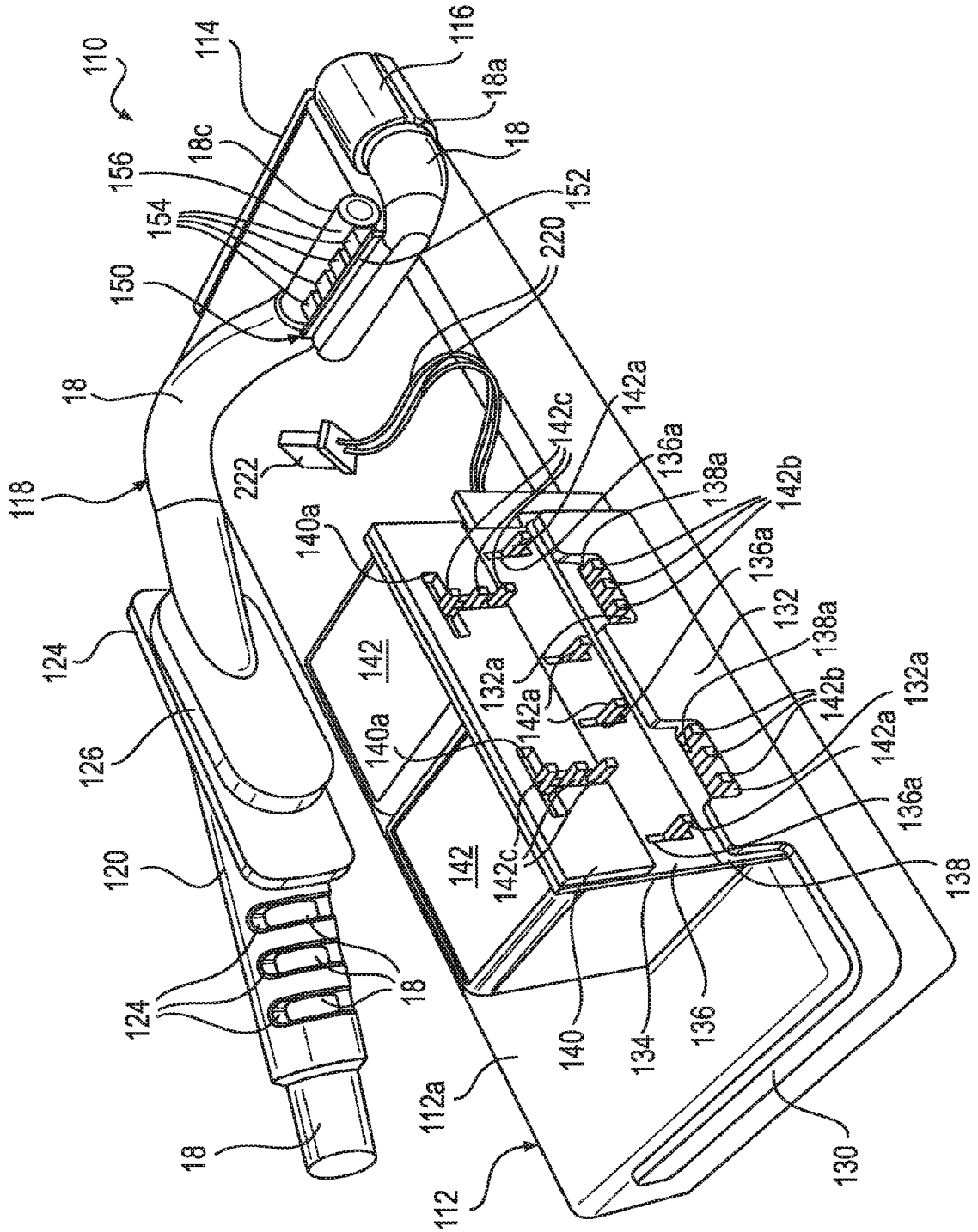

110
114
116
18a
118a
220
222
122
118
120b
124
126
120a
120
124
18
18
142
142
142b
22
142b
142b
22b
142b
132b
22a
134
136
140
112a
112
22
130

FIG. 9


110
114
116
18a
18
18c
156
154
152
150
220
18
118
222
142c
142a
136a
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142b
140a
136a
132
138a
124
142
132a
142a
142b
132a
126
140a
142a
136a
120
142
142c
138
124
18
140
134
136
112a
18
112
130

FIG. 10

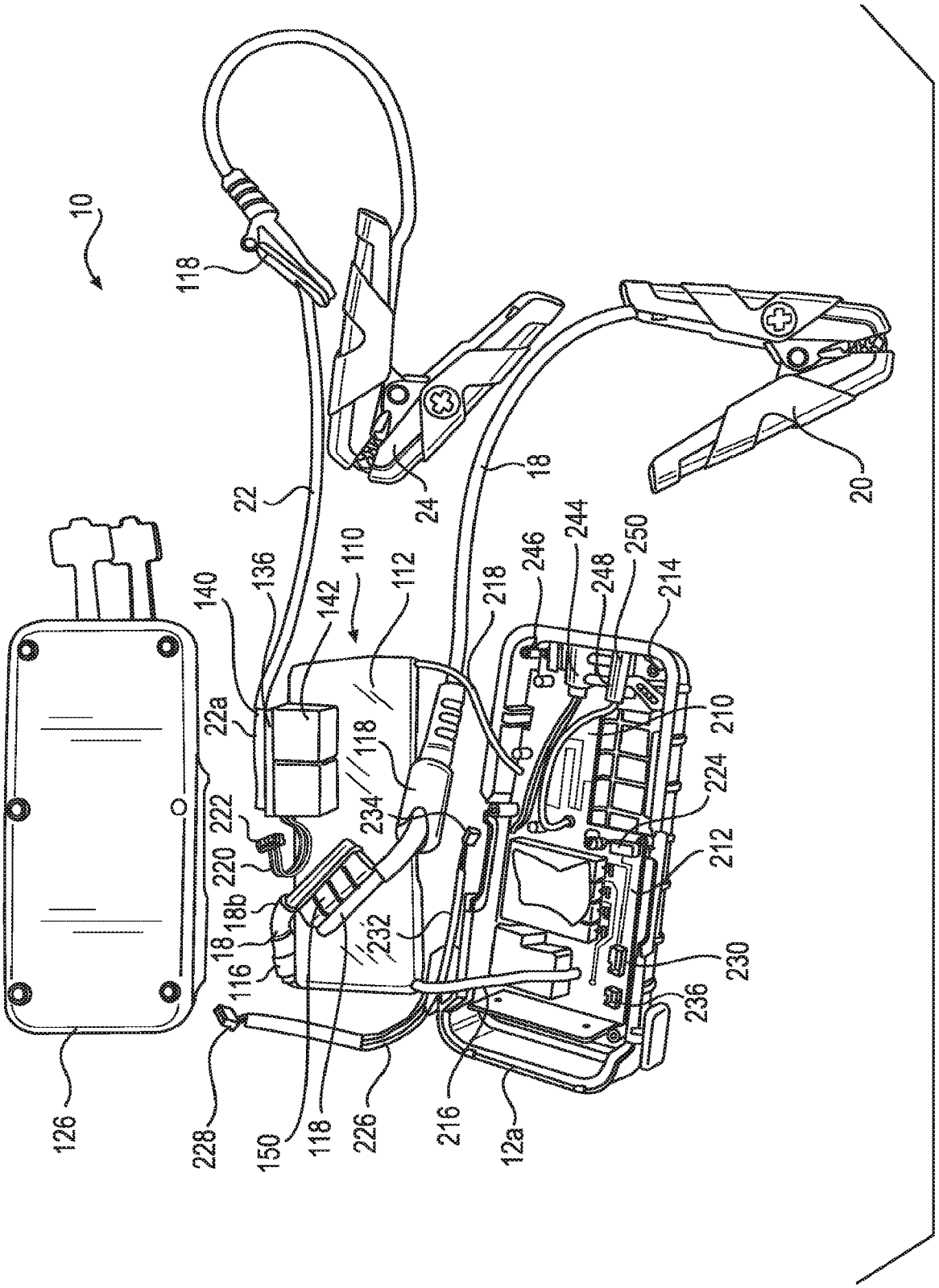
10
118
22
24
18
20
140
136
142
110
112
218
246
244
248
250
214
210
224
212
230
236
22a
222
220
18b
18
116
234
232
126
228
150
118
226
216
12a

FIG. 11

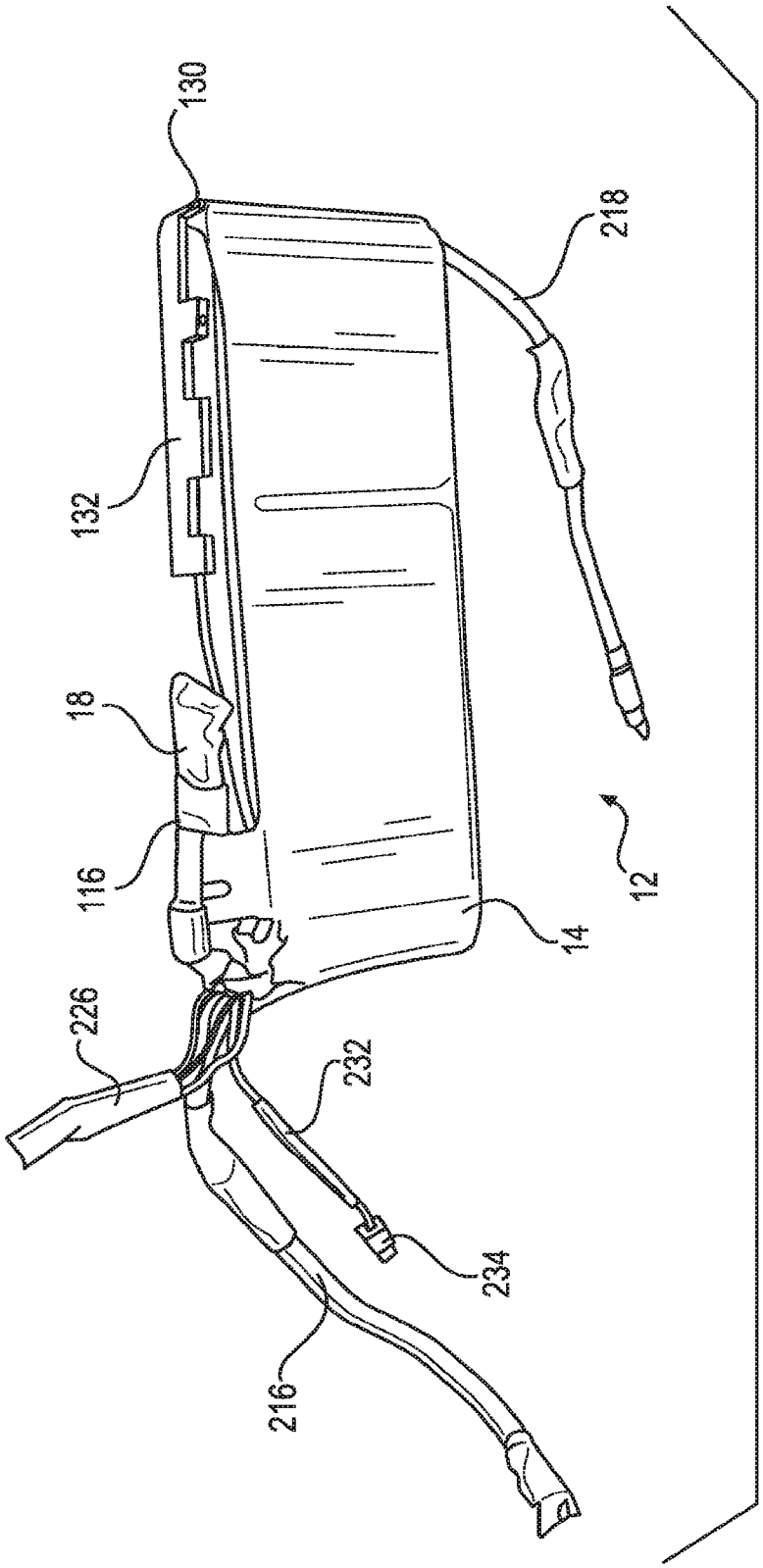

FIG. 12

Espacenet

Bibliographic data: CA2957431 (A1) — 2017-08-11

BATTERY ASSEMBLY DEVICE

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Classification: **- international:** ***F02N11/12; H01M10/44; H01M2/34; H02J7/00***
- cooperative: **H01M2/30 (US); H01R11/24 (US); H02J1/122 (EP); H02J7/14 (EP, GB, US); H02J7/342 (GB);** F02N11/12 (EP); F02N11/14 (EP); H02J1/122 (US)

Application number: CA20162957431 20160329 Global Dossier

Priority number(s): US201662294067P 20160211 ; WO2016US24680 20160329

Also published as: AU2016392707 (A1) AU2016392707 (B2) AU2020200268 (A1) CN107852004 (A) DE112016002206 (T5) more

Abstract of CA2957431 (A1)

A battery assembly device for a battery jump starting device. The battery assembly is configured to maximize electrical conductivity from a battery pack of the battery jump starting device to a battery to be recharged.

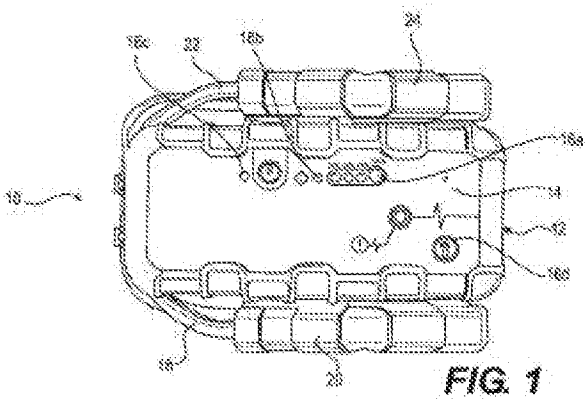

FIG. 1

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(54) Titre : DISPOSITIF D'ASSEMBLAGE DE BATTERIE
(54) Title: BATTERY ASSEMBLY DEVICE

(57) Abrégé/Abstract:
A battery assembly device for a battery jump starting device. The battery assembly is configured to maximize electrical conductivity from a battery pack of the battery jump starting device to a battery to be recharged.

ABSTRACT

A battery assembly device for a battery jump starting device. The battery assembly is configured to maximize electrical conductivity from a battery pack of the battery jump starting device to a battery to be recharged.

TITLE

BATTERY ASSEMBLY DEVICE

FIELD

A battery assembly device, for example, for use in a battery jump starting device.

BACKGROUND

The exists a portable vehicle battery jump start apparatus as disclosed in U.S. Patent No. 9,007,015 to Nook et al. The apparatus utilizes a lithium ion battery pack. In this type of apparatus, there exists a need to maximize conductivity from the battery pack of the apparatus to the vehicle battery of the vehicle being jump started.

For successful car jump-starts, there are two main factors dictating the results. The first factor is the amount of power provided by the lithium ion battery pack, and the second factor is the maximum conductivity. You need both factors to have the best chance to jump-start big engines. One factor without the other factor is not enough.

SUMMARY

The subject matter relates to a battery assembly device for use with an apparatus for jump starting a vehicle, and an apparatus for jump starting a vehicle comprising the battery assembly device.

The subject matter relates to the following objects.

A battery assembly device comprising or consisting of a battery having at least one battery conductor connected to a terminal of the battery.

A battery assembly device comprising or consisting of a battery having at least one battery conduct connected to a terminal tab of the battery.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery, the battery conductors being soldered to the respective terminal contacts of the battery.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery, and a relay connected to one of the battery conductors of the battery.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery, and a relay connected to the negative battery conductor.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery, and a relay connected to the negative battery conductor.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative

battery conductor connected to a negative terminal contact of the battery, and multiple relays connected to the negative battery conductor.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery, and a positive cable connected to the positive battery conductor.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a front perspective view of the battery jump starting device with the clamps undeployed.

FIG. 2 is a rear perspective view of the battery jump starting device shown in FIG. 1.

FIG. 3 is an end perspective view of the battery jump starting device shown in FIGS. 1 and 2.

FIG. 4 is a front perspective view of the battery jump starting device shown in FIG. 1, however, with the clamps deployed.

FIG. 5 is a perspective view of a battery assembly device contained within the battery jump starting device shown in FIG. 1 when installed therein , however, with the negative cable not yet installed.

FIG. 6 is a top planer view of the battery assembly device shown in FIG. 5.

FIG. 7 is a front elevational view of the battery assembly device shown in FIG. 5.

FIG. 8 is a side view of the bent cable connector for the positive cable.

FIG. 9 is a perspective view of the battery assembly device shown in FIG. 5, with the negative cable connected to the battery assembly device.

FIG. 10 is a perspective view of the battery assembly device shown in FIG. 5 with a diode device installed on the positive cable.

FIG. 11 is a perspective view of the battery assembly device connected to other components or devices of the battery jump starting device.

FIG. 12 is a perspective view of the battery pack device contained within the battery jump starting device shown in FIG. 1 when installed therein.

DETAILED DESCRIPTION

A battery jump starter device 10 is shown in FIGS. 1 and 2. The battery jump starting device 10 comprises a casing 12 having a display 14 provided with an arrangement of light emitting diodes 16 (LEDs). The battery jump starting device 10 further comprises a positive cable 18 having a positive clamp 20 and a negative cable 22 having a negative clamp 24. The positive cable 18 and negative cable 22 pass through openings 12a, 12b in the casing 12, and are wired to an internally located component (i.e. battery assembly device) to be described in detail below.

The clamps 20, 24 are stowed away or docked in an undeployed mode by clamping each to a respective side posts 26 extending outwardly on opposite sides of the casing 12, as shown in FIG. 1. The side posts 26 are shown in FIG. 2. The clamps 20, 24 are docked when the battery jump starter device 10 is in non-use, and unclamped from the side post 26 during use.

The battery jump starting device 10 is configured for jump starting a vehicle battery. For example, the battery jump starting device 10 can be the PORTABLE VEHICLE JUMP START APPARATUS WITH SAFETY PROTECTION disclosed in U.S. Patent No. 9,007,015, which is fully incorporated herein by reference, or an apparatus similar thereto.

The battery jump starting device 10 comprises a variety of electrical components or parts located inside the casing 12. For example, the battery jump starting device 10 comprises the battery assembly 110 shown in FIGS. 5-10 and internal electrical components shown in FIG. 11.

As shown in FIGS. 5-10, the battery assembly 110 comprises a battery 112. For example, the battery 112 is a lithium ion rechargeable type battery. The battery assembly 110 is configured to maximize electrical conductivity from the battery 112 to the cables 18, 22 and clamps 20, 24 of the battery jump starter device 10. The battery 112 comprises a casing, for example, a rectangular-shaped casing 112a.

The battery assembly 110 further comprises a positive terminal conductor bar 114 connected (e.g. soldered) at one end to the positive terminal tab (i.e. contact) of the battery 112. The other end of the positive terminal conductor bar 114 is provided with a conductive loop 116 wrapping around and connected (e.g. crimped and/or soldered) to an exposed conductor end 18a of a cable conductor for the positive cable 18.

As shown in FIGS. 5 and 6, the positive terminal conductor bar 114, for example, can be L-shaped so as to wrap around a square-shaped corner of the rectangular-shaped casing 112a of the battery 112 (e.g. when viewing the battery 112 in plan view).

The L-shaped positive terminal conductor bar 114 extends along an end of the battery 112 and along at least a portion of the side of the battery 112, as shown in FIG. 6.

The positive terminal conductor bar 114 can also be mechanically coupled and/or adhered to the outer surface of the battery casing 112a to provide additional structural support and stability thereof (e.g. to survive mechanical shock in the event of accidentally dropping battery jump starter device 10). For example, the positive terminal conductor bar 114 can be mechanically connected to the battery casing 112a by adhesive (e.g. silicone adhesive), double sided tape, double sided foam tape, insulating plastic or ceramic connector with snap fit connection and/or mechanical fastener.

The positive cable 18 comprises a bent cable portion 118 connecting the positive cable 18 to the positive terminal conductor bar 114. The bent cable portion 118 comprises an outer sleeve portion 118a transitioning into flexible sleeve 120. The flexible sleeve 120 comprises an outer sleeve portion 120a located externally relative to the casing 112 of the battery jump starter device 10, and a flexible inner sleeve portion 120b located internally relative to the casing 112 of the battery jump starter device 10.

The flexible sleeve 120 is configured to reinforce the connection between the positive cable 18 and the casing 12 of the battery jump starter device 10 while remaining flexible. For example, the flexible sleeve 120 is provided with one or more grooves 124 (three (3) shown in FIG. 3) exposing the outer sleeve 18a of the positive cable 18. The one or more grooves 124 act as hinges to ease bending of the positive cable 18 at the location of the flexible outer sleeve portion 120.

The flexible sleeve 120 further comprises an outer flange 124 spaced apart from an inner flange 126 defining a groove 125 therebetween. For example, the outer flange

124 is spaced apart a distance equal to the wall thickness of the casing 12 from the inner flange 126. The flanges 124, 126 are configured to anchor the flexible connector 120 along with the positive cable 18 to the casing 12 of the battery jump starter device 10. A sleeve portion 128 (FIG. 6) of the flexible connector 120 connects together the outer flange 126 and inner flange 128. For example, the flexible sleeve 120 is molded separately and assembled onto the positive cable 18, or molded onto the positive cable 18 to form a single unit. For example, the flexible outer sleeve portion 120 is insert injection molded with a portion of the positive cable 18 inserted within the mold during the molding process. Alternatively, the flexible outer sleeve portion 120 is made (e.g. molded) separately, and then installed or assembled onto a portion of the positive cable 18. For example, the positive cable 18 comprises an inner conductor (e.g. solid wire conductor or multi-strand metal wire conductor, e.g. made of copper, aluminum) and an outer insulating sleeve 18a (e.g. molded plastic sleeve). The flexible sleeve 120 can be applied (e.g. molded or installed or assembled) onto and surrounding the outer sleeve 18a of the positive cable 18.

