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APPLICATION NO.	ISSUE DATE	PATENT NO.
17/301,609	27-JUN-23	11689153

Maschoff Brennan
1389 Center Drive, Suite 300
Park City, UT 84098

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/301,609	06/27/2023	11689153	S4079.10001US03	3509

97149 7590 06/07/2023

Maschoff Brennan
1389 Center Drive, Suite 300
Park City, UT 84098

ISSUE NOTIFICATION

The projected patent number and issue date are specified above. The patent will issue electronically. The electronically issued patent is the official patent grant pursuant to 35 U.S.C. § 153. The patent may be accessed on or after the issue date through Patent Center at https://patentcenter.uspto.gov/. The patent will be available in both the public and the private sides of Patent Center. Further assistance in electronically accessing the patent, or about Patent Center, is available by calling the Patent Electronic Business Center at 1-888-217-9197.

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

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Patents Stakeholder Experience (OPSE), Stakeholder Support Division (SSD) at (571)-272-4200.

INVENTOR(s) (Please see PAIR WEB site http://pair.uspto.gov for additional inventors):

Dean Solon, Gallatin, TN;

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

SHOALS TECHNOLOGIES GROUP, LLC, Portland, TN;

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/301,609	04/08/2021	Dean Solon	S4079.10001US03	3509

97149 7590 03/30/2023

Maschoff Brennan
1389 Center Drive, Suite 300
Park City, UT 84098

EXAMINER
CANNON, RYAN SMITH

ART UNIT	PAPER NUMBER
1726	

NOTIFICATION DATE	DELIVERY MODE
03/30/2023	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):

d@mabr.com

Voltage, LLC
EX1021-4

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
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Application No. : 17301609
Applicant : Solon
Filing Date : 04/08/2021
Date Mailed : 03/30/2023

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Notice of Allowance Mailed

This application has been accorded an Allowance Date and is being prepared for issuance. The application, however, is incomplete for the reasons below.

Applicant is given two (2) months from the mail date of this Notice within which to respond. This time period for reply is extendable under 37 CFR 1.136(a) for only TWO additional MONTHS.

The informalities requiring correction are indicated in the attachment(s). If the informality pertains to the abstract, specification (including claims) or drawings, the informality must be corrected with an amendment in compliance with 37 CFR 1.121 (or, if the application is a reissue application, 37 CFR 1.173). Such an amendment may be filed after payment of the issue fee if limited to correction of informalities noted herein. See Waiver of 37 CFR 1.312 for Documents Required by the Office of Patent Publication, 1280 Off. Gaz. Patent Office 918 (March 23, 2004). In addition, if the informality is not corrected until after payment of the issue fee, for purposes of 35 U.S.C. 154(b)(1)(iv), "all outstanding requirements" will be considered to have been satisfied when the informality has been corrected. A failure to respond within the above-identified time period will result in the application being ABANDONED.

See attachment(s).

A copy of this notice MUST be returned with the reply. Please address response to "Mail Stop Issue Fee, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450".

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Application No. 17301609 **Drawings filed: 04/08/2021**

IDENTIFICATION OF DRAWING DEFICIENCIES

- [ ] There is a hole or the image thereof within the illustration. FIG(s)
- [ ] The illustration is penetrated or traversed by a solid or broken line that is not intended to be part of the drawing, such as a dark line caused by a flaw in the copying process. FIG(s)
- [ ] An ink stamp or the image thereof obscures part of the illustration. FIG(s)
- [ ] The drawing is marred by black smudges, obliterations, or fax/copier marks (for example, speckles or dots in a substantial portion of the drawing). FIG(s)
- [ ] Figure numbers are duplicated or missing. FIG(s)
- [ ] Drawing sheet or figure is missing. FIG(s)
- [ ] Numbers, letters, or reference characters in the drawing have been crossed out or are illegibly handwritten. FIG(s)
- [X] The character of the lines, numbers, and letters is poor. FIG(s) 1-3
- [ ] The drawing's background shows that the original drawing was made on graph paper or other paper with a pattern or decoration. FIG(s)
- [ ] The FIG. number label is placed in a location that causes the drawing to be read upside down. FIG(s)
- [ ] Data, a reference number, or part of the drawing is truncated or missing, or a lead line has no reference number. FIG(s)
- [ ] The drawing and/or the FIG. label contain(s) foreign language. FIG(s)
- [X] This utility application contains a photograph of a view that is capable of being illustrated as a line drawing. FIG(s) 8, 27-60
- [ ] A petition under 37 CFR 1.84(a)(2) to accept color drawings has been granted, but the brief description of the drawings in the specification does not contain (or has not been amended to contain) the paragraph required by 37 CFR 1.84(a)(2)(iii).
- [ ] This reissue application contains added and/or amended drawings that are not labeled as “New” or “Amended” or “Canceled” as required by 37 CFR 1.173(b)(3). FIG(s)
- [ ] This Design reissue application contains a drawing that is labeled as “Canceled” but is not surrounded by brackets, or a drawing that is surrounded by brackets but is not labeled as “Canceled.” See 37 CFR 1.173(b)(3). FIG(s)
- [ ] OTHER:
- [ ] COMMENTS:

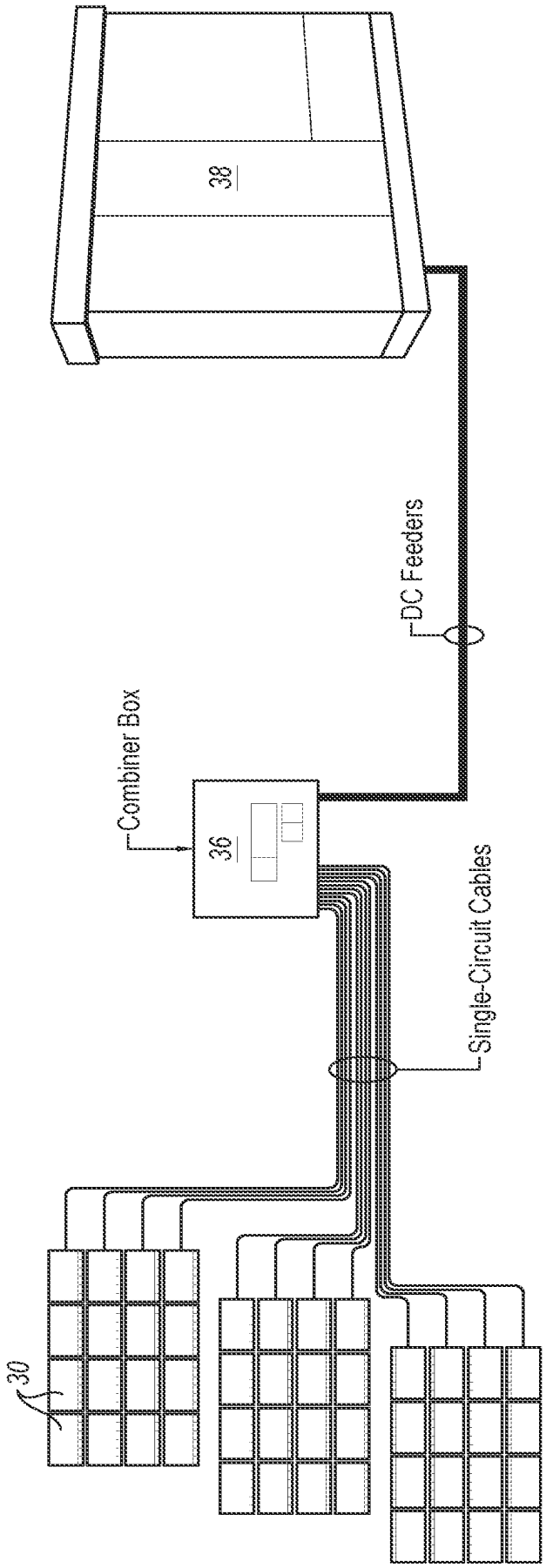


FIG. 1
Prior Art

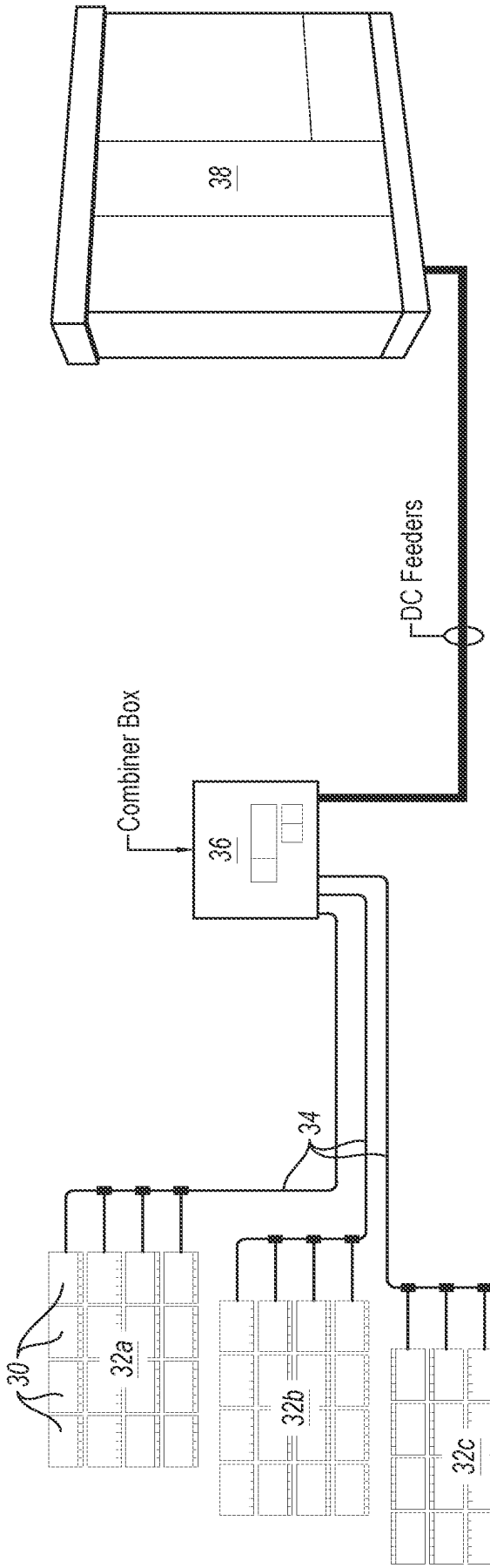


FIG. 2
Prior Art