The battery assembly 110 further comprises a negative terminal conductor bar 130 connected (e.g. soldered) at one end to the negative terminal tab (i.e. contact) of the battery 112. The other end of the negative terminal conductor bar 130 is provided with a negative terminal conductor bar connector portion 132, as shown in FIG. 5.

The negative terminal conductor bar 130 can be L-shaped to wrap around a corner of the rectangular-shaped battery 112, as shown in FIG. 6. The L-shaped negative terminal conductor bar 130 extends along an end of the battery 112 and along at least a portion of the side of the battery 112.

The negative terminal conductor bar 130 can also be mechanically coupled and/or adhered to the outer surface of the battery casing 112a to provide additional support and stability thereof (e.g. to survive mechanical shock in the event of accidental dropping battery jump starter device 10). For example, the negative terminal conductor bar 114 can be mechanically connected to the battery casing 112a by adhesive (e.g. silicon adhesive), double sided tape, double sided foam tape, insulating plastic or ceramic connector with snap fit connection and/or mechanical fastener.

The battery assembly 110 further comprises a smart switch battery interface 134, as shown in FIG. 5. The smart switch battery interface 134 comprises a circuit board 136 having a first circuit board conductor bar 138 spaced apart from a second circuit board conductor bar 140 both located on one side of the circuit board 136, as shown in FIG. 5.

A pair of relays 142 are mounted on an opposite side of the circuit board 136. The relays 142 include relay anchoring pins 142a extending through the slots 136a in the circuit board 136 (FIG. 5). The relays 142 further include first relay connector pins 142b extending through the slots located in both in the circuit board 136 and through slots 132a in the negative terminal conductor bar connector portion 132. The relays 142 even further include second relay connector pins 142c extending through the slots located in both the circuit board 136, windows 138a of the first circuit board conductor bar 138, and the slots 132a provided in the first conductor bar 138. The relay anchoring pins 136a are soldered in place to mechanically connect the relays 142 to the circuit board 136. The relay connecting pins 142b and 142c are soldered in place to

mechanically and electrically connect the relays 142, respectively, to the circuit board conductor plates 138, 140.

The slots 136a in the circuit board 136, for example, are rectangular-shaped (FIG. 5), and accommodate the rectangular-shaped relay anchoring pins 142a. Specifically, a base portion of the relay anchoring pins 142a are rectangular-shaped transitioning to square-shaped ends. The square-shaped ends are dimensionally less wide verses the base portions creating transverse edges oriented flush with the outer surface of the circuit board 136. When solder is applied to the exposed ends of the relay anchoring pins 142a, the solder connects to the sides of the square-shaped ends and transverse edges to anchor and lock the relay anchoring pins 142a to the circuit board 136.

The slots 132a are provided in negative terminal conductor bar connector portion 132, and the slots 138a in the first circuit board conductor bar 138 are rectangular-shaped. The slots140a in the second circuit board conductor bar 140 (FIG. 5) are T-shaped to accommodate the three (3) horizontally oriented relay connector pins 142b. The ends of the relay connector pins 142b are shown flush with the outer surface of the negative terminal conductor bar connector portion 132. When solder is applied to the exposed ends of the relay connector pins 142b, the solder fills in the slots 132a in the negative terminal conductor bar connector portion 132 and the slots 138a of the first circuit board conductor bar 138, and connects the sides of the connector pins 142b with inner edges of the slots 132a and slots 138a to anchoring the relays 142 to the circuit board 136 and negative terminal conductor bar connector portion 132. This applied

solder also electrically connects the negative terminal conductor bar connector portion 132 to the first circuit board conductor bar 138.

The slots 140a provided in the second circuit board conductor bar 140 are T-shaped to accommodate the three (3) vertically oriented second relay connecting pins 142c. The second relay connector prongs 142c extend outwardly from the outer surface of the circuit board 136 to connect with the exposed cable end 14a of the negative cable 14, as shown in FIG. 9. When solder is applied to the ends of the second relay connector prongs 142c, the solder fills in the T-shaped slots 140a (FIG. 5) and electrically connects the second relay connector prongs140c to the second circuit board conductor bar 140. The exposed cable end 22a of the negative cable 22 is soldered to the second relay connector prongs 142c (FIG. 5), as shown in FIG. 9.

The negative terminal conductor bar connector portion 132 of the negative terminal conductor bar 130 is connected (e.g. by soldering) to the first circuit board conductor bar 138 of the circuit board 136. Again, the exposed cable end 22a (i.e. with the insulating sleeve removed) of the negative cable 22 is connected (e.g. by soldering) to the second circuit board conductor bar 140, as shown in FIG. 9. The negative cable 22 is fitted with a flexible sleeve 118, as shown in FIG. 11.

As an alternative to the arrangement of the bent cable connector 118 (FIG. 5), a diode device 150 is installed onto (i.e. spliced into) the flexible cable connector 118, as shown in FIG. 10. The diode device 150 comprises a circuit board 152 provided with a set of back-charge diodes 154 located on one side thereof, and a conductor bar 156 provided on an opposite side of the circuit board 152.

ASSEMBLY

The battery jump starting device 10 comprises the casing 12 having an upper casing portion 12a and a lower casing portion 12b, as shown in FIG. 11. The upper casing portion 12a and the lower casing portion 12b are configured to be connected together when assembling the battery jump starting device 10.

The battery jump starting device 10 further comprises the battery assembly 110 and controller assembly 210 both disposed within the casing 12 when assembling the battery jump starting device 10, as shown in FIG. 11. The controller assembly 210 comprises a circuit board 212 located adjacent to another circuit board 214.

The positive terminal of the battery assembly 110 is connected to the circuit board 212 via a positive power wire 216, as shown in FIG. 11. For example, the positive power wire 216 is soldered to the positive conductor bar 114 (FIG. 5). The negative terminal of the battery assembly 110 is connected to the circuit board 214 via a negative power wire 218.

The relay circuit board 136 is provided with a wire set 220 having a connector 222, as shown in FIG. 11. The connector 222 is configured to connect with the relay board connector 224 located on the circuit board 212 of the controller assembly 210 during assembly of the battery jump starting device 10, as shown in FIG. 11.

The battery assembly 110 further comprises a wire set 226 having a connector 228, as shown in FIG. 11. The connector 228 is configured to connect with the battery cell charging/monitoring connector 230 located on the circuit board 212 of the controller assembly 220.

The battery assembly 110 also comprises a battery temperature sensor having a wire set 232 having a connector 234, as shown in FIG. 11. The connector 234 is configured to connect with the temperature sensor connector 236 located on the circuit board 212 of the controller assembly 220.

The circuit board 212 is provided with in charge power resistors 240 and an out relay 242, as shown in FIG. 11. Further, the lower casing portion 12a is provided with a main user out connector 244 having a wire set 246 connected to the circuit board 214, and a main user in connector 248 having a wire set 250 connected to the circuit board 214.

The battery assembly 110 is connected to battery jump starting device 10, as shown in FIG. 11. The battery connector device 110 is installed within the casing 12 of the battery jump starting device 10 when assembled.

CLAIMS

1. A battery assembly device for a battery jump starting device having a smart switch, the device comprising:

a battery comprising a positive terminal tab and a negative terminal tab;

a positive terminal conductor bar connected to the positive terminal tab of the battery;

a negative terminal conductor bar connected to the negative terminal tab of the battery;

a positive cable connected to the positive terminal conductor bar; and

a smart switch interface connectable to the smart switch of the jump starting device, the smart switch interface comprising a circuit board having a first circuit board conductor bar and a second circuit board conductor spaced apart from each other on the circuit board, the smart switch interface further comprising one or more relays connected between the first circuit board conductor bar and the second circuit board conductor bar for providing isolation between the negative terminal tab of the battery and a battery being jump started.

2. A battery assembly device for a battery jump starting device having a smart switch, the device comprising:

a rectangular-shaped battery comprising a positive terminal tab and a negative terminal tab;

a positive terminal conductor bar connected to the positive terminal tab of the battery;

a negative terminal conductor bar connected to the negative terminal tab of the battery;

a positive cable connected to the positive terminal conductor bar by a flexible cable connector; and

a smart switch interface connectable to the smart switch of the jump starting device, the smart switch interface comprising a circuit board having a first circuit board conductor bar and a second circuit board conductor spaced apart from each other on the circuit board, the smart switch interface further comprising one or more relays connected between the first circuit board conductor bar and the second circuit board conductor bar for providing isolation between the negative terminal tab of the battery being jump started.

3. A battery assembly device for a battery jump starting device having a smart switch, the device comprising:

a rectangular-shaped battery comprising a positive terminal tab and a negative terminal tab each located at opposite ends of the battery;

an L-shaped positive terminal conductor bar connected to the positive terminal tab of the battery, the L-shaped positive terminal bending around a corner of the battery and extending along at least a portion of a side of the battery;

an L-shaped negative terminal conductor bar connected to the negative terminal tab of the battery, the L-shaped negative terminal bending around a corner of the battery and extending along at least a portion of a side of the battery;

a positive cable connected to the positive terminal conductor bar; and

a smart switch interface connectable to the smart switch of the jump starting device, the smart switch interface comprising a circuit board having a first circuit board conductor bar and a second circuit board conductor spaced apart from each other on the circuit board, the smart switch interface further comprising one or more relays connected between the first circuit board conductor bar and the second circuit board conductor bar for providing isolation between the negative terminal tab of the battery being jump started.

4. The device according to claim 1, wherein the relay is multiple relays connected in parallel between the first circuit board conductor bar and the second circuit board conductor bar.

5. The device according to claim 1, wherein the negative terminal conductor bar mechanically and electrically connects the battery to the smart switch battery interface.

6. The device according to claim 5, wherein the smart switch battery interface is positioned above and adjacent to the battery by the negative terminal conductor bar.

7. The device according to claim 1, wherein one end of the positive cable is configured to at least partial wrap around an exposed cable conductor end of the positive cable.

8. The device according to claim 1, wherein the positive terminal conductor bar is ultrasonically welded to the positive terminal tab of the battery and the negative terminal conductor bar is ultrasonically welded to the negative terminal tab of the battery.

9. The device according to claim 1, wherein the battery is rectangular-shaped, and the positive terminal conductor bar and the negative terminal conductor bar are L-shaped and wrap around a respective corner of the battery.

10. The device according to claim 9, wherein the battery tabs aremounted flush with a casing of the battery.

11. The device according to claim 1, wherein the positive cable is connected to the positive terminal conductor bar by a flexible cable connector.

12. The device according to claim 11, wherein the flexible cable connector comprises a flexible outer sleeve portion and a flexible inner sleeve portion.

13. The device according to claim 12, wherein the flexible outer sleeve portion comprises an outer flange, and the flexible inner sleeve portion comprises an inner flange, the outer flange and inner flange sandwiching a casing wall of the battery jump starting device.

14. The device according to claim 11, wherein the flexible cable connector comprises an inner serpentine cable portion.

15. The device according to claim 14, wherein the flexible cable connector is configured to accommodate the positive cable oriented at an angle relative to a casing wall of the battery jump starting device, and the inner serpentine cable portion is configured to accommodate a misalignment between the angle relative to the casing wall and an angle of attachment of the inner serpentine cable portion with the positive terminal conductor bar.

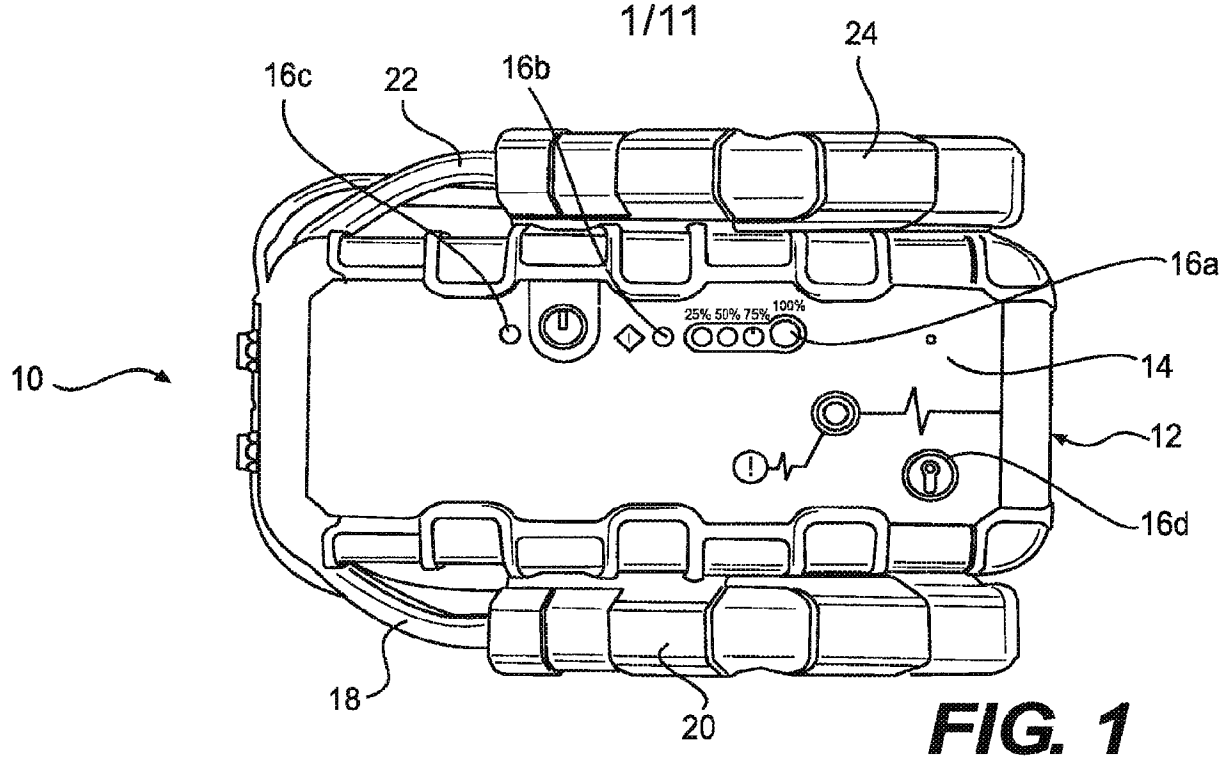


FIG. 1

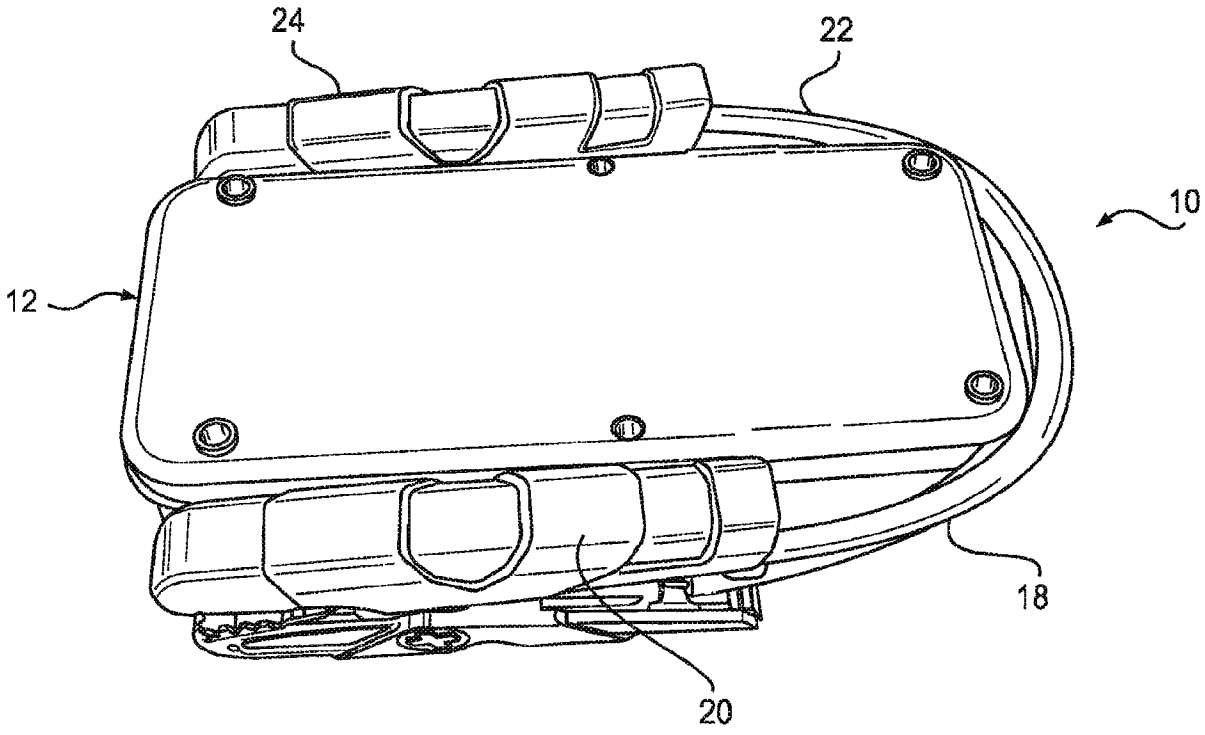


FIG. 2

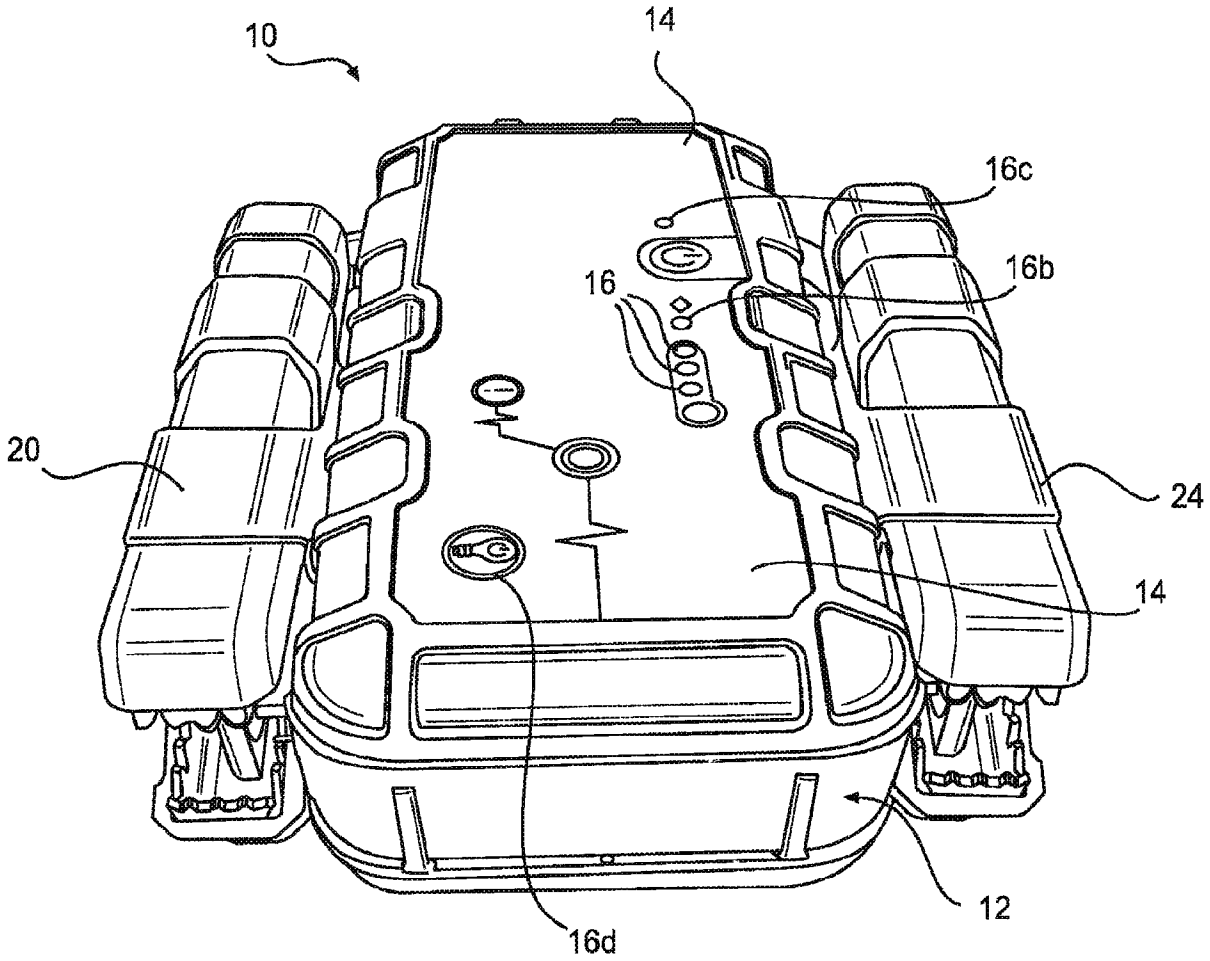


FIG. 3

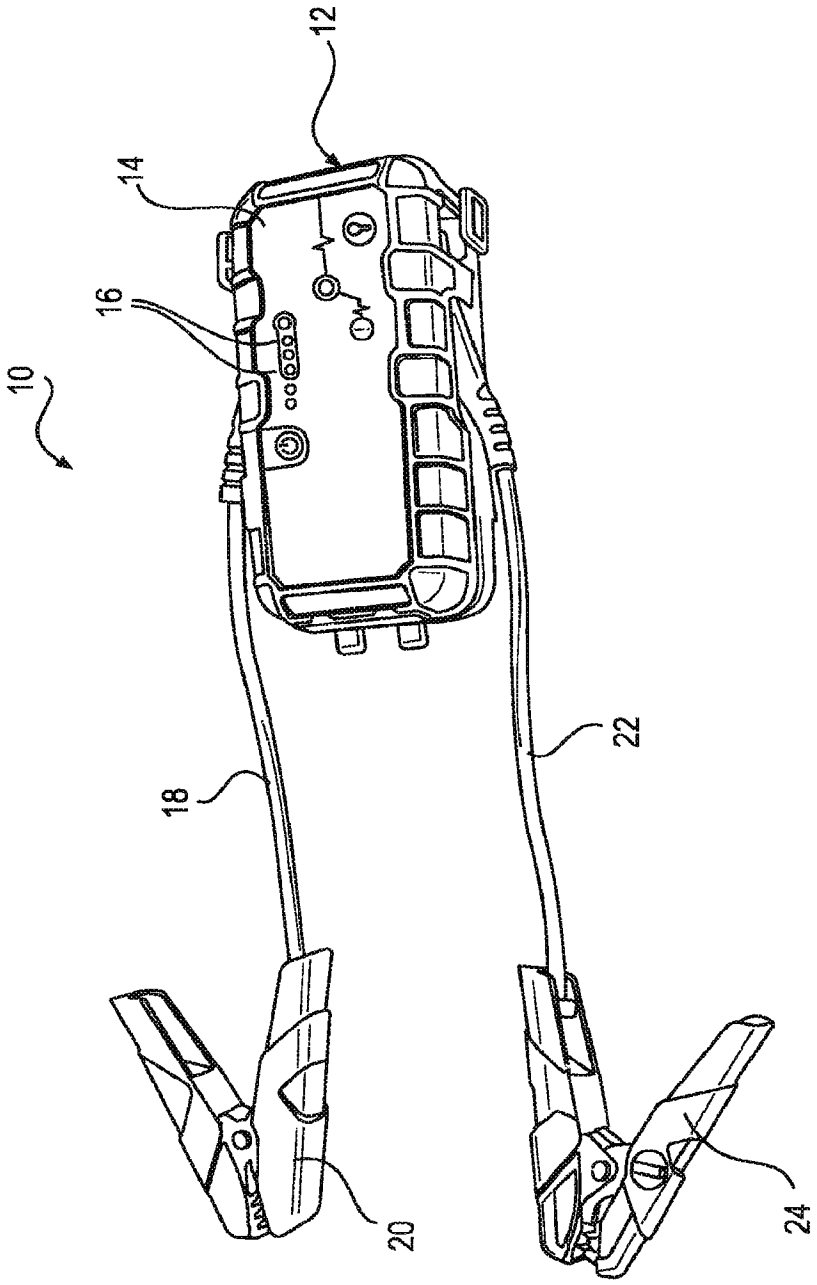
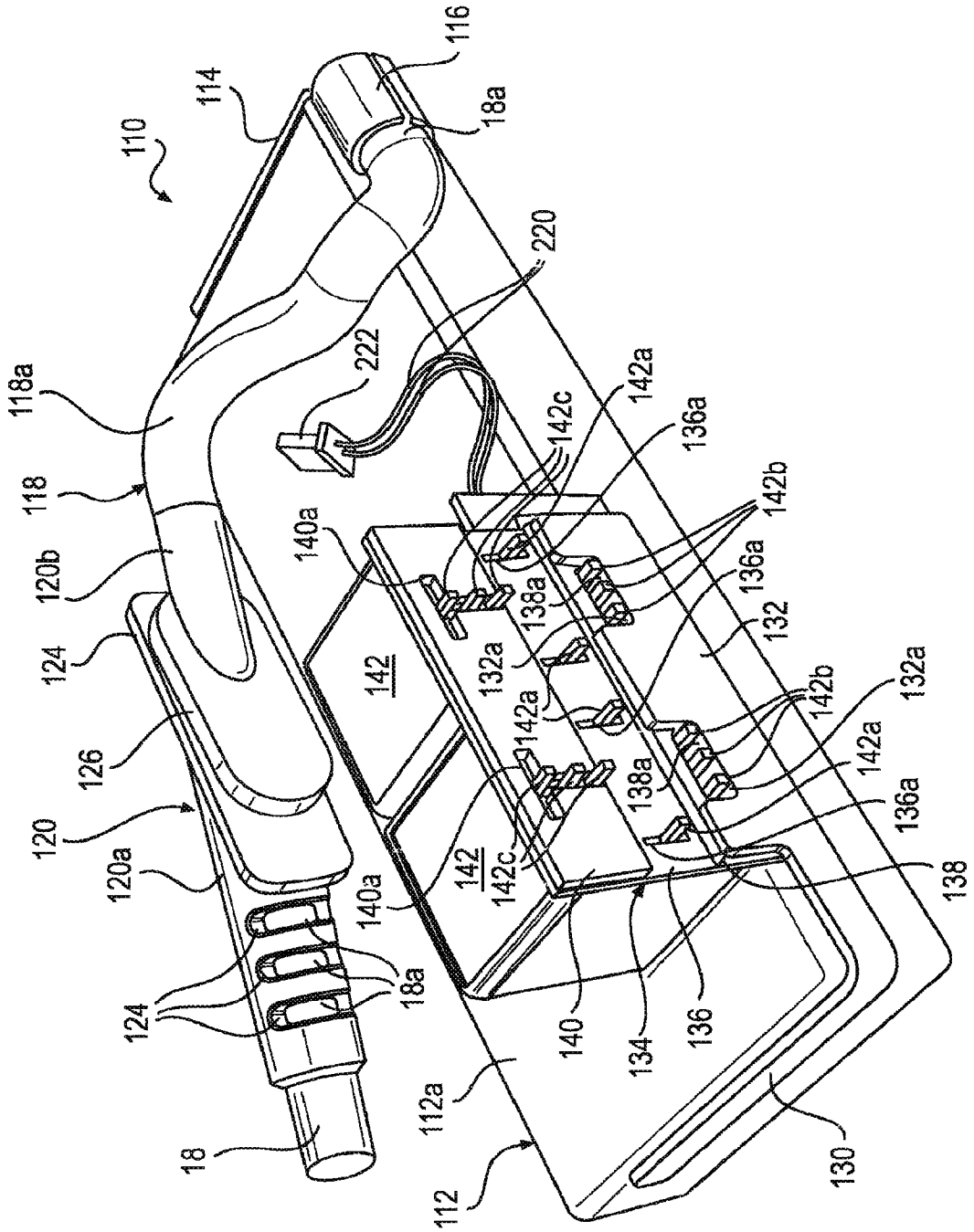


FIG. 4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134
136
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136a
142a
142b
142c
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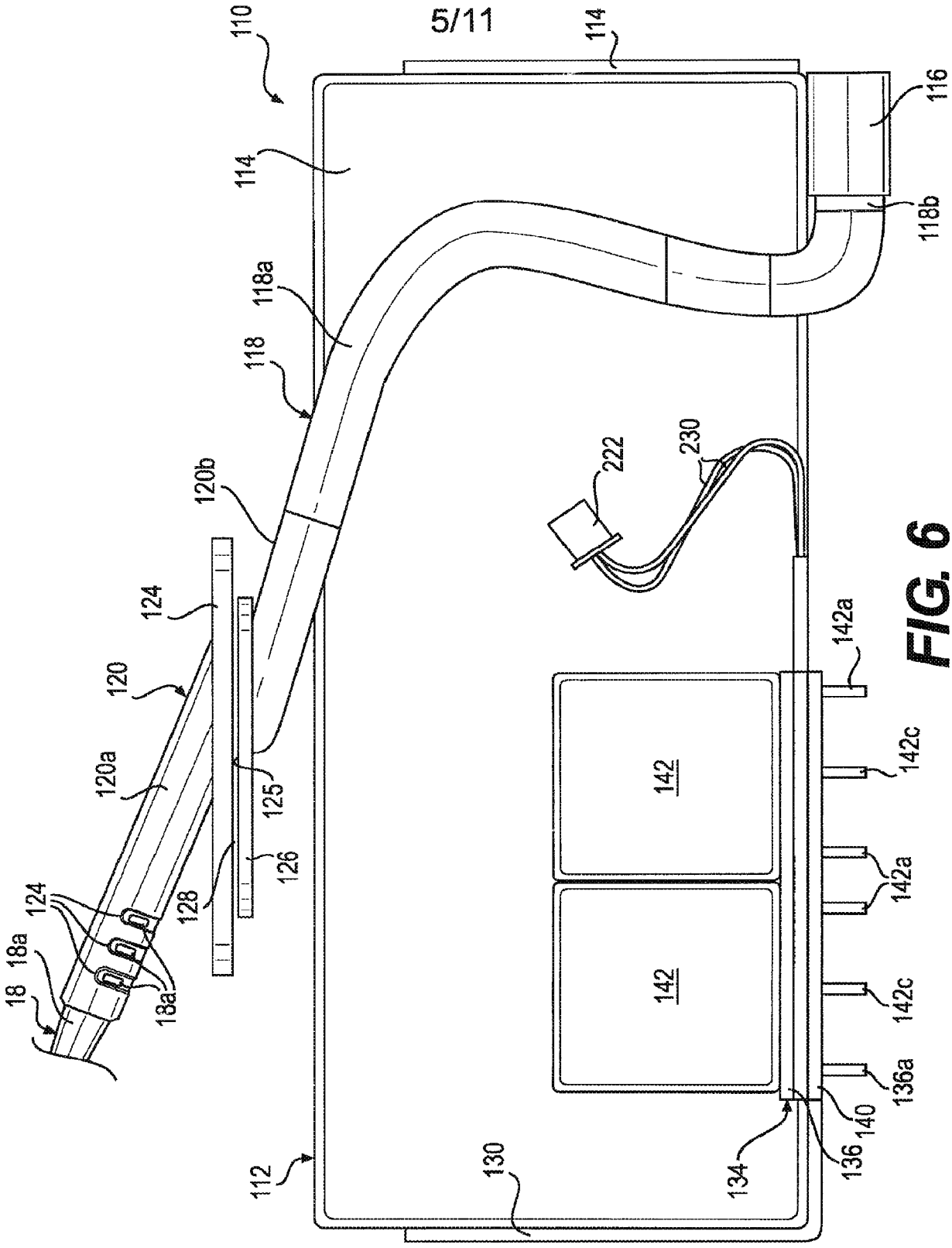
136a
142c
142
140a

FIG. 5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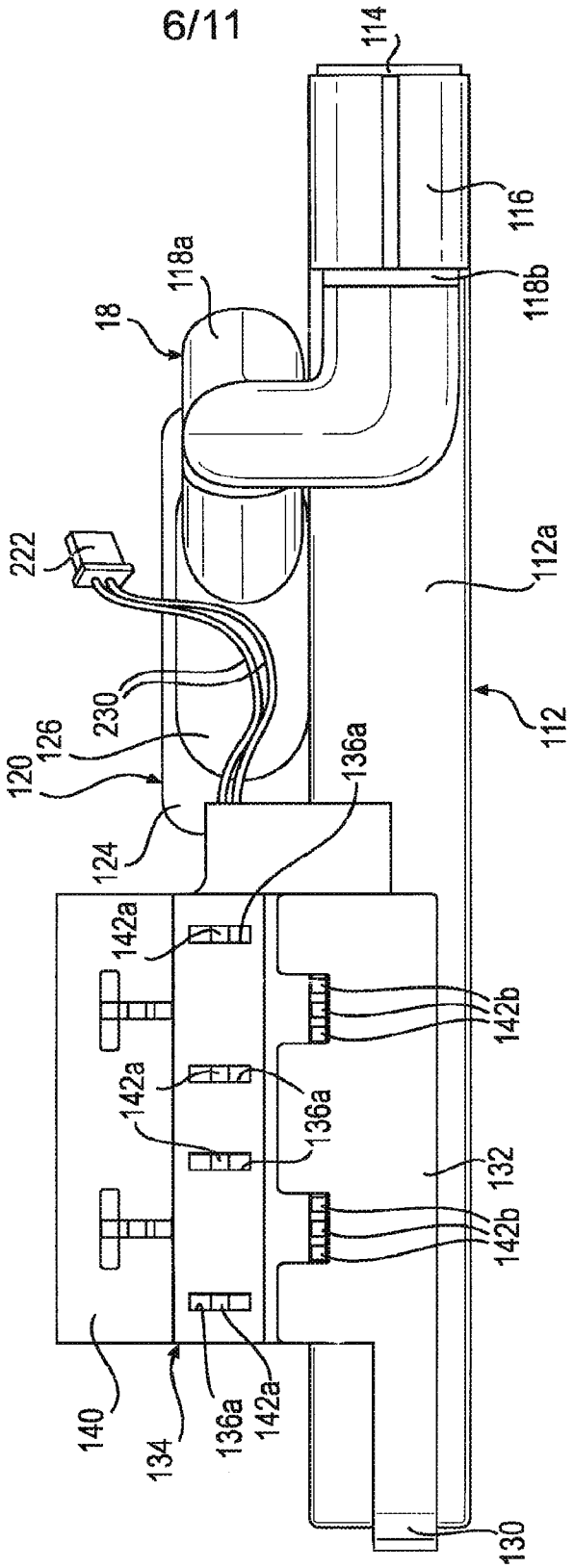
134
130
112

FIG. 6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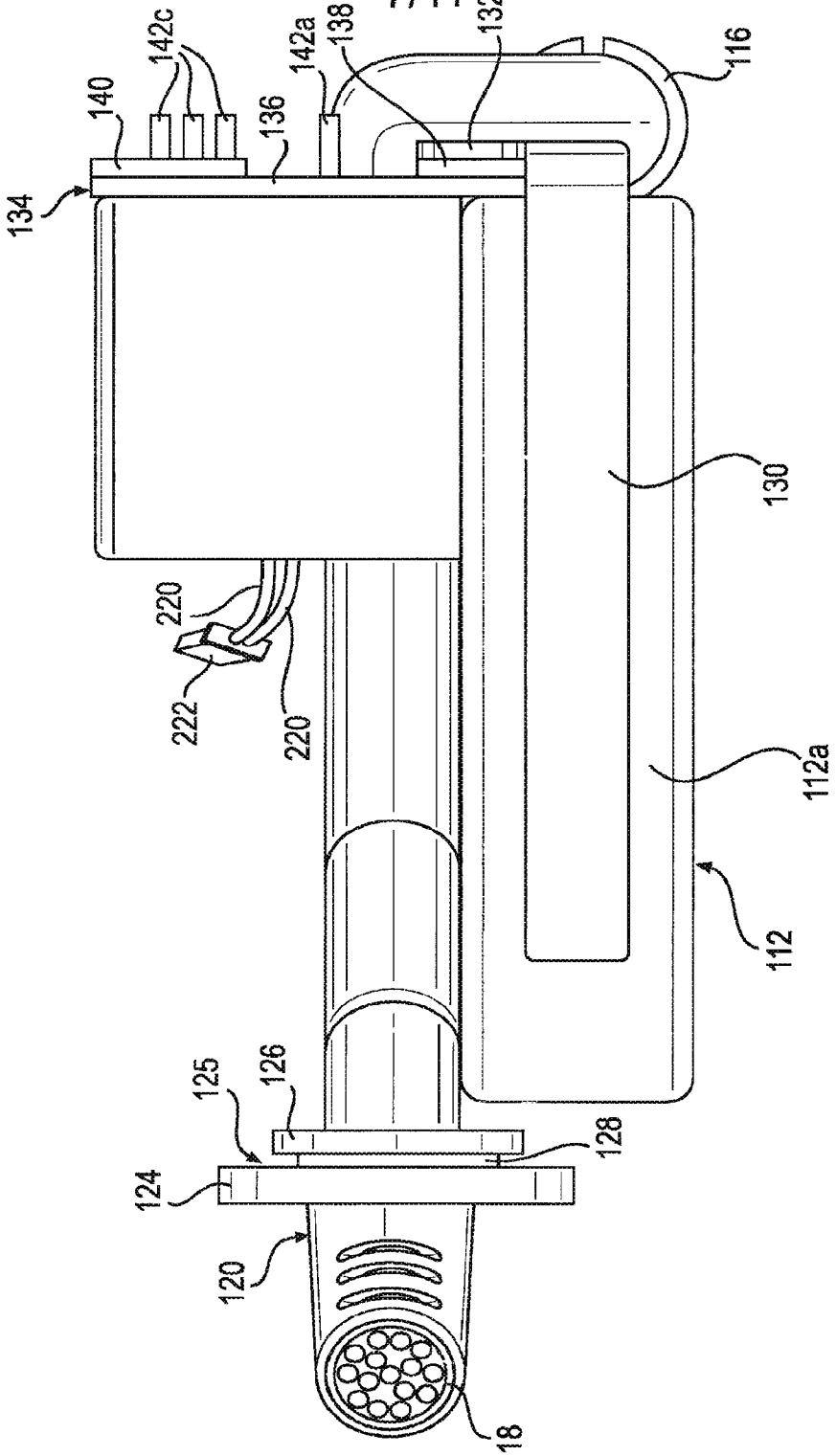
142a
130