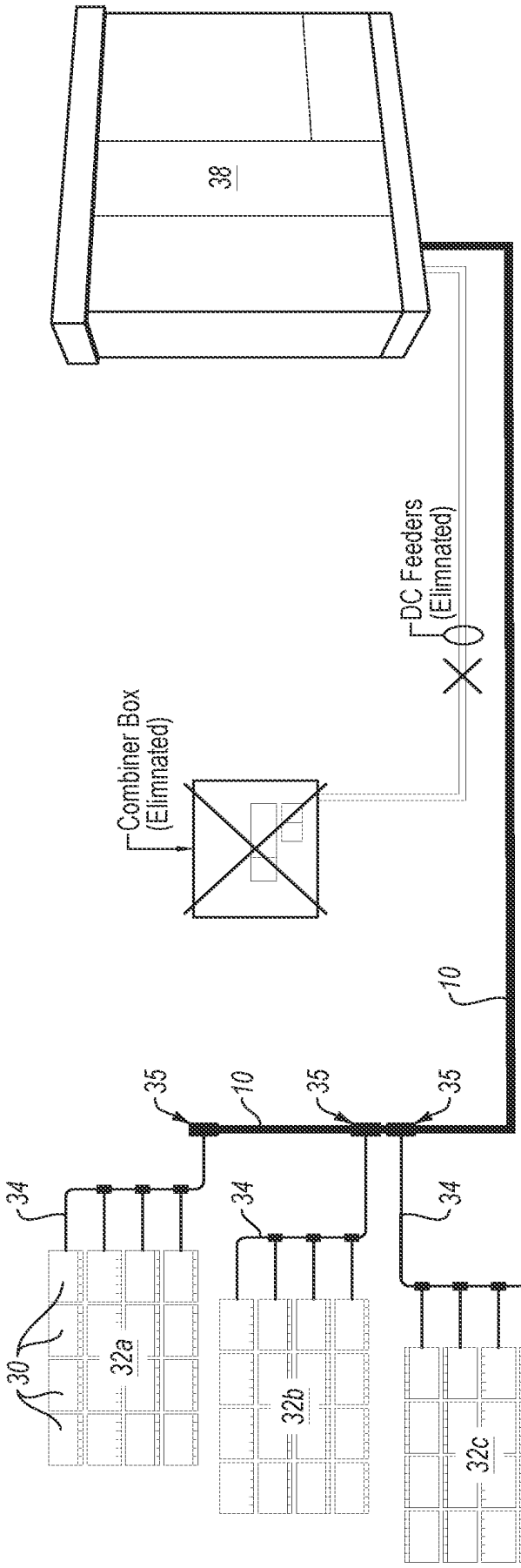

38
DC Feeders
(Eliminated)
Combiner Box
(Eliminated)
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32b