FIG. 7


142c
140
142a
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222
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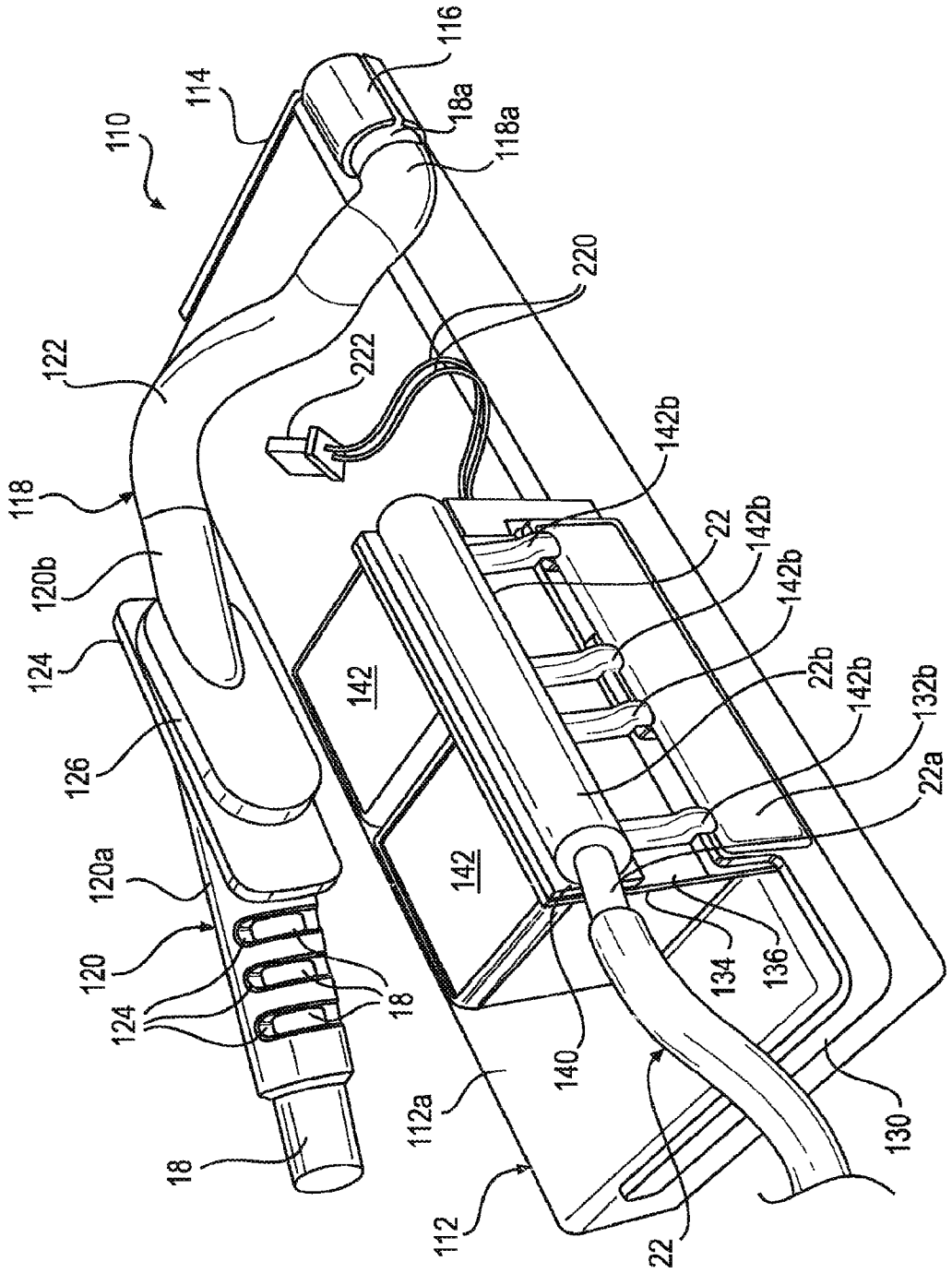
FIG. 8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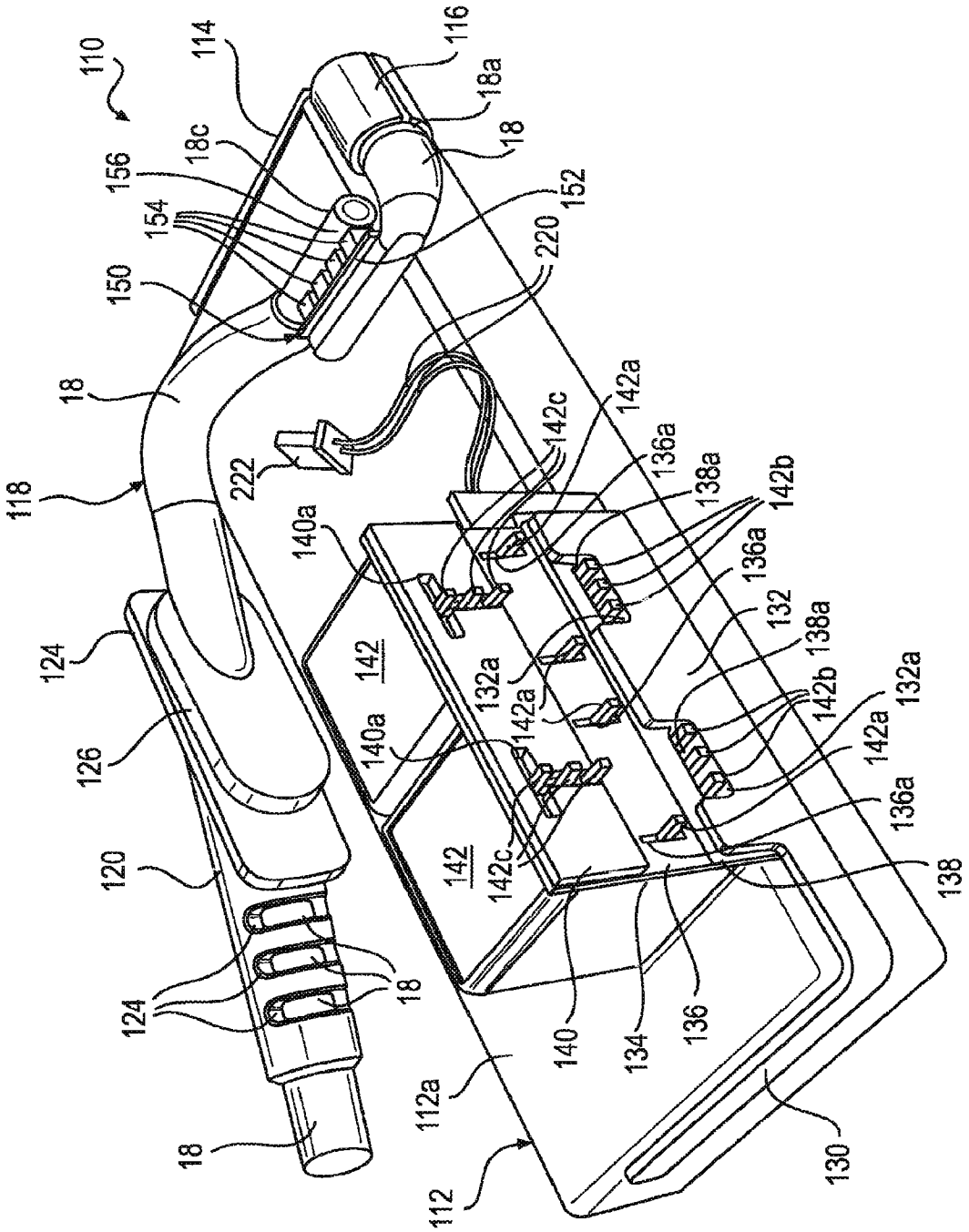
142b
142b
22b
142b
132b
22a
134
136
140
112a
112
22
130

FIG. 9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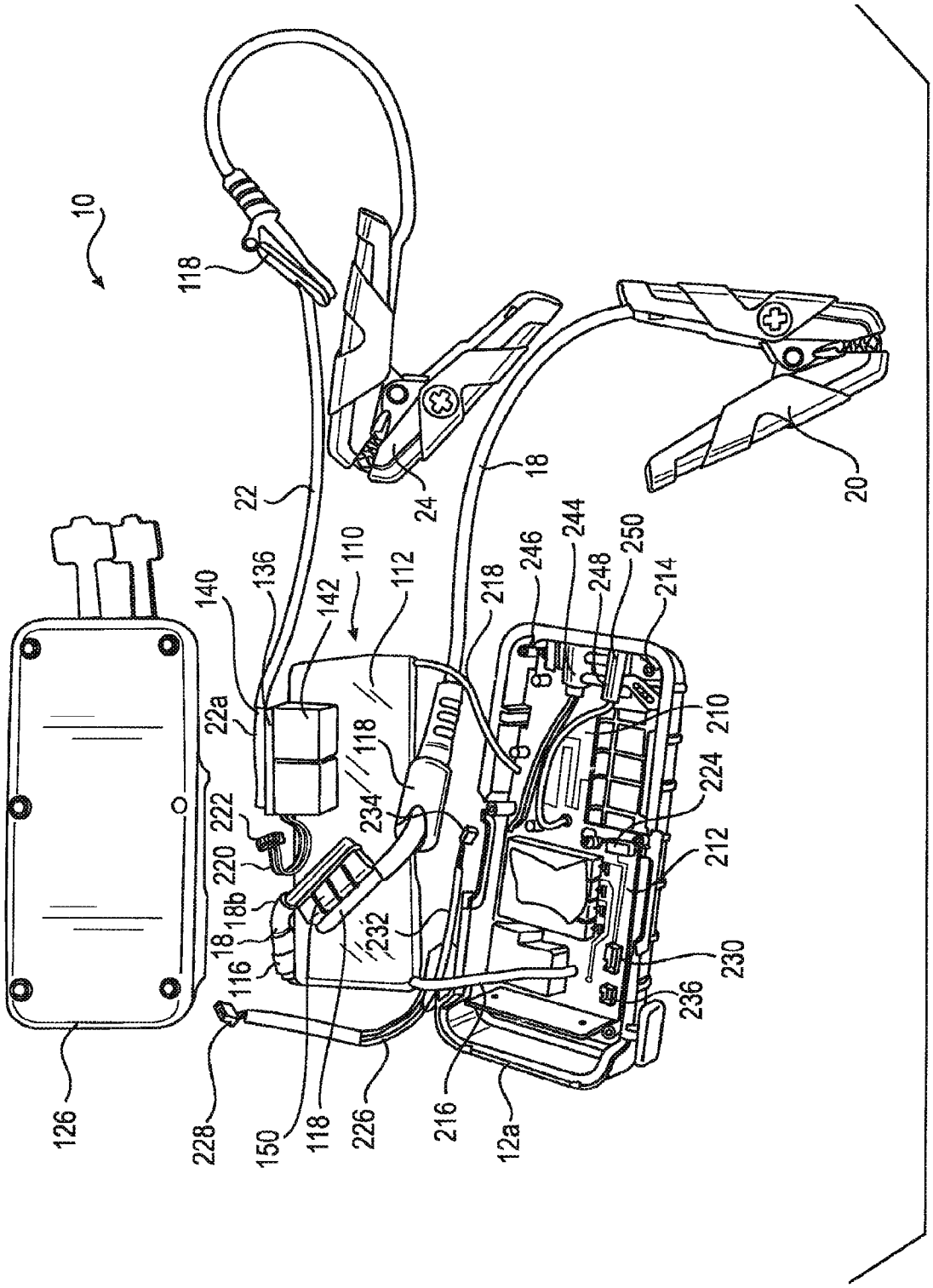
130

FIG. 10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24
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136
142
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112
218
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250
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22a
118
224
222
234
220
212
18b
18
232
116
230
236
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228
150
118
226
216
12a

FIG. 11

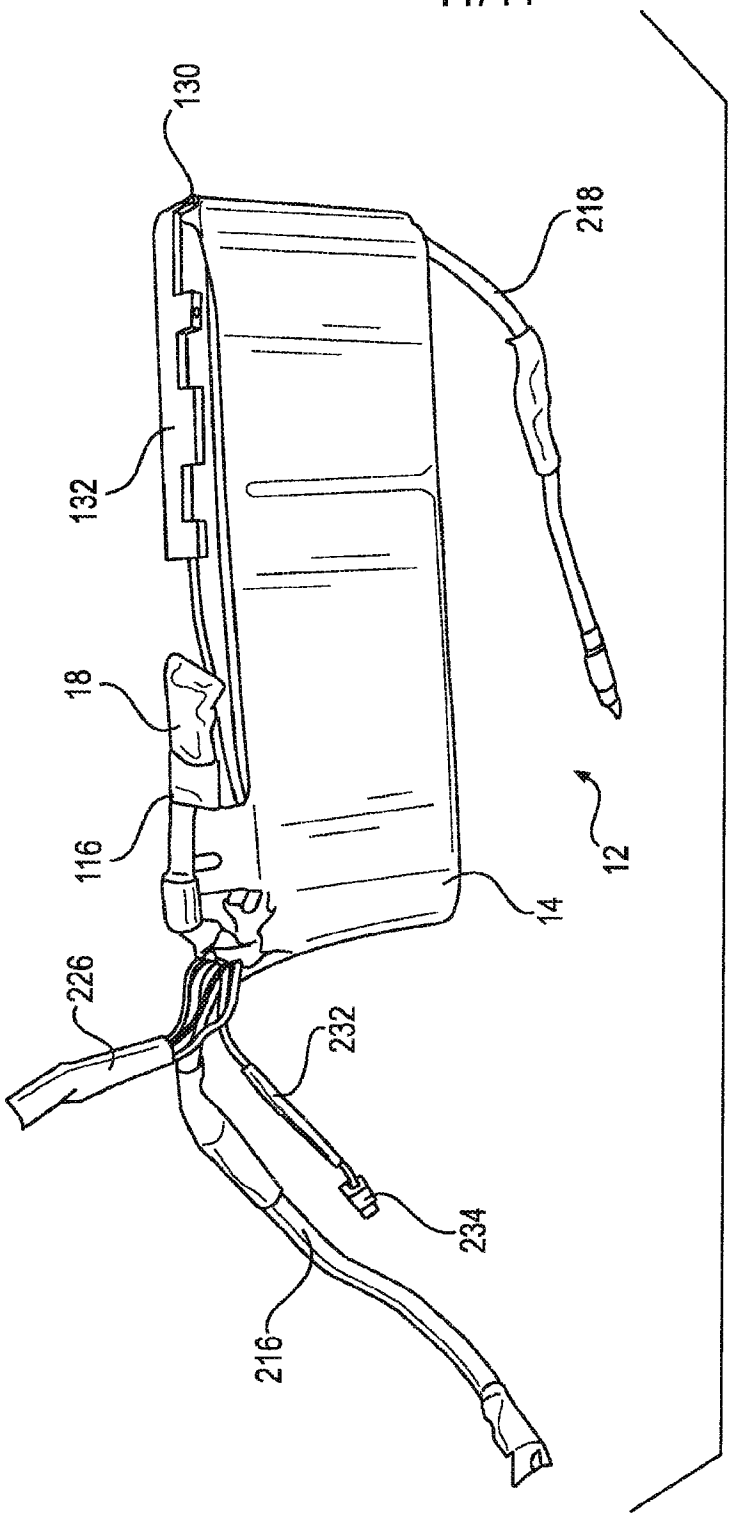

FIG. 12

Espacenet

Bibliographic data: CA2916782 (A1) — 2016-01-07

PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION

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Classification: **- international:** ***F02N11/12; F21L4/00; F21V33/00; H02J7/00; F21K9/00***

- cooperative: **H02J7/0034 (EP, GB); H02J7/0036 (EP, GB); H02J7/342 (EP, GB)**

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Priority number(s): WO2014US45434 20140703

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Abstract of CA2916782 (A1)

A handheld device for jump starting a vehicle engine includes a rechargeable lithium ion battery pack and a microcontroller. The lithium ion battery is coupled to a power output port of the device through a FET smart switch actuated by the microcontroller. A vehicle battery isolation sensor connected in circuit with positive and negative polarity outputs detects the presence of a vehicle battery connected between the positive and negative polarity outputs. A reverse polarity sensor connected in circuit with the positive and negative polarity outputs detects the polarity of a vehicle battery connected

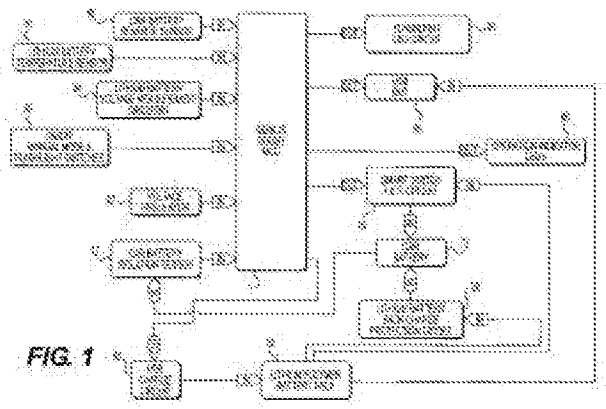

FIG. 1

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.

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(54) Titre : APPAREIL PORTABLE D'ASSISTANCE AU DEMARRAGE POUR BATTERIE DE VEHICULE AVEC PROTECTION DE SURETE

(54) Title: PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION

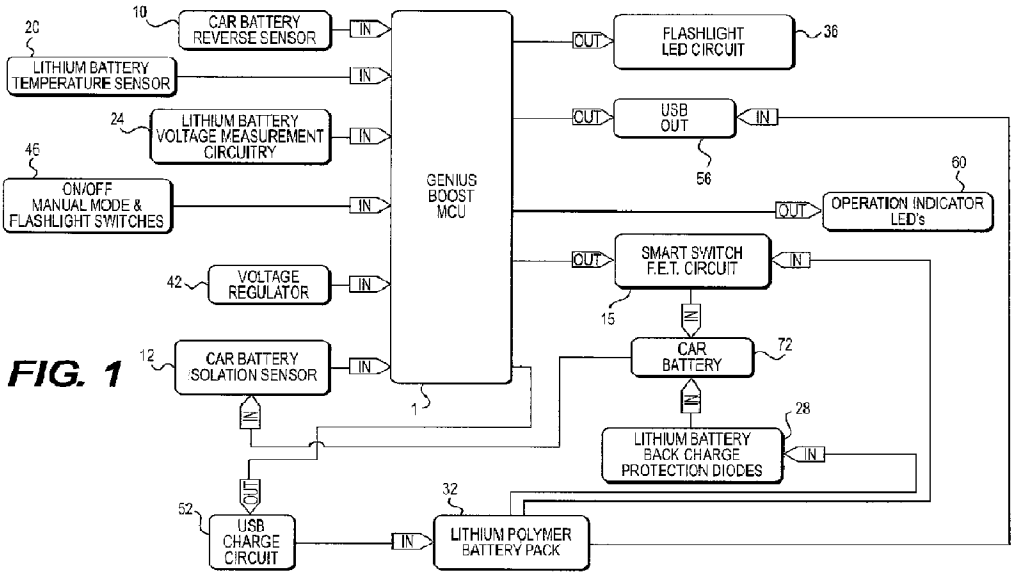

FIG. 1

(57) Abrégé/Abstract:
A handheld device for jump starting a vehicle engine includes a rechargeable lithium ion battery pack and a microcontroller. The lithium ion battery is coupled to a power output port of the device through a FET smart switch actuated by the microcontroller. A vehicle battery isolation sensor connected in circuit with positive and negative polarity outputs detects the presence of a vehicle battery connected between the positive and negative polarity outputs. A reverse polarity sensor 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.

PORTABLE VEHICLE BATTERY JUMP START APPARATUS WITH SAFETY PROTECTION

BACKGROUND OF THE INVENTION

The present invention relates generally to apparatus for jump-starting a vehicle having a depleted or discharged battery. Prior art devices are known, 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.

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.

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.

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.

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.

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 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.

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.

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.

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.

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.

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.

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.

SUMMARY OF THE INVENTION

In accordance with an aspect of the invention, apparatus is provided for jump starting a vehicle engine, including: 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; a power FET 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 FET switch, such that said power FET switch is turned on to connect said internal power supply 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.

In accordance with another aspect of the invention, the internal power supply is a rechargeable lithium ion battery pack.

In accordance with yet another aspect of the invention, a jumper cable device is provided, having a plug configured to plug into an output port of a handheld battery charger booster device having an internal power supply; 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.

BRIEF DESCRIPTION OF THE DRAWINGS

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

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;

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

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.

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DETAILED DESCRIPTION OF THE INVENTION

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).

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.

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.

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.

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 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.

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).

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 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.

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.

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 micro controller output is driven to a logic high, the FETs 16 (Q15, Q18, and Q19) are in a low resistant state, allowing current to flow 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.

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.

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.

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

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.

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 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. 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.

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.

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.

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.

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.

WHAT IS CLAIMED IS:

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;

a power FET 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 FET switch, such that said power FET switch is turned on to connect said internal power supply 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.

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.

4. The apparatus of claim 1, wherein said power FET 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.

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.

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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.

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, or 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.

24. A jumper cable device, comprising:

a plug configured to plug into an output port of a handheld battery charger booster device having an internal power supply;

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.

25. The jumper cable device of claim 24, further comprising a pair of ring terminals configured to respectively connect said pair of cables at said another end thereof with one of a battery terminal, or a battery terminal clamp.

26. The jumper cable device of claim 24, wherein said output port and said plug are dimensioned so that the plug will fit into the output port only in one specific orientation.

ABSTRACT OF THE DISCLOSURE

A handheld device for jump starting a vehicle engine includes a rechargeable lithium ion battery pack and a microcontroller. The lithium ion battery is coupled to a power output port of the device through a FET smart switch actuated by the microcontroller. A vehicle battery isolation sensor connected in circuit with positive and negative polarity outputs detects the presence of a vehicle battery connected between the positive and negative polarity outputs. A reverse polarity sensor 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.

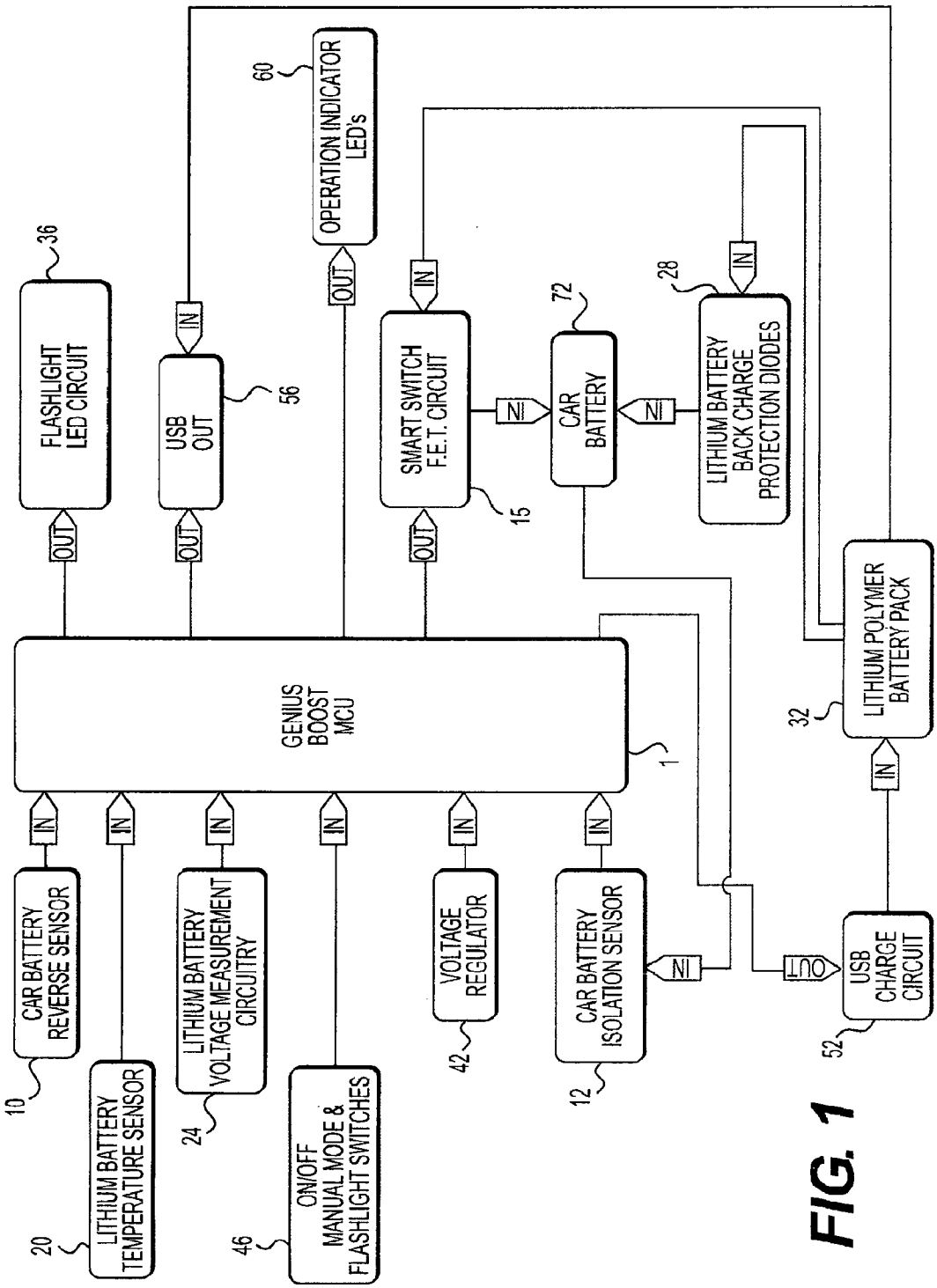

GENIUS BOOST MCU
1
FLASHLIGHT LED CIRCUIT
36
USB OUT
56
OPERATION INDICATOR LED's
60
SMART SWITCH F.E.T. CIRCUIT
15
CAR BATTERY
72
LITHIUM BATTERY BACK CHARGE PROTECTION DIODES
28
LITHIUM POLYMER BATTERY PACK
32
USB CHARGE CIRCUIT
52
CAR BATTERY ISOLATION SENSOR
12
VOLTAGE REGULATOR
42
LITHIUM BATTERY VOLTAGE MEASUREMENT CIRCUITRY
24
ON/OFF MANUAL MODE & FLASHLIGHT SWITCHES
46
LITHIUM BATTERY TEMPERATURE SENSOR
20
CAR BATTERY REVERSE SENSOR
10
IN
OUT

FIG. 1

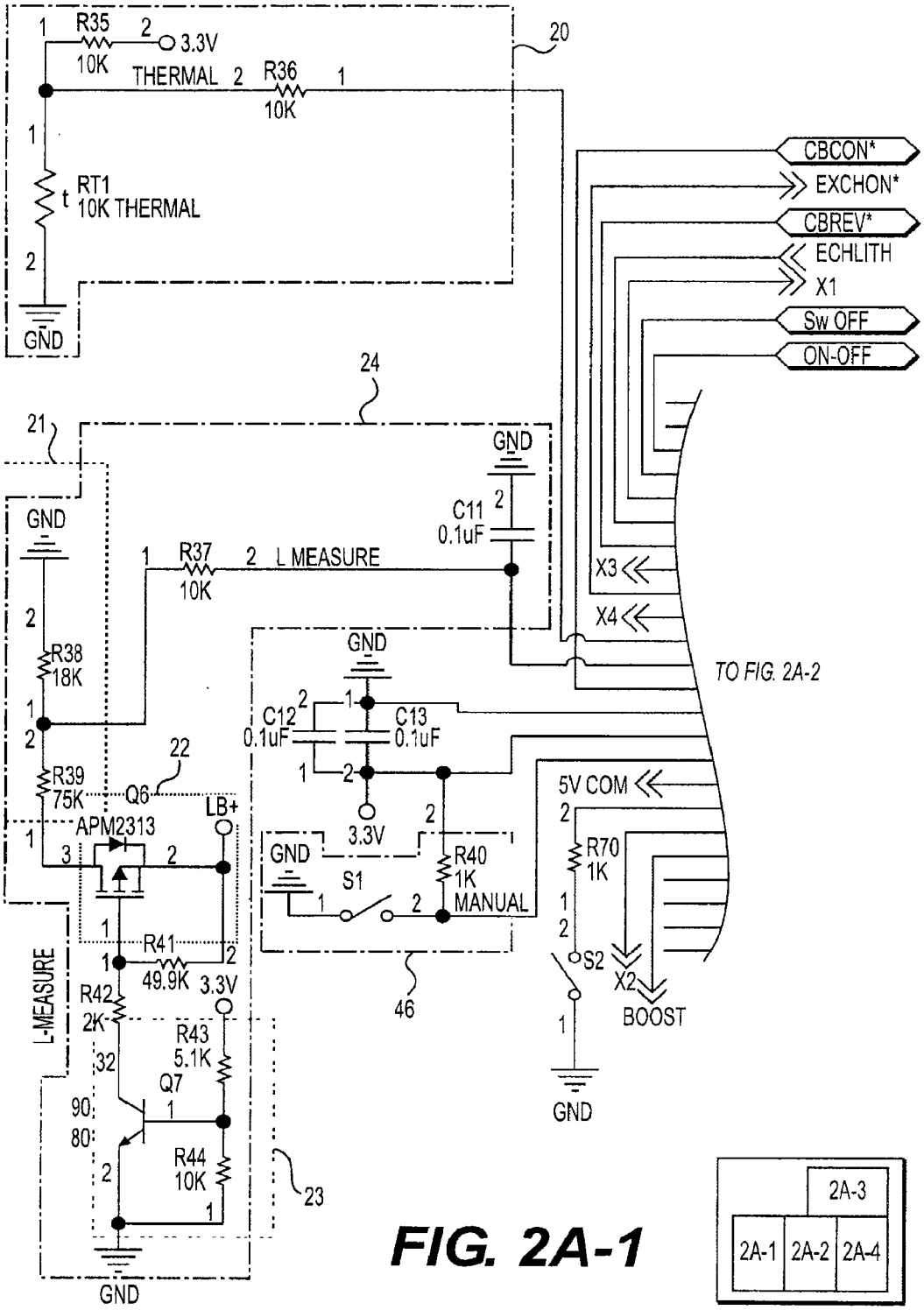
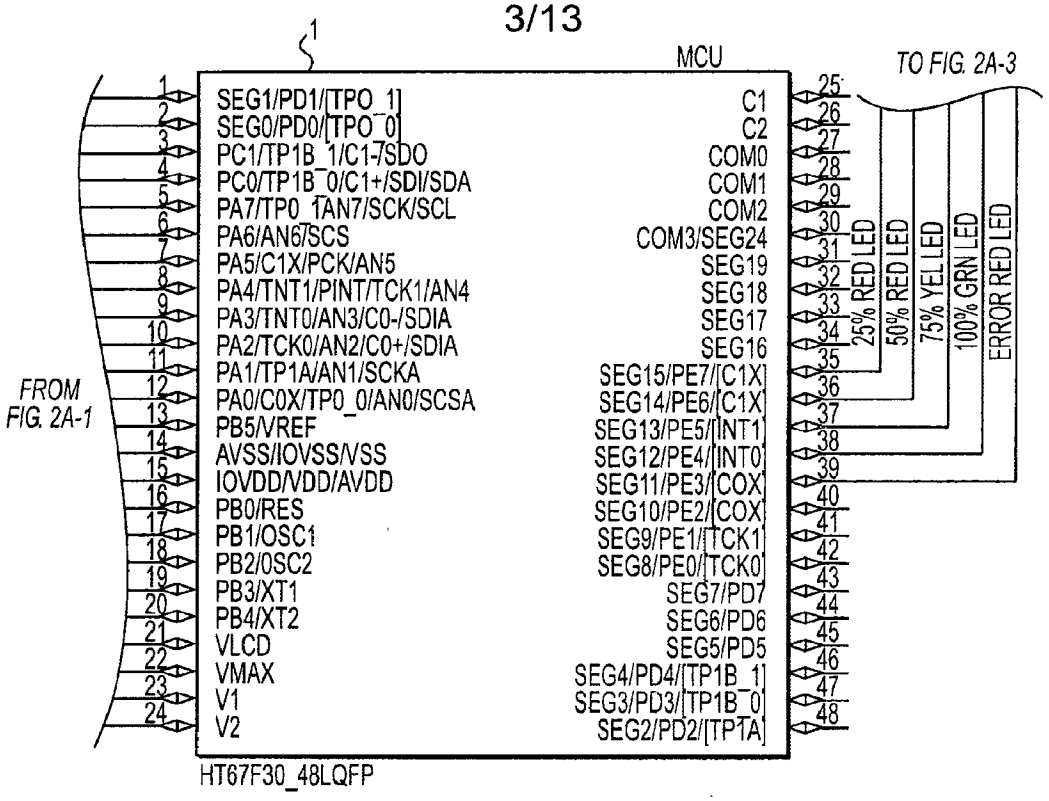
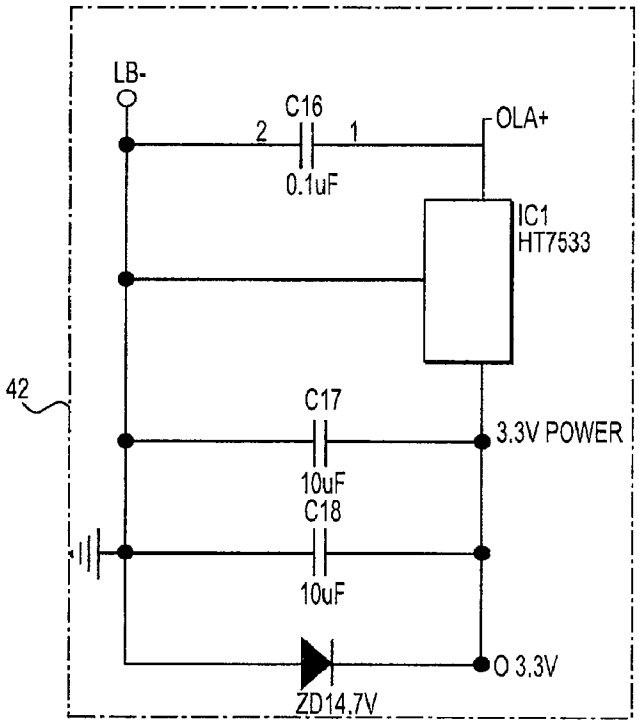

R35
10K
3.3V
THERMAL
R36
10K
RT1
10K THERMAL
GND
20
CBCON*
EXCHON*
CBREV*
ECHLITH
X1
Sw OFF
ON-OFF
24
21
GND
C11
0.1uF
R37
10K
L MEASURE
X3
X4
TO FIG. 2A-2
R38
18K
C12
0.1uF
C13
0.1uF
22
R39
75K
Q6
APM2313
LB+
3.3V
S1
R40
1K
MANUAL
5V COM
R70
1K
S2
X2
BOOST
46
R41
49.9K
R42
2K
R43
5.1K
Q7
R44
10K
L-MEASURE
23

FIG. 2A-1

2A-3
2A-1
2A-2
2A-4


1
MCU
TO FIG. 2A-3
FROM FIG. 2A-1
SEG1/PD1/[TPO_1]
SEG0/PD0/[TPO_0]
PC1/TP1B_1/C1-/SDO
PC0/TP1B_0/C1+/SDI/SDA
PA7/TP0_1AN7/SCK/SCL
PA6/AN6/SCS
PA5/C1X/PCK/AN5
PA4/TNT1/PINT/TCK1/AN4
PA3/TNT0/AN3/C0-/SDIA
PA2/TCK0/AN2/C0+/SDIA
PA1/TP1A/AN1/SCKA
PA0/C0X/TP0_0/AN0/SCSA
PB5/VREF
AVSS/IOVSS/VSS
IOVDD/VDD/AVDD
PB0/RES
PB1/OSC1
PB2/OSC2
PB3/XT1
PB4/XT2
VLCD
VMAX
V1
V2
C1
C2
COM0
COM1
COM2
COM3/SEG24
SEG19
SEG18
SEG17
SEG16
SEG15/PE7/[C1X]
SEG14/PE6/[C1X]
SEG13/PE5/[INT1]
SEG12/PE4/[INT0]
SEG11/PE3/[COX]
SEG10/PE2/[COX]
SEG9/PE1/[TCK1]
SEG8/PE0/[TCK0]
SEG7/PD7
SEG6/PD6
SEG5/PD5
SEG4/PD4/[TP1B_1]
SEG3/PD3/[TP1B_0]
SEG2/PD2/[TP1A]
25% RED LED
50% RED LED
75% YEL LED
100% GRN LED
ERROR RED LED
HT67F30_48LQFP


LB-
C16
0.1uF
OLA+
IC1
HT7533
42
C17
10uF
C18
10uF
3.3V POWER
O 3.3V
ZD14.7V

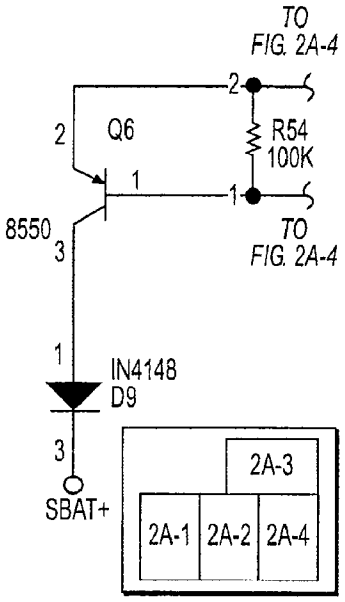

TO FIG. 2A-4
Q6
R54
100K
8550
TO FIG. 2A-4
IN4148
D9
SBAT+
2A-3
2A-1
2A-2
2A-4

FIG. 2A-2

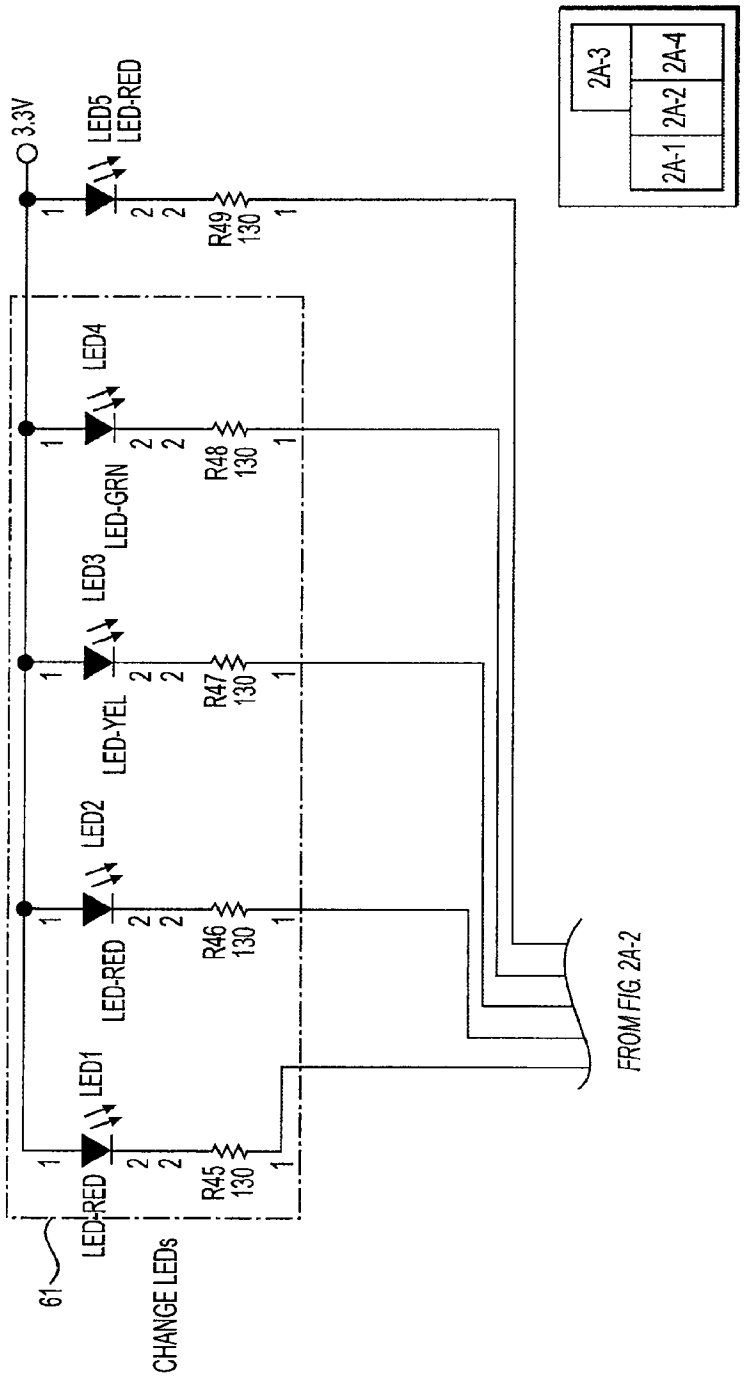

2A-3
2A-4
2A-2
2A-1
3.3V
LED5
LED-RED
R49
130
LED4
LED-GRN
R48
130
LED3
LED-YEL
R47
130
LED2
LED-RED
R46
130
LED1
LED-RED
R45
130
61
CHANGE LEDs
FROM FIG. 2A-2

FIG. 2A-3

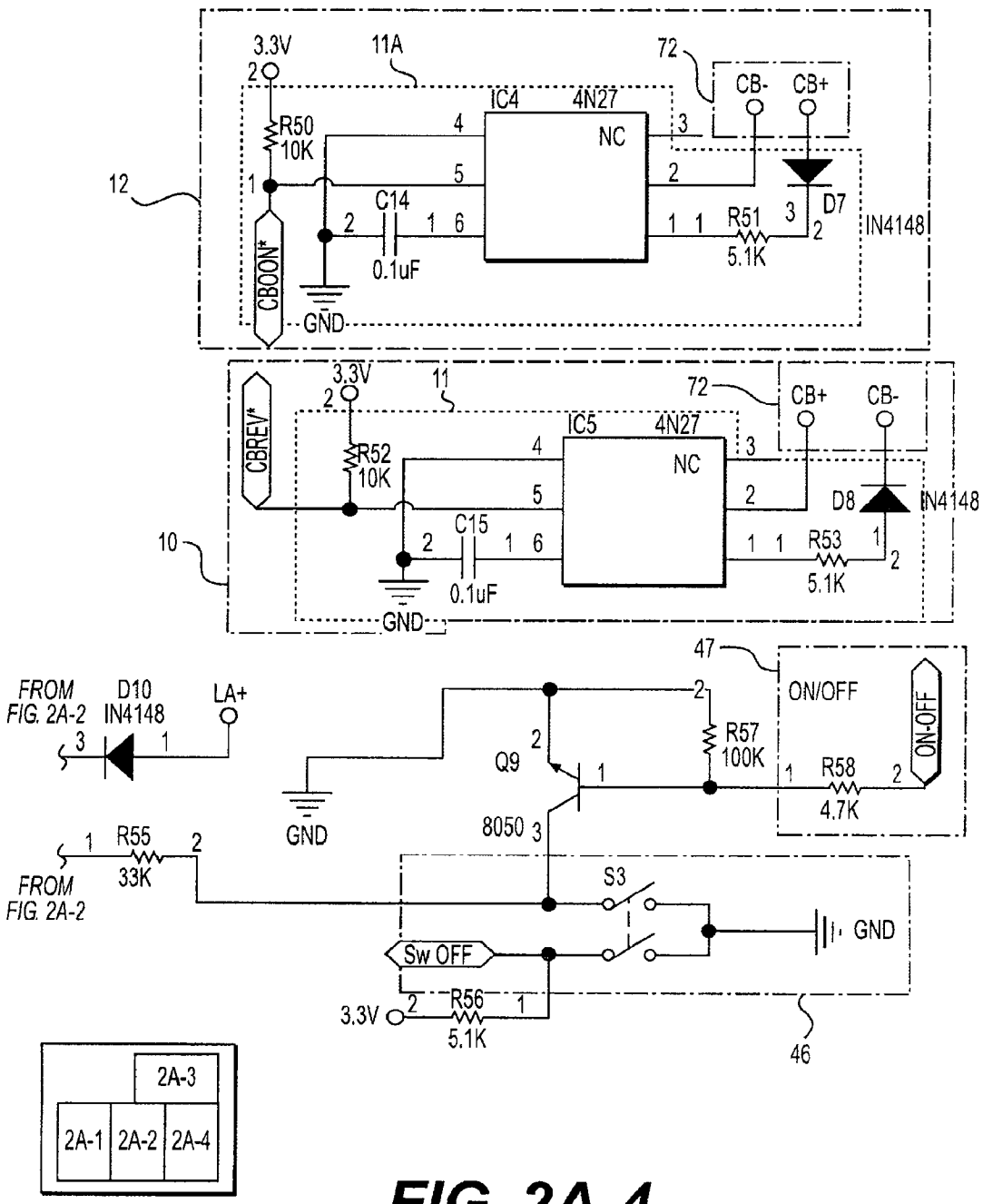

3.3V
11A
72
CB-
CB+
IC4
4N27
NC
R50
10K
12
C14
0.1uF
R51
5.1K
D7
IN4148
CBOON*
GND
3.3V
11
72
CB+
CB-
CBREV*
IC5
4N27
NC
R52
10K
D8
IN4148
10
C15
0.1uF
R53
5.1K
GND
47
ON/OFF
ON-OFF
FROM
FIG. 2A-2
D10
IN4148
LA+
R57
100K
Q9
R58
4.7K
GND
8050
R55
33K
FROM
FIG. 2A-2
S3
GND
Sw OFF
3.3V
R56
5.1K
46
2A-3
2A-1
2A-2
2A-4

FIG. 2A-4

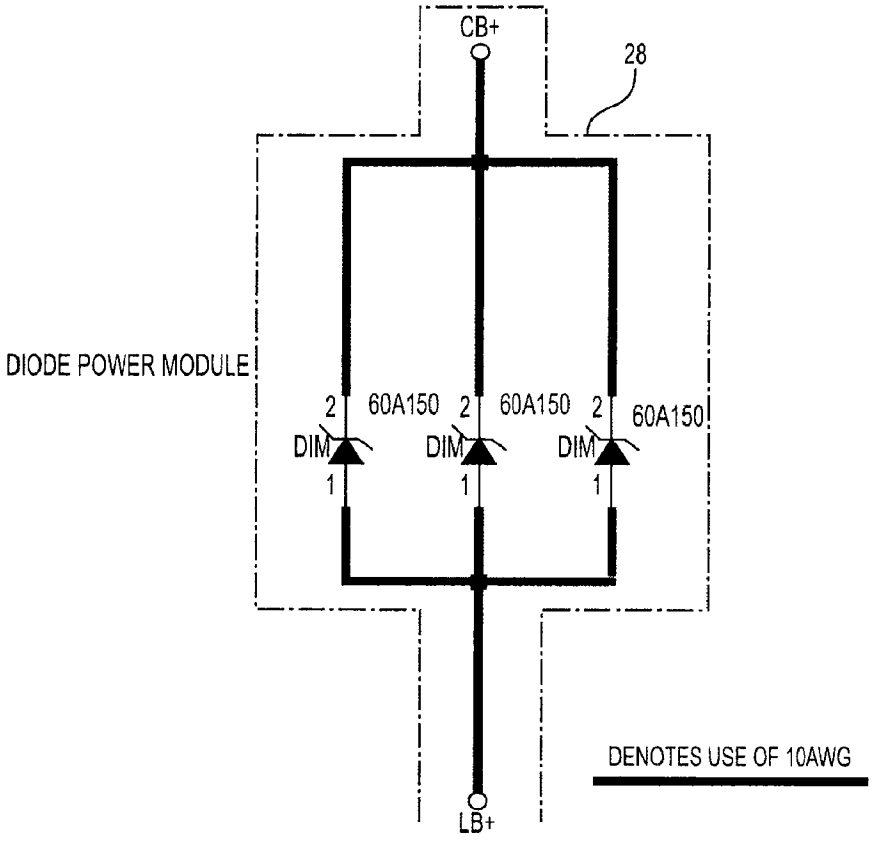
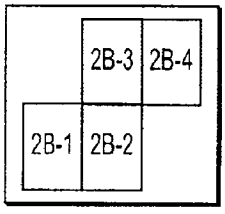

CB+
28
DIODE POWER MODULE
2
60A150
2
60A150
2
60A150
DIM
DIM
DIM
1
1
1
DENOTES USE OF 10AWG
LB+

FIG. 2B-1


2B-3
2B-4
2B-1
2B-2

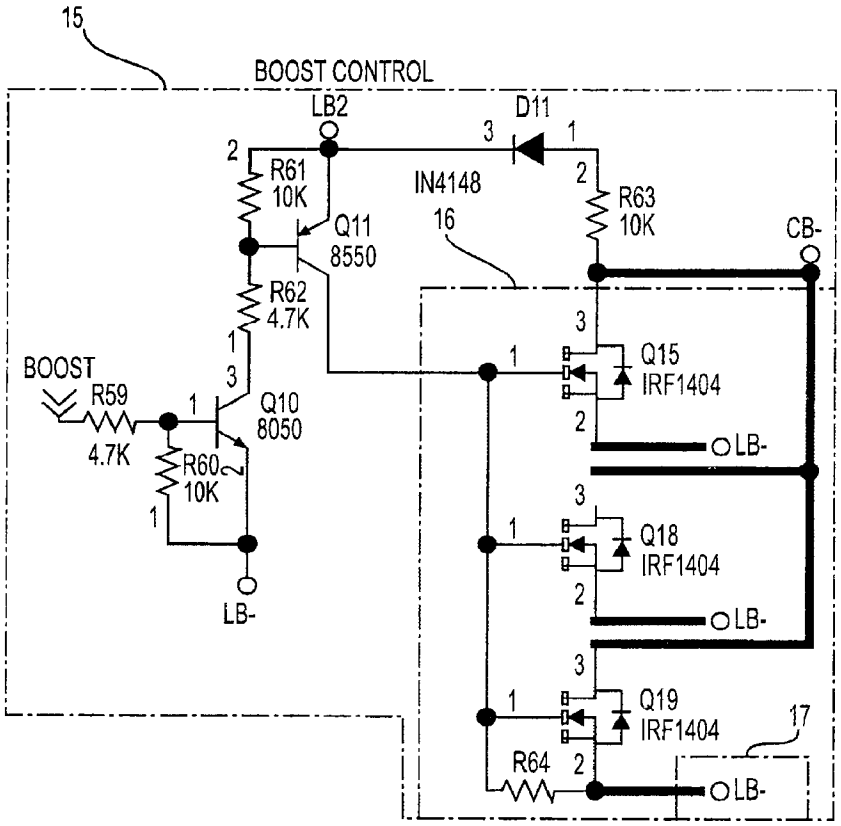
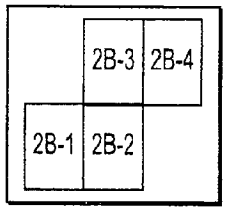

15
BOOST CONTROL
LB2
D11
R61
10K
IN4148
R63
10K
Q11
8550
16
CB-
R62
4.7K
BOOST
R59
4.7K
Q10
8050
R60
10K
LB-
Q15
IRF1404
LB-
Q18
IRF1404
LB-
Q19
IRF1404
17
R64
LB-

FIG. 2B-2


2B-3
2B-4
2B-1
2B-2

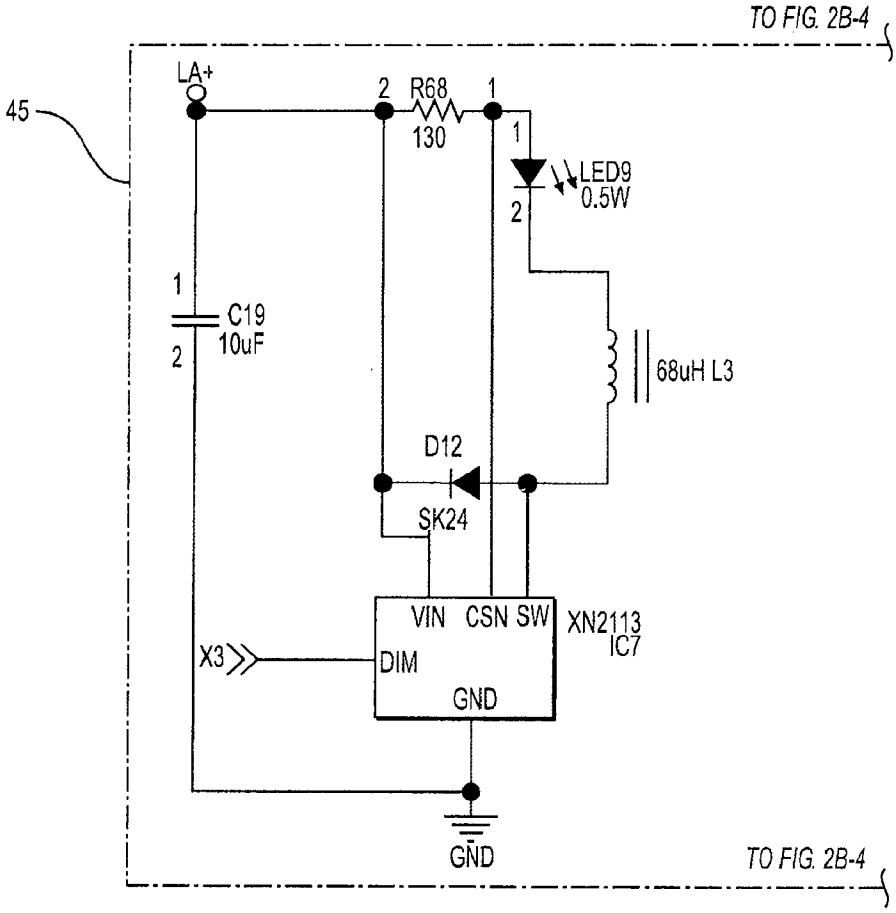
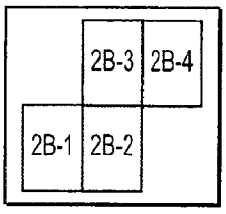

TO FIG. 2B-4
45
LA+
2
R68
130
1
1
LED9
0.5W
2
1
C19
10uF
2
68uH L3
D12
SK24
VIN
CSN
SW
XN2113
IC7
X3
DIM
GND
GND
TO FIG. 2B-4

FIG. 2B-3


2B-3
2B-4
2B-1
2B-2

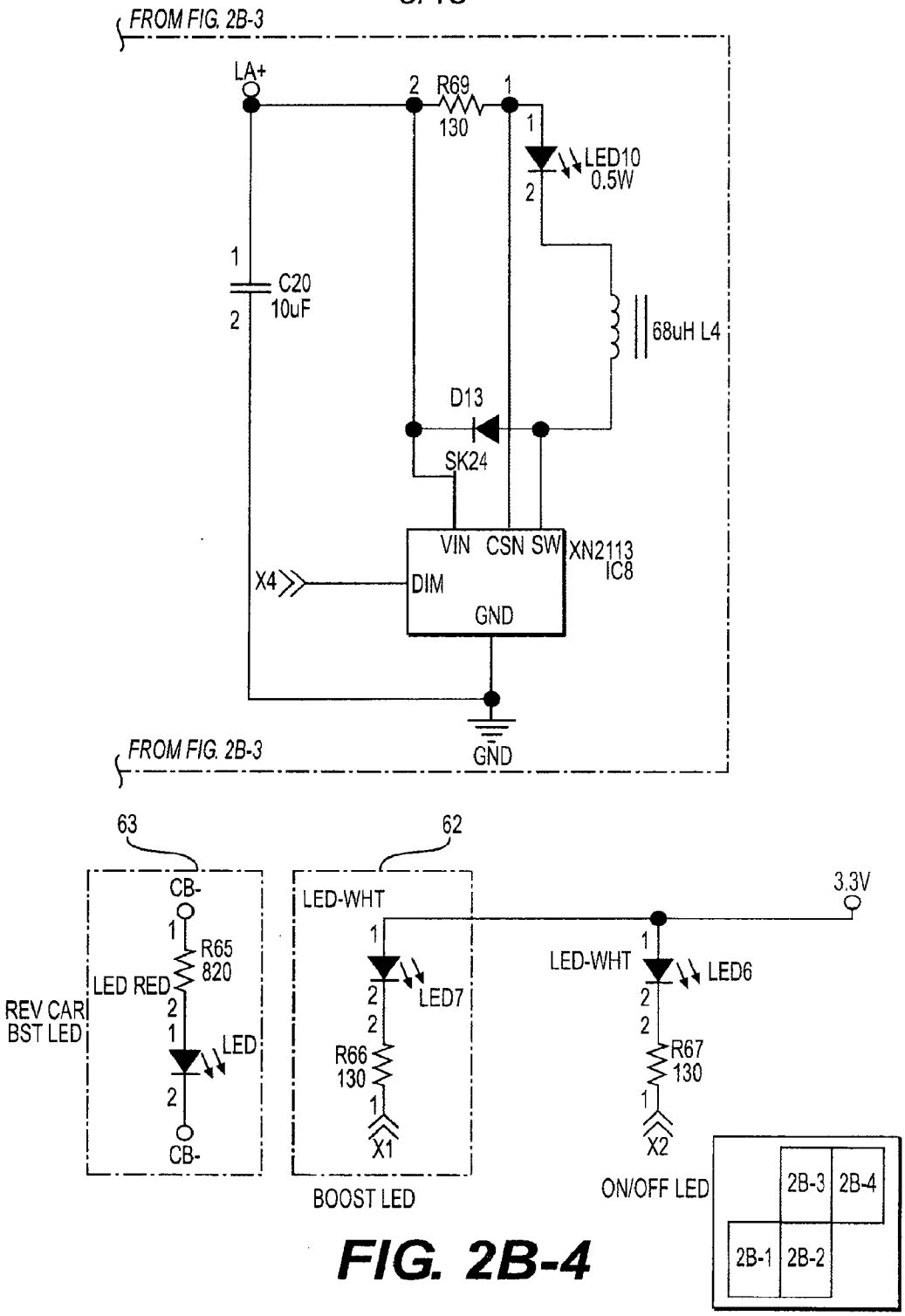

FROM FIG. 2B-3
LA+
2
R69
130
1
1
LED10
0.5W
2
1
C20
10uF
2
68uH L4
D13
SK24
VIN
CSN
SW
XN2113
IC8
X4
DIM
GND
GND
FROM FIG. 2B-3
63
62
CB-
1
R65
820
LED RED
2
REV CAR
BST LED
1
LED
2
CB-
LED-WHT
1
LED7
2
2
R66
130
1
X1
BOOST LED
3.3V
1
LED-WHT
LED6
2
2
R67
130
1
X2
ON/OFF LED
2B-3
2B-4
2B-1
2B-2

FIG. 2B-4

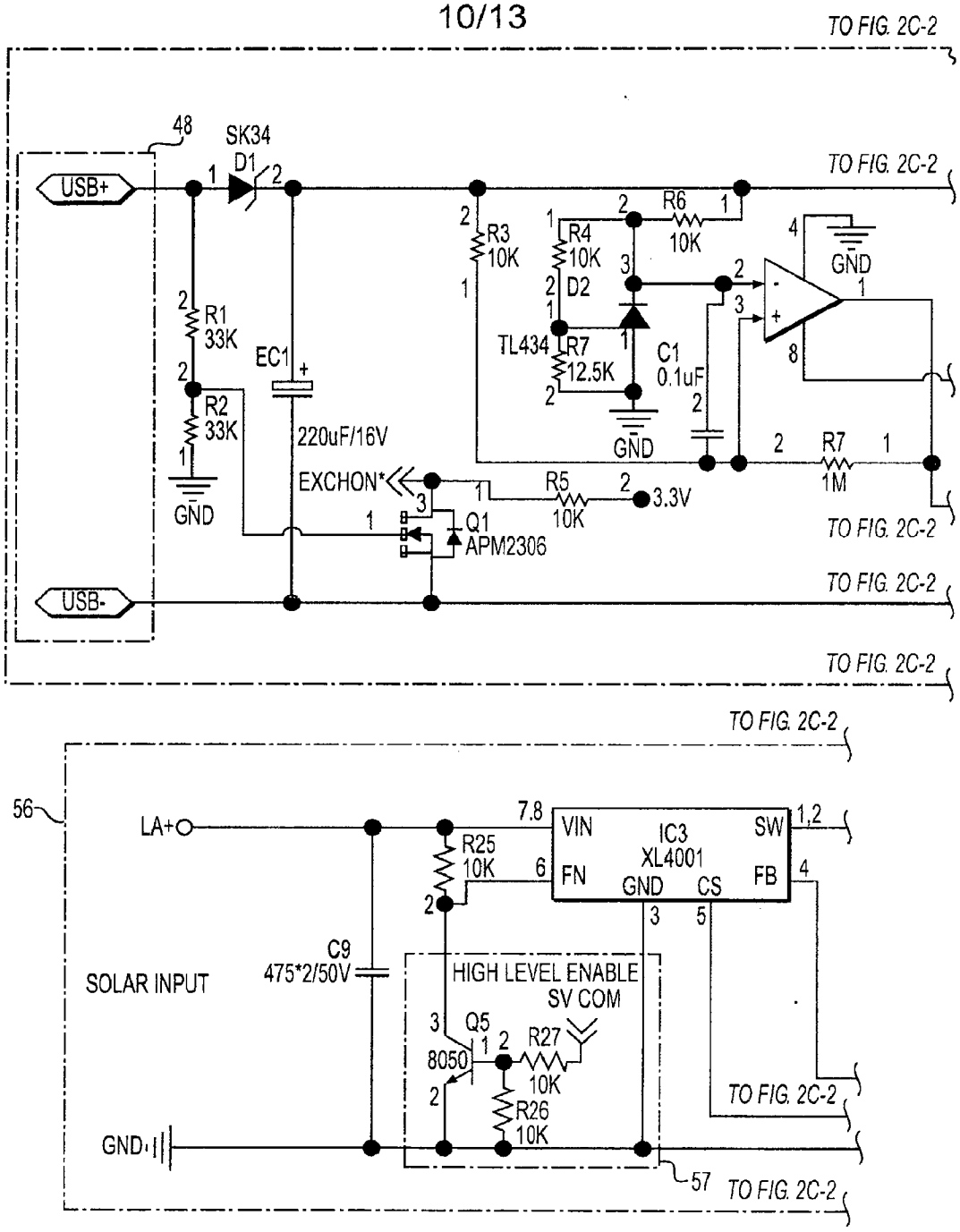
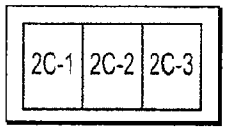

TO FIG. 2C-2
48
SK34
D1
USB+
USB-
R1
33K
R2
33K
GND
EC1
220uF/16V
EXCHON*
Q1
APM2306
R3
10K
R4
10K
D2
TL434
R7
12.5K
R6
10K
C1
0.1uF
R5
10K
3.3V
R7
1M
56
LA+
SOLAR INPUT
C9
475*2/50V
R25
10K
IC3
XL4001
VIN
FN
GND
CS
SW
FB
HIGH LEVEL ENABLE
SV COM
Q5
8050
R27
10K
R26
10K
57

FIG. 2C-1


2C-1
2C-2
2C-3

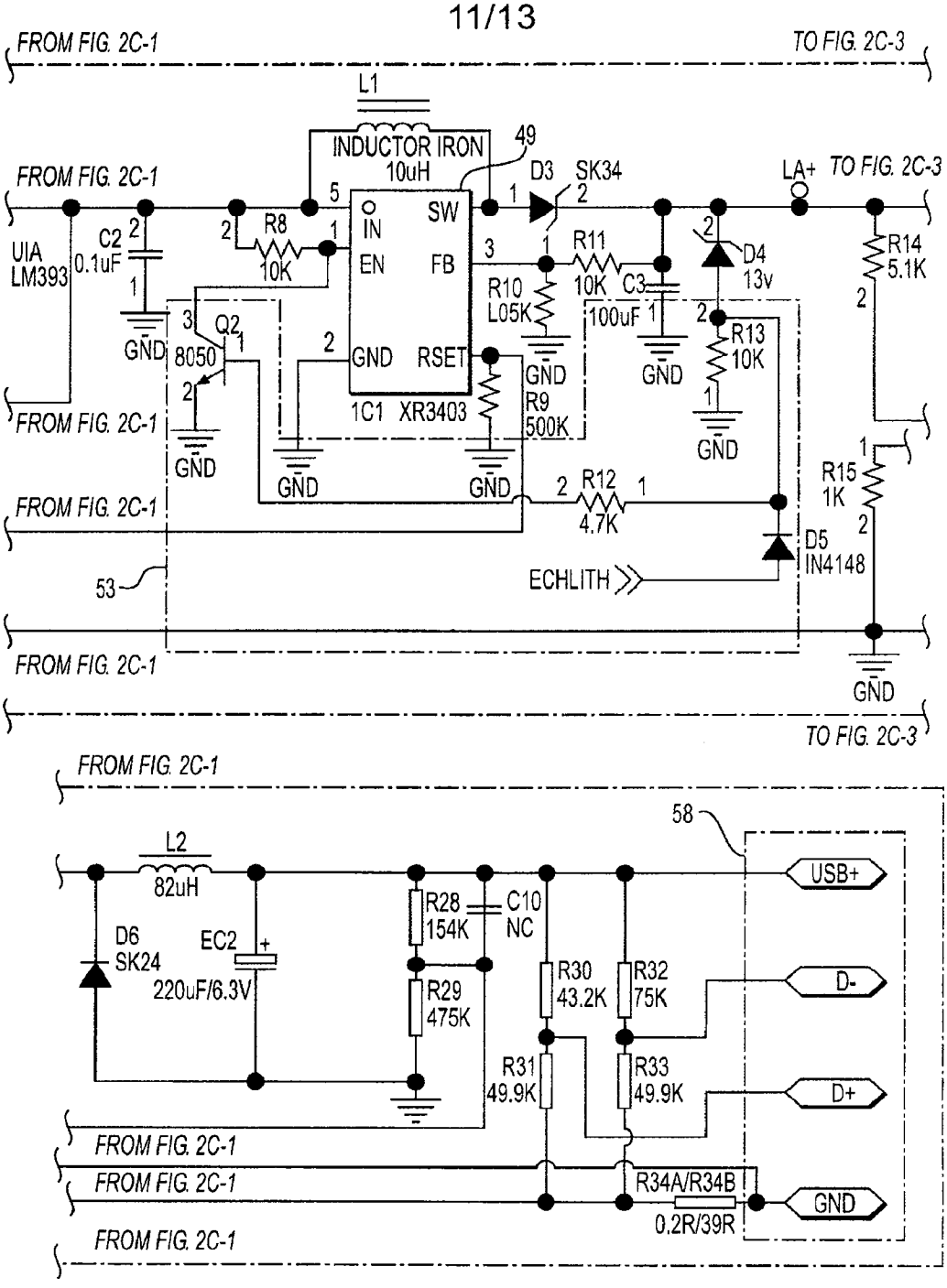
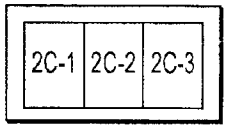
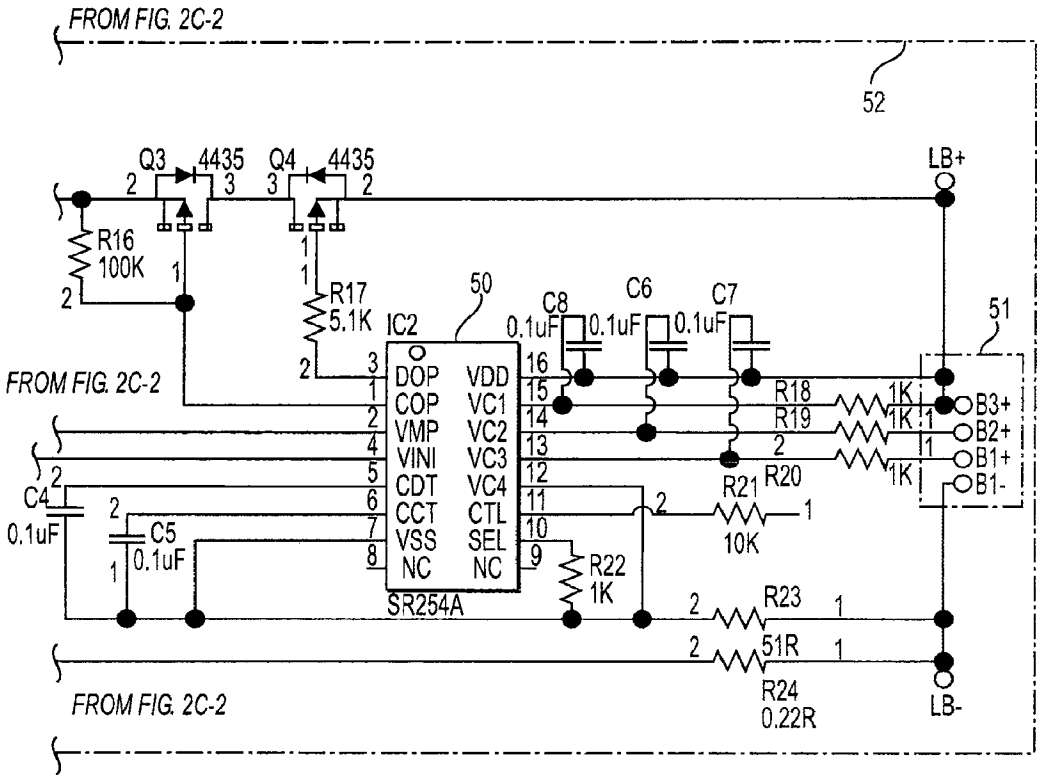

FROM FIG. 2C-1
TO FIG. 2C-3
L1
INDUCTOR IRON
10uH
49
D3
SK34
LA+
UIA
LM393
C2
0.1uF
R8
10K
IN
SW
EN
FB
GND
RSET
1C1 XR3403
R10
L05K
R11
10K
C3
100uF
D4
13v
R14
5.1K
Q2
8050
R13
10K
R9
500K
R12
4.7K
R15
1K
D5
IN4148
ECHLITH
53
L2
82uH
D6
SK24
EC2
220uF/6.3V
R28
154K
C10
NC
R29
475K
R30
43.2K
R32
75K
R31
49.9K
R33
49.9K
58
USB+
D-
D+
R34A/R34B
0.2R/39R
GND

FIG. 2C-2


2C-1
2C-2
2C-3


FROM FIG. 2C-2
52
Q3 4435
Q4 4435
LB+
R16
100K
R17
5.1K
IC2
50
C8
C6
C7
0.1uF
0.1uF
0.1uF
51
FROM FIG. 2C-2
DOP
COP
VMP
VINI
CDT
CCT
VSS
NC
VDD
VC1
VC2
VC3
VC4
CTL
SEL
NC
SR254A
R18
R19
R20
R21
1K
1K
1K
10K
B3+
B2+
B1+
B1-
C4
0.1uF
C5
0.1uF
R22
1K
R23
51R
R24
0.22R
FROM FIG. 2C-2
LB-

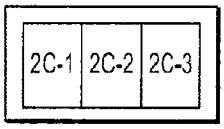

2C-1
2C-2
2C-3

FIG. 2C-3

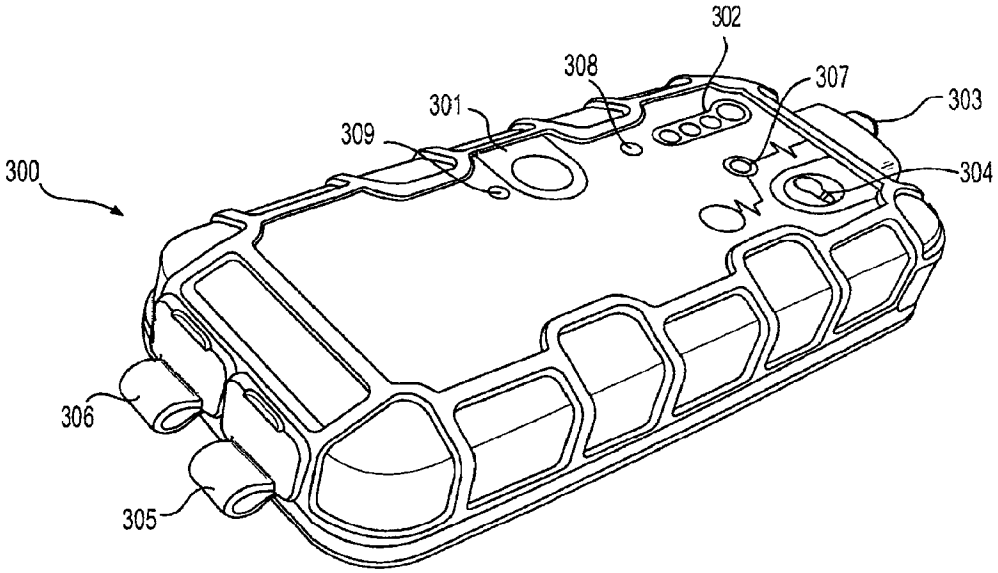

302
308
307
303
301
309
300
304
306
305

FIG. 3

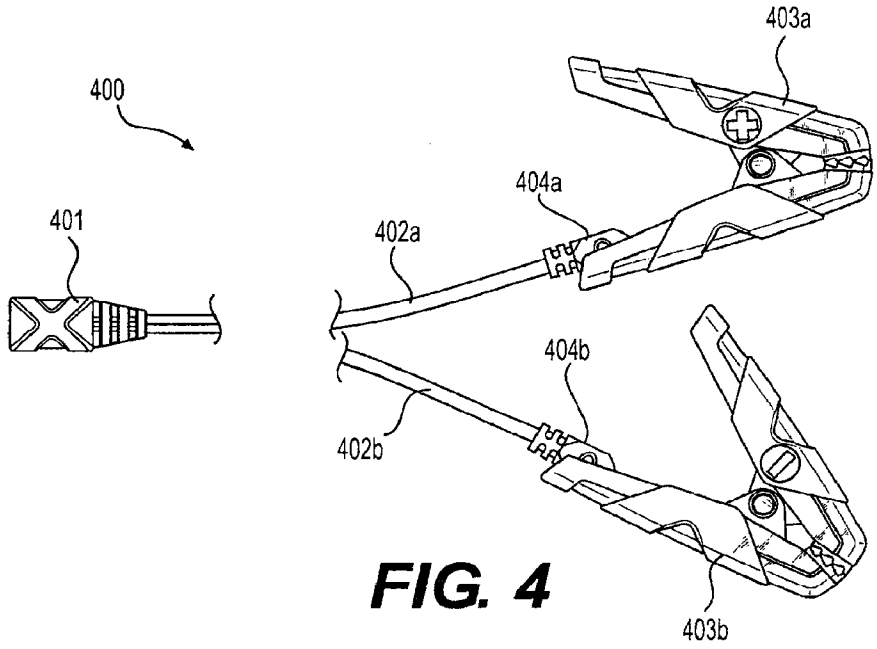

403a
400
404a
401
402a
404b
402b
403b

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/045434

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H02J 7/00 (2014.01)
CPC - H02J7/0034 (2014.09)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - B60R-016/03, B60R-016/04, F02N-11/08, H02J 7/00 (2014.01)
USPC -307/150, 320/105, 307/127, 340/636.1, 340/636.150, 361/82, 320/103

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - H02J7/0063, H02J7/0034, H02J 2001/006 (2014.09)

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2005/0110467 A1 (THOMASON) 26 May 2005 (26.05.2005) entire document	1, 4-6,8-9, 12-18, 22, 25 --- 2, 3, 7, 10, 11, 19, 20, 21, 23, 24, 26
Y	WO 2013/137873 A1 (DAO) 19 September 2013 (19.09.2013) entire document	2-3, 10-11
Y	US 6362599 B1 (TURNER et al.) 26 March 2002 (26.03.2002) entire document	7, 19-20
Y	US 7148580 B2 (SODEMANN et al.) 12 December 2006 (12.12.2006) entire document	21,23,24,26
A	US 6803743 B2 (GEORGE et al.) 12 October 2004 (12.10.2004) entire document	1-26

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"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
07 October 2014	03 NOV 2014
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

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

Espacenet

Bibliographic data: CA3005971 (A1) — 2017-08-17

BATTERY CONNECTOR DEVICE FOR A BATTERY JUMP STARTING DEVICE

Inventor(s): NOOK JONATHAN LEWIS [US]; NOOK WILLIAM KNIGHT [US]; STANFIELD JAMES RICHARD [US]; UNDERHILL DEREK MICHAEL [US] ± (NOOK, JONATHAN LEWIS, ; NOOK, WILLIAM KNIGHT, ; STANFIELD, JAMES RICHARD, ; UNDERHILL, DEREK MICHAEL)

Applicant(s): NOCO CO [US] ± (THE NOCO COMPANY)

Classification: **- international:** ***F02N11/12; H02J7/32***
- cooperative: **F02N11/12 (EP, GB)**; **F02N11/14 (GB)**; **F02N19/00 (GB)**; **H01M2/30 (EP)**; **H02J1/122 (EP)**; **H02J7/00 (GB)**; **H02J7/0032 (GB)**; F02N11/087 (EP); F02N11/14 (EP)

Application number: CA20173005971 20170210 Global Dossier

Priority number(s): US201662294067P 20160211 ; WO2016US24680 20160329 ; US201615137626 20160329 ; US201662424297P 20161118 ; WO2017US17289 20170210

Also published as: AU2017217661 (A1) AU2017217661 (B2) AU2019201081 (A1) CN108884801 (A) EP3286429 (A1) more

Abstract of CA3005971 (A1)

An enhanced conductivity battery connector device for use in a battery jump starting device. The enhance conductivity battery connector providing enhanced conductivity from the battery to a battery being recharged by the battery jump starting device.

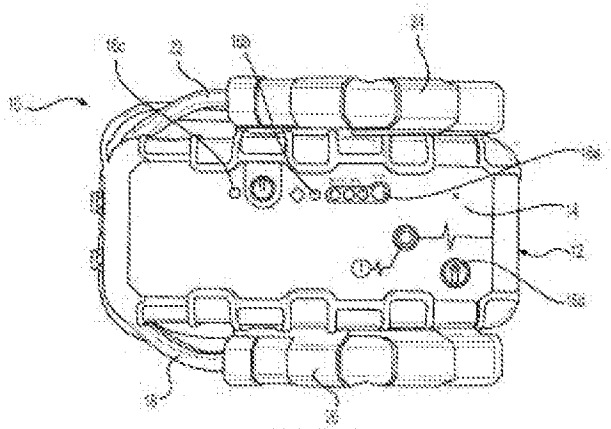


FIG. 1

Innovation, Sciences et Développement économique Canada
Office de la Propriété Intellectuelle du Canada

Innovation, Science and Economic Development Canada
Canadian Intellectual Property Office

CA 3005971 A1 2017/08/17

(21) 3 005 971

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) Date de dépôt PCT/PCT Filing Date: 2017/02/10
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(85) Entrée phase nationale/National Entry: 2018/05/22
(86) N° demande PCT/PCT Application No.: US 2017/017289
(87) N° publication PCT/PCT Publication No.: 2017/139524
(30) Priorités/Priorities: 2016/02/11 (US62/294,067); 2016/03/29 (USPCT/US2016/024680); 2016/04/25 (US15/137,626); 2016/11/18 (US62/424,297)

(51) Cl.Int./Int.Cl. *F02N 11/12* (2006.01), *H02J 7/32* (2006.01)
(71) Demandeur/Applicant:
THE NOCO COMPANY, US

(72) Inventeurs/Inventors:
NOOK, JONATHAN LEWIS, US;
NOOK, WILLIAM KNIGHT, US;
STANFIELD, JAMES RICHARD, US;
UNDERHILL, DEREK MICHAEL, US

(74) Agent: SMART & BIGGAR

(54) Titre : DISPOSITIF CONNECTEUR DE BATTERIE POUR UN DISPOSITIF DE BATTERIE DE DEMARRAGE DE SECOURS

(54) Title: BATTERY CONNECTOR DEVICE FOR A BATTERY JUMP STARTING DEVICE

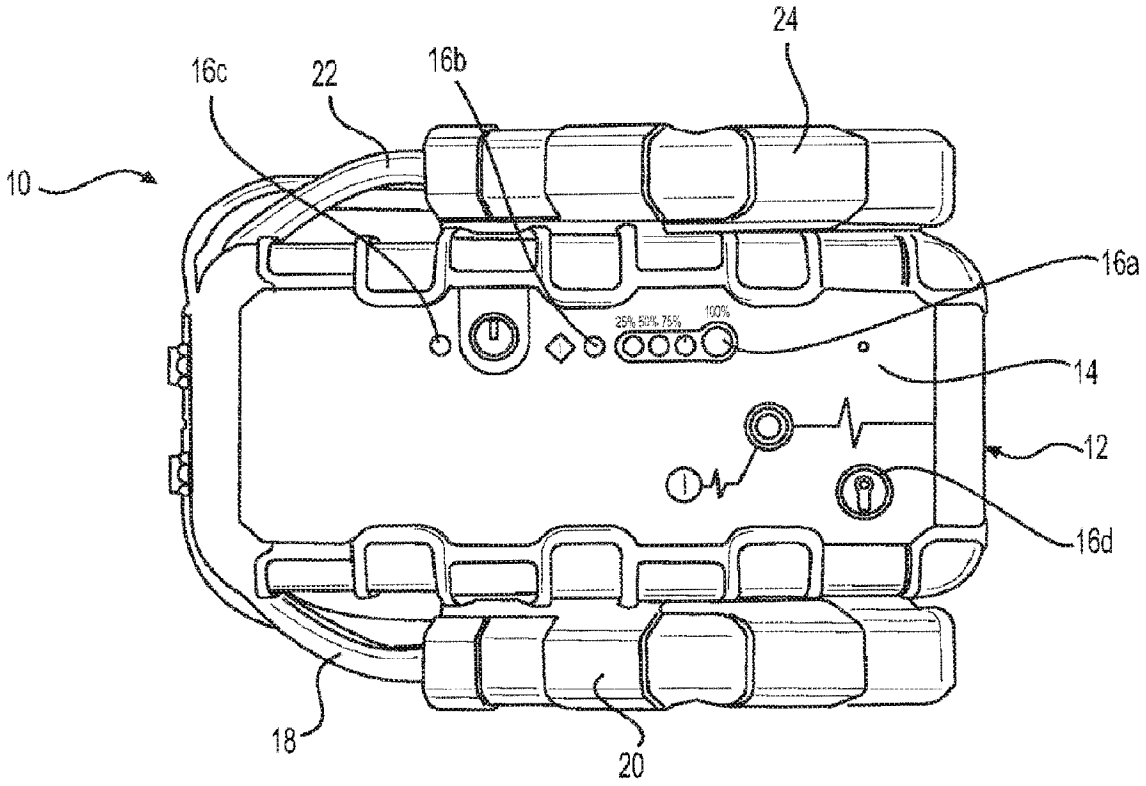

FIG. 1

(57) Abrégé/Abstract:
An enhanced conductivity battery connector device for use in a battery jump starting device. The enhance conductivity battery connector providing enhanced conductivity from the battery to a battery being recharged by the battery jump starting device.

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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
17 August 2017 (17.08.2017)

WIPO | PCT

(10) International Publication Number
WO 2017/139524 A1

(51) International Patent Classification:
F02N 11/12 (2006.01) *H02J 7/00* (2006.01)
F02N 11/14 (2006.01) *H02J 7/32* (2006.01)
F02N 19/00 (2010.01)

(21) International Application Number:
PCT/US2017/017289

(22) International Filing Date:
10 February 2017 (10.02.2017)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/294,067 11 February 2016 (11.02.2016) US
PCT/US2016/024680 29 March 2016 (29.03.2016) US
15/137,626 25 April 2016 (25.04.2016) US
62/424,297 18 November 2016 (18.11.2016) US

(71) Applicant: **THE NOCO COMPANY** [US/US]; 30339 Diamond Parkway, #102, Glenwillow, OH 44139 (US).

(72) Inventors: **NOOK, Jonathan Lewis**; c/o The Noco Company, 30339 Diamond Parkway, #102, Glenwillow, Ohio 44139 (US). **NOOK, William Knight**; c/o The Noco Company, 30339 Diamond Parkway, #102, Glenwillow, Ohio 44139 (US). **STANFIELD, James Richard**; c/o The Noco Company, 30339 Diamond Parkway, #102, Glenwillow, Ohio 44139 (US). **UNDERHILL, Derek Michael**; c/o The Noco Company, 30339 Diamond Parkway, #102, Glenwillow, Ohio 44139 (US).

(74) Agents: **KLIMA, William L.** et al.; Vorys, Sater, Seymour and Pease LLP, 1909 K Street, N.W., 9th Floor, Washington, District of Columbia 20006 (US).

(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, 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,

[Continued on next page]

(54) Title: BATTERY CONNECTOR DEVICE FOR A BATTERY JUMP STARTING DEVICE

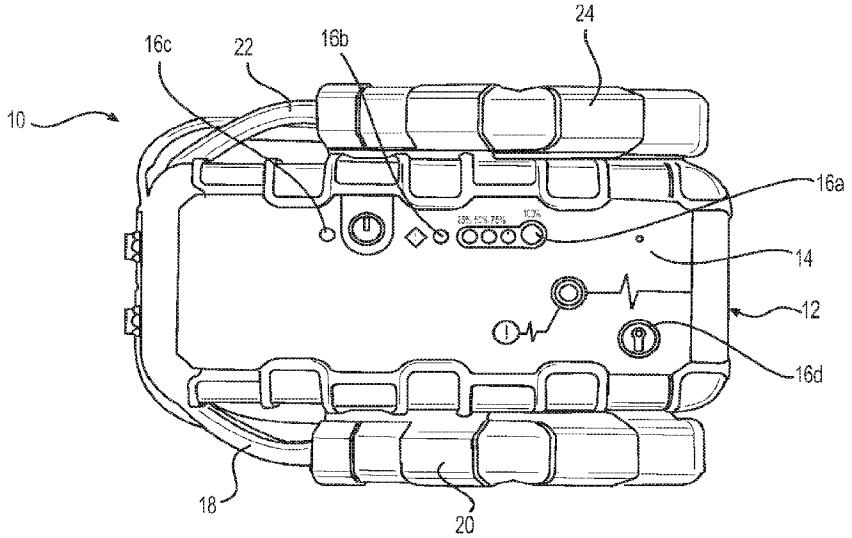

FIG. 1

(57) Abstract: An enhanced conductivity battery connector device for use in a battery jump starting device. The enhance conductivity battery connector providing enhanced conductivity from the battery to a battery being recharged by the battery jump starting device.

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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))*

TITLE

BATTERY CONNECTOR DEVICE FOR A BATTERY JUMP STARTING DEVICE

FIELD

A portable battery connector device, for example, a battery connector arrangement or assembly for a battery jump starting device, in particular a portable vehicle jump starting apparatus, configured for enhancing the conductivity between the battery of the jump starting apparatus and a battery being charged.

BACKGROUND

The exists a portable vehicle battery jump start apparatus as disclosed in U.S. Patent No. 9,007,015 to Nook et al. The apparatus utilizes a lithium ion battery pack. In this type of apparatus, there exists a need to maximize conductivity from the battery pack to the vehicle battery of the vehicle being jump started.

For successful car jump-starts, there are two main factors dictating the results. The first factor is the amount of power provided by the lithium ion battery pack, and the second factor is the maximum conductivity. You need both factors to have the best chance to jump-start big engines. One factor without the other factor is not enough.

SUMMARY

The presently described subject matter is directed to a battery device, for example, a battery connector, battery connector arrangement, or battery conductor assembly for use in a device for jump starting a vehicle, and a device for jump starting a vehicle comprising the battery connector device.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having at least one battery conductor connected to a terminal of the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having at least one battery conductor or cable connected to a battery tab of the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive conductor and a negative conductor connected to the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive conductor plate and/or a negative conductor plate connected to the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive conductor plate and/or a negative conductor plate connected to the battery, and a positive cable connected to the positive conductor plate and/or a negative cable connected to the negative conductor plate.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal of the battery and/or a negative battery conductor connected to a negative terminal of the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and/or a negative battery conductor connected to a negative terminal contact of the battery, the battery conductors being soldered to the respective terminals of the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal of the battery and/or a negative battery conductor connected to a negative terminal contact of the battery, and a relay connected to one of the battery conductors of the battery.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and/or a negative battery conductor connected to a negative terminal contact of the battery, and a relay connected to the negative battery conductor.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and/or a negative battery conductor connected to

WINPLUS Ex. 1003, p. 563

a negative terminal contact of the battery, and a relay connected to the negative battery conductor.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and/or a negative battery conductor connected to a negative terminal contact of the battery, and multiple relays connected to the negative battery conductor.

The presently described subject matter is directed to a battery connector device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and/or a negative battery conductor connected to a negative terminal contact of the battery, and a positive cable connected to the positive battery conductor.

According to one aspect of the present invention, there is provided a rechargeable battery with connector device for use in a battery jump starting device, the device comprising: a rechargeable battery comprising at least one battery cell having a positive tab and a negative tab; a positive cable having a conductor connected to the positive tab of the at least one battery cell of the rechargeable battery; and a negative terminal conductor bar connected to the negative tab of the at least one cell of the rechargeable battery.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a front view of the battery jump starting device with the clamps un-deployed.

FIG. 2 is a rear perspective view of the battery jump starting device shown in FIG. 1.

FIG. 3 is an end perspective view of the battery jump starting device shown in FIGS. 1 and 2.

FIG. 4 is a front perspective view of the battery jump starting device shown in FIG. 1, however, with the clamps deployed.

FIG. 5 is a front perspective view of a battery connector device contained within the battery jump starting device shown in FIG. 1, however, with the negative cable not yet installed.

FIG. 6 is a top planer view of the battery connector device shown in FIG. 5.

FIG. 7 is a side elevational view of the battery connector device shown in FIG. 5.

FIG. 8 is an end elevational view of the battery connector device shown in FIG. 5.

FIG. 9 is a perspective view of the battery connector device shown in FIG. 5, however, with the negative cable connected to the battery connector device.

FIG. 10 is a view perspective view of the battery connector device shown in FIG. 5, however, with a diode connector installed on the positive cable.

FIG. 11 is a perspective view of the battery connector device connected to other components or parts of the battery jump starting device.

FIG. 12 is a perspective view of the battery assembly of the battery connector device shown in FIG. 5.

FIG. 13 is a front perspective view of another battery connector device for the battery jump starting device.

FIG. 14 is a detailed view of the positive cable connection with the relay printed circuit board prior to being soldered thereto.

FIG. 15 is a detailed view of the positive cable connection with the relay printed circuit board after being soldered thereto.

FIG. 16 is a front perspective view of the battery assembly of the battery connector device shown in FIG. 13.

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FIG. 17 is a partial top planar view of the battery assembly shown in FIG. 16, however, with the positive terminal conductor sheet in an unwound condition.

FIG. 18 is a partial top planer view of the positive terminal conductor of the battery assembly shown in FIG. 16.

FIG. 19 is an end perspective view of the positive terminal conductor partially wound around the end of the positive cable.

FIG. 20 is an end perspective view of the positive terminal conductor fully wound around the end of the positive cable.

FIG. 21 is a side perspective view of the positive terminal conductor fully wound around and soldered to the end of the positive cable.

FIG. 22 is an opposite end perspective view of the positive terminal conductor fully wound around and soldered to the end of the positive cable.

FIG. 23 is a perspective view of the diode connector between sections of the positive cable.

FIG. 24 is a perspective view of a Schottky Diode used in the diode connector.

FIG. 25 is a perspective view of the diode connector insulated with a shrink wrap sleeve.

FIG. 27 is a graphical illustration showing a load test of the battery connection shown in FIGS. 5-10.

FIG. 28 is a graphical illustration showing a load test of the battery connection shown in FIGS. 13-25.

FIG. 29 is a front view of a further battery connector device for the battery jump starting device.

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FIG. 30 is a front view of the battery connector device comprising a plurality of battery cells, separate tab, and conductors (e.g. plate conductors) prior to assembly.

FIG. 31 is a front view of the battery connector device comprising battery cells being prepared with separate tabs for lengthening the tabs.

FIG. 32 is a front view of the battery connector device comprising the plurality of battery cells, separate tab, and conductors shown in FIG. 30, after assembly.

FIG. 33 is a perspective view showing the battery connector device comprising the battery cell assembly shown in FIG. 32, after folding the battery cells.

FIG. 34 is an end perspective view of the battery connector device showing the separate tab being wrapped or wound around an exposed end of the positive cable, and soldered together.

FIG. 35 is an opposite end perspective view of the battery connector device showing a negative battery tab wrapped around the negative terminal conductor plate and welded and/or soldered together.

FIG. 36 is a perspective view of the battery connector device showing the flat separate tab connected to the battery and extending outwardly prior to connection to the positive cable.

FIG. 37 is a side view of the temperature sensor assembly with wires and connector.

FIG. 38 is a perspective view of the diode circuit board assembled connected inline or spliced into the positive cable.

DETAILED DESCRIPTION

A battery jump starter device 10 is shown in FIGS. 1 and 2. The battery jump starting device 10 comprises a casing 12 having a display 14 provided with an arrangement of light emitting diodes (LEDs) 16.

The battery jump starting device 10 further comprises a positive cable 18 having a positive clamp 20 and a negative cable 22 having a negative clamp 24. The positive cable 18 and negative cable 22 pass through openings 12a, 12b, respectively, in the casing 12.

The clamps 20, 24 are stowed away or docked in an un-deployed mode by clamping each to a respective side posts 26 extending outwardly on opposite sides of the casing 12, as shown in FIG. 1. The side posts 26 are shown in FIG. 2. The clamps 20, 24 are docked when the battery jump starter device 10 is in non-use, and then undamped from the side post 26 during use.

The battery jump starting device 10 is configured to jump start a vehicle battery. For example, the battery jump starting device 10 can be the PORTABLE VEHICLE JUMP START APPARATUS WITH SAFETY PROTECTION disclosed in U.S. Patent No. 9,007,015, or a device or apparatus similar thereto.

The battery jump starting device 10 comprises electrical components or parts located inside the casing 12. For example, the battery jump starting device 10 comprises a battery connector device 100 shown in FIGS. 3 - 9.

The battery connector device 100 comprises a battery assembly 110 having a battery 112. For example, the battery 112 is a lithium ion rechargeable type battery. The

battery connector device 100 is configured to maximize conductivity from the battery 112 to the cables 18, 22 and clamps 20, 24 of the battery jump starter device 10. The battery 112 comprises a battery casing 112a, for example, a rectangular-shaped battery casing 112a.

The battery 112 comprises a positive tab at one end (e.g. width) of the battery 112, and a negative terminal tab at an opposite end (e.g. width) of the battery 112. For example, the battery 112 comprises one or more battery cells each having a positive and negative tab. For example, the positive tab from one battery cell is located at the one end of the battery 112 and the negative tab from one battery cell is located at the opposite end of the battery 112. A positive terminal conductor plate 114 is connected (e.g. soldered, welded, or sonically welded) at the one end of the battery 112 to the positive tab (i.e. contact) of the battery 112. The positive terminal conductor plate 114 extends along the one end (e.g. width) of the battery 112.

The positive cable 18 can be connected (e.g. directly connected by soldering) to the positive terminal conductor plate 114 and/or the positive tab of the battery 112. For example, the positive terminal conductor bar 114 can be provided with a conductive loop 116 wrapping around (e.g. entirely wrapping around) and connected (e.g. crimped and/or soldered) to an exposed end 18a of the positive cable 18. For example, the positive terminal conductor plate 114 is made from heavy gauge copper sheet (e.g. machined, cut, or stamped therefrom).

As shown in FIGS. 5 and 6, the positive terminal conductor sheet 114 can be configured (e.g. bent) to wrap around one of the square-shaped corners of the rectangular-shaped casing 112a of the battery 112 (e.g. L-shaped). The L-shaped

positive terminal conductor sheet 114 can extend along an end of the battery 112 and along at least a portion of the side of the battery 112, as shown in FIG. 5.

The positive terminal conductor plate 114 can also be mechanically coupled and/or adhered to the outer surface of the battery casing 112a to provide additional support and stability thereof (e.g. assembled to survive mechanical shock when drop testing the battery jump starter device 10). For example, the positive terminal conductor bar 114 can be mechanically connected to the battery casing 112 by adhesive (e.g. silicon adhesive), double sided tape, double sided foam tape, insulated plastic or ceramic connector with snap fit connection and/or adhesive connection, and/or the battery casing 112 can be formed (e.g. molded) to mechanically connect (e.g. snap fit or interference connection) with the positive terminal conductor plate 114.

The positive cable 18 can be a single piece of wire or a cable (e.g. twisted or braided wires) extending from the battery 110 to the positive clamp 20. Specifically, one end of the positive cable 18 is connected to the positive terminal conductor plate 114 connected to the battery 18, and the opposite end of the positive cable 18 is connected to the positive clamp 20.

More specifically, the positive cable 18 can comprise a flexible or bent cable portion 118 for changing the direction of the positive cable 18 within the casing 12. The positive cable 18 can be fitted with a flexible outer sleeve portion 120 transitioning into a flexible inner sleeve portion 122 to flexibly accommodate the positive cable 18 passing through the casing 12. The flexible outer sleeve portion 120 is externally located relative to the casing 12 of the battery jump starter device 10, and the flexible inner sleeve

portion 122 is internally located relative to the casing 12 of the battery jump starter device 10.

The flexible outer sleeve portion 120 is configured to reinforce the connection between the positive cable 18 and the casing 12 of the battery jump starter device while remaining flexible. For example, the flexible outer sleeve portion 120 is provided with one or more grooves 124 (e.g. three (3) shown in FIG. 5) exposing portions of the positive cable 18. The one or more grooves 124 act as hinges to ease bending of the positive cable 18 within the flexible outer sleeve portion 120.

The flexible sleeve 120 comprises an outer flange 124 spaced apart (e.g. a small distance equal to about a wall thickness of the casing 12 of the battery jump starter device 10) from an in inner flange 126. The flanges 124, 126 further anchor the positive cable 18 to the casing 12 of the battery jump starter device 10.

The flexible sleeve 120 comprises a sleeve portion 128 (FIG. 6) connecting together the outer flange 124 and inner flange 126. For example, the flexible outer sleeve portion 120 is molded or applied onto and around the positive cable 18 as a single unit (e.g. the flexible sleeve 120 is molded onto a portion of the positive cable 18 inserted within the mold during the molding process). Alternatively, the flexible sleeve 120 is made (e.g. molded) separately, and then installed or assembled onto a portion of the positive cable 18.

The positive cable 18 comprises an inner conductor 18b (e.g. single wire conductor, twisted wires, or braided wires) disposed within an outer insulating sheath 18c (e.g. extruded plastic sheath). The inner conductor 18b, for example, can be a solid wire conductor or a multi strand metal wire conductor comprising bundle of wires 18d.

The inner wire can be made of copper or aluminum. The flexible sleeve 120 can be applied (e.g. molded or installed or assembled) onto and surrounding the outer insulating sheath 18c of the positive cable 18.

The battery connector device 100 further comprises a negative terminal conductor plate 130 connected (e.g. soldered, welded, or sonically welded) at an opposite end of the battery 112 to the negative tab (i.e. contact) of the battery 112. The negative terminal conductor plate 130 can extend along the opposite end of the battery 112.

The other end of the negative terminal conductor plate 130 is provided with a negative terminal conductor plate connector portion 132, as shown in FIGS. 5 and 6.

The negative terminal conductor plate 130 can be configured to wrap around one of the corners of the rectangular-shaped battery 112 (e.g. L-shaped). The L-shaped negative terminal conductor plate 130 can extend along an end of the battery 112 and along at least a portion of the side of the battery 112, as shown in FIGS. 5 and 6.

The negative terminal conductor bar 130 can also be mechanically coupled and/or adhered to the outer surface of the battery casing 112a to provide additional support and stability thereof (e.g. to survive mechanical shock when drop testing the battery jump starter device 10). For example, the negative terminal conductor bar 114 can be mechanically connected to the battery casing 112a by adhesive (e.g. silicon adhesive), double sided tape, double sided foam tape, insulating plastic or ceramic connector with snap fit connection and/or adhesive connection, and/or the battery casing 112 can be formed (e.g. molded) to mechanically connect (e.g. snap fit or interference connection) with the positive terminal conductor plate 114.

The battery connector device 100 further comprises a smart switch battery interface 134. The smart switch battery interface 134 comprises a relay printed circuit board (PCB) 136 having a first circuit board conductor bar 138 spaced apart from a second circuit board conductor bar 140 located on one side of the circuit board 136, as shown in FIGS. 5 and 6.

A pair of relays 142 are mounted on an opposite side of the circuit board 136. The relays 142 include relay anchoring pins 142a located in through holes 136a in the relay printed circuit board 136 (FIGS. 5 and 7). The relays 142 further comprise relay connector pins 142b extending through the through holes 136b provided in the circuit board 136 and slots 138a provided in the first conductor bar 138. The relays 142 even further comprise relay connector pins 142c located in the through holes 136c provided in the circuit board 136 and through holes 140a provided in the second conductor bar 140. The relay anchoring pins 136a are soldered in place to mechanically connect the relays 142 to the circuit board 136. The relay connecting pins 142b and 142c are soldered in place to mechanically and electrically connect the relays 142, respectively, to the circuit board conductor plates 138, 140.

The through holes 136a in the circuit board 136 are rectangular-shaped (FIGS. 5 and 7) and accommodate the relay anchoring pins 142a. Specifically, a base portion of the relay anchoring pins 142a are rectangular-shaped with square-shaped ends. The square-shaped ends are dimensionally less wide verses the base portions creating transverse edges oriented flush with the outer surface of the circuit board 136. When solder is applied to the exposed ends of the relay anchoring pins 142a, the solder

connects to the sides of the square-shaped ends and transverse edges to anchor and lock the relay anchoring pins to the circuit board 136.

The slots 132a provided in negative terminal conductor bar connector portion 132 are rectangular-shaped and the through holes138a in the first circuit board conductor bar 138 (FIG. 3) are T-shaped to accommodate the three (3) horizontally oriented relay connector pins 142b, as shown in FIG. 3. The ends of the relay connector pins 142b are shown flush with the outer surface of the negative terminal conductor bar connector portion 132. When solder is applied to the exposed ends of the relay connector pins 142b, the solder fills in the slots 132a in the negative terminal conductor bar connector portion 132 and the through holes 138a of the first circuit board conductor bar 138, and connects the sides of the connector pins 142b with inner edges of the slots 132a and through holes 138a to anchoring the relays 142 to the circuit board 136 and negative terminal conductor bar connector portion 132. This applied solder also electrically connects the negative terminal conductor bar connector portion 132 to the first circuit board conductor bar 138.

The through holes 140a provided in the second circuit board conductor bar 140 are T-shaped to accommodate the three (3) vertically oriented relay connecting pins 142c, as shown in FIG. 3. The relay connector prongs 140a extend outwardly from the outer surface of the circuit board 136 to connect with the exposed conductor end 144a of the negative cable 144, and shown in FIG. 7. When solder is applied to the exposed conductor end 144a and the ends of the relay connector prongs 140a, the solder fills in the T-shaped slot and electrically connects the relay connector prongs 140a, second

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circuit board conductor 140, and exposed conductor end 144a of the negative cable 144.

The negative terminal conductor bar connector portion 132 of the negative terminal conductor bar 130 is connected (e.g. by soldering) to the first circuit board conductor bar 138 of the circuit board 136. The exposed conductor end 22a (i.e. with the insulating sheath removed) of the negative cable 22 is connected (e.g. by soldering) to the second circuit board conductor bar 140, as shown in FIG. 9.

The battery connector device 100 can be modified by providing the positive cable 18 with a diode connection 150, as shown in FIG. 10. For example, a diode connection is installed (e.g. spliced) into the positive cable 18. The diode connection 150 comprises a diode printed circuit board (PCB) 152 provided with a set of back-charge diodes 154 (e.g. Schottky Diodes) located on one side thereof, and a conductor bar 156 provided on an opposite side of the circuit board 152.

ASSEMBLY

The battery jump starting device 10 comprises the casing 12 having an upper casing portion 12a and a lower casing portion 12b, as shown in FIG. 11. The upper casing portion 12a and the lower casing portion 12b are configured to be connected together when assembling the battery jump starting device 10.

The battery jump starting device 10 further comprises the battery connection device 100 and controller assembly 210 both disposed within the casing 12. The

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controller assembly 210 comprises a circuit board 212 located adjacent to another circuit board 214.

The positive terminal of the battery assembly 110 (FIG. 12) is connected to the circuit board 212 via a positive power wire 216. For example, the positive power wire 216 is soldered to the positive conductor bar 114 (FIG. 5). The negative terminal of the battery assembly 110 is connected to the circuit board 214 via a negative power wire 218.

The relay circuit board 136 is provided with a wire set 220 having a connector 222. The connector 222 is configured to connect with the relay board connector 224 located on the circuit board 212 of the controller assembly 210 during assembly of the battery jump starting device 10.

The battery assembly 110 further comprises a wire set 226 having a connector 228. The connector 228 is configured to connect with the battery cell charging/monitoring connector 230 located on the circuit board 212 of the controller assembly 220.

The battery assembly 110 also comprises a battery temperature sensor having a wire set 232 having a connector 234. The connector 234 is configured to connect with the temperature sensor connector 236 located on the circuit board 212 of the controller assembly 220.

The circuit board 212 is provided with in charge power resistors 240 and an out relay 242, as shown in FIG. 11. Further, the lower casing portion 12a is provided with a main user out connector 244 having a wire set 246 connected to the circuit board 214,

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and a main user in connector 248 having a wire set 250 connected to the circuit board 214.

The battery assembly 110 is connected to battery jump starting device 10, as shown in FIG. 11. The battery connector device 110 is installed within the casing 12 of the battery jump starting device 10 when assembled.

ENHANCED CONDUCTIVITY

An enhanced conductivity battery connector device 400 is shown in FIGS. 13 – 25. The enhanced conductivity battery connector device 400 provides a significantly increased conductivity compared to the battery connector device 100, as shown in FIGS. 5 – 10.

The amount of power to be conducted from the battery 412 to the clamps can be enhanced as follows:

1) Increase Wire Gauge

e.g. change 4AWG (American Wire Gage) positive cable 18 and negative cable 22 (FIG. 9) to a 2AWG positive cable 318 and negative cable 322 (FIGS. 13 and 15).

2) Increase Conductivity of Negative Cable Connection

e.g. negative cable end 322a (FIG. 15) connection to the relays will extend all the way across the connector pins 422c of the relays 422.

3) Increase Conductivity of Positive Cable Connection

e.g. the positive battery tab 414 is lengthened so that the positive cable 318 can be rolled up (FIGS. 17-22) in the positive battery tab 414 and soldered together thoroughly;

4) Increase Conductivity of Diode Connection

e.g. replace the diode connection 150 (FIG. 5) with the diode connection 450 (FIG. 23).

5) Redesign Resistor/Diode Printed Circuit Board (PCB)

e.g. replace the diode printed circuit board (PCB) 152 (FIG. 10) with the diode printed circuit board (PCB) 452 (FIG. 23).

6) Reconnect Resistors

e.g. reconnect resistors R134A&B, R135A&B located on the diode printed circuit board (PCB) 152 (FIG. 10) to be connected again.

A detailed description of each of these enhanced conductivity features or arrangement is set forth below.

1) Increase Wire Gauge

The gauge of the positive cable 18 and negative cable 22 (FIG. 9), for example, can be increased from 4AWG (American Wire Gage) cable to a 2AWG cable for positive cable 318 and negative cable 322 (FIGS. 13 and 15). The comparative specifications of the 4AWG cable and 2AWG cable are as follows:

	2AWG	4AWG
Diameter	0.2576 in	0.2294 in
	(6.544 mm)	(5.189 mm)
Turns of wire	3.88/in	4.89/in
	(1.53/cm)	(1.93/cm)
Area	66.4 kcmil	41.7 kcmil
	(33.6 mm^2)	(21.2 mm^2)
Resistance/length	0.5127 mΩ/m	0.8152 mΩ/m
	(0.1563 mΩ/ft)	(0.2485 mΩ/m)
Ampacity	95 (60° C)	70 (60° C)
	115 (75° C)	85 (75° C)
	130 (90° C)	95 (90° C)
Fusing current	1.3 kA (10 s)	946 A (10 s)
	10.2 kA (1s)	6.4 kA (1 s)
	57kA (32 ms)	36 kA (32 ms)

The 2AWG cable provides a significant increase of conductivity (i.e. ampacity) compared to the 4AWG cable (i.e. approximately 36%).

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2) Increase Conductivity of Negative Cable Connection

The negative cable 322 (FIG. 15) can be connected to the battery 412 (FIG. 13) in a manner to increase the conductivity (i.e. ampacity) between the battery 412 and negative cable 322. For example, the negative cable end 322a can be directly connected (e.g. soldered) to the connector prongs 442c (FIG. 15) of the relays 442. Specifically, the negative cable end 322a can extend across and directly connect to all relays 342 of the smart switch battery interface 434, as shown in FIGS. 14 and 15. Further, the negative cable end 322a can be connected to a conductor loop 441 of the circuit board conductor bar 440.

The negative cable 322, for example, can be stranded wire comprising an inner electrical wire conductor 322b composed of an untwisted or twisted bundle of wires 322d disposed within an outer electrical insulating sheath 322c. The electrical insulating sheath 322c of the negative cable 322 can be removed from the negative cable end 322a exposing the inner electrical conductor 322b at the negative cable end 322a.

The exposed bundle of wires 322d of the electrical conductor 322b can be forced over the ends of the exposed connector pins 442c of the relays 442 so that strands of wires 322d are captured between the adjacent connector pins 442c. The exposed bundles of wires 332d can be further forced into contact with the conductor bar 440 (e.g. made of copper). Solder 423 is applied to this assembly so that the solder flows between the exposed bundles of wires 422d to the connector pins 442c and the conductor bar 440 to complete the electrical connection between the negative cable 322 and the smart switch battery interface 434 connected to the battery 412.

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