32c

FIG. 3

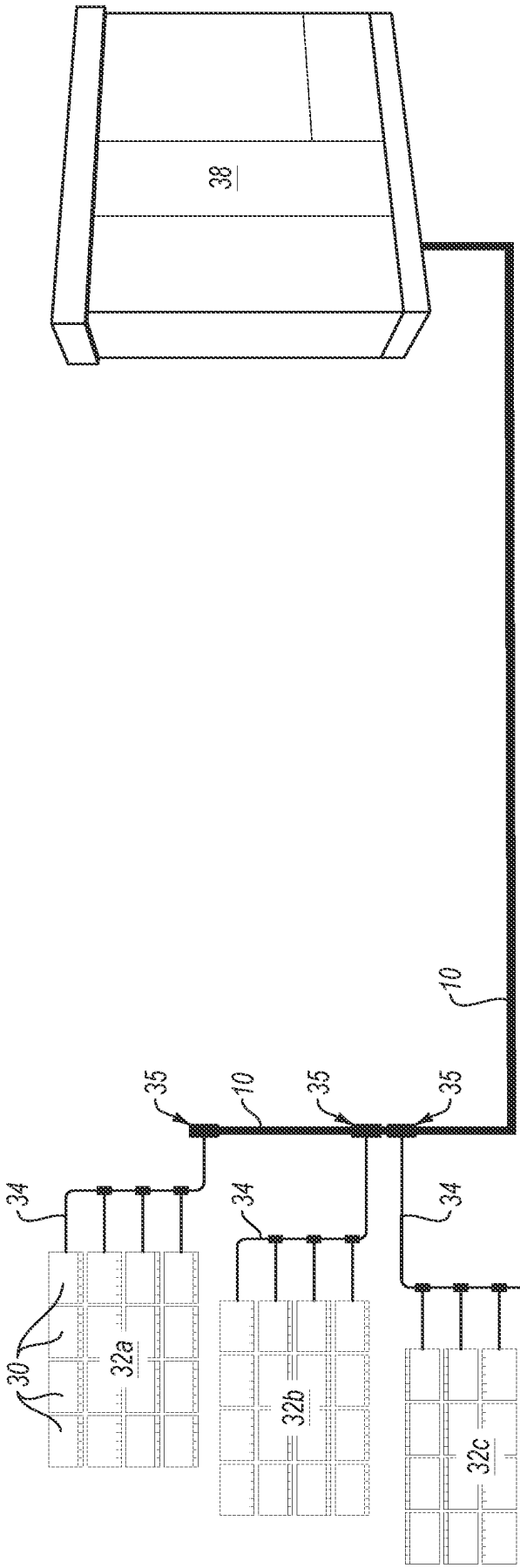


FIG. 4

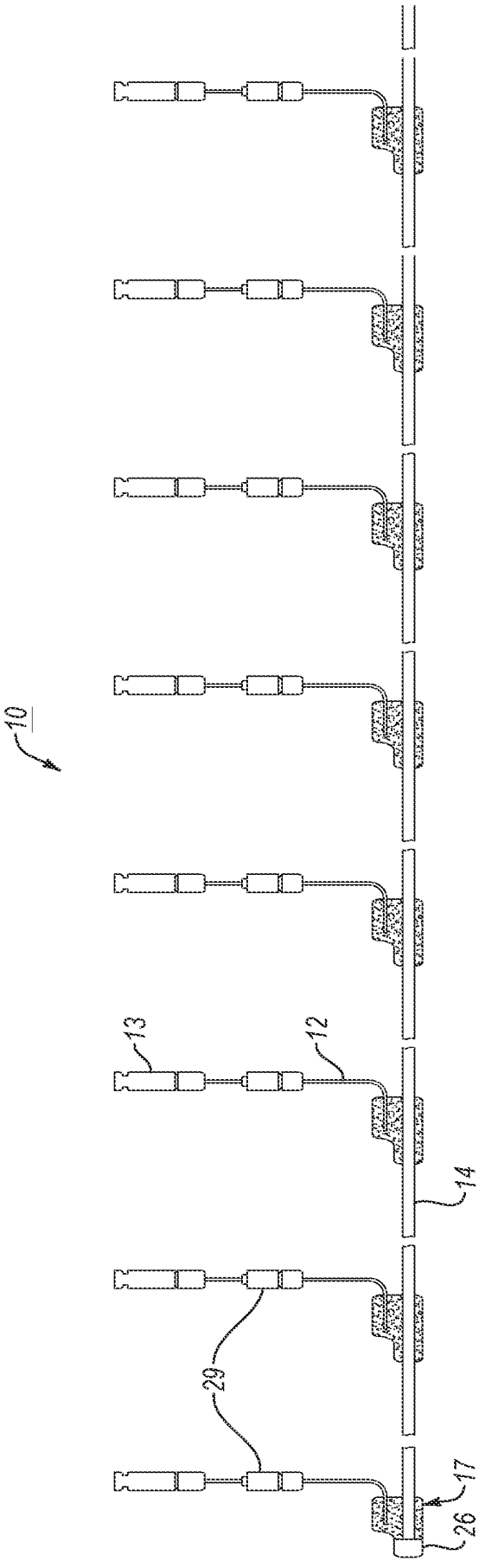


FIG. 5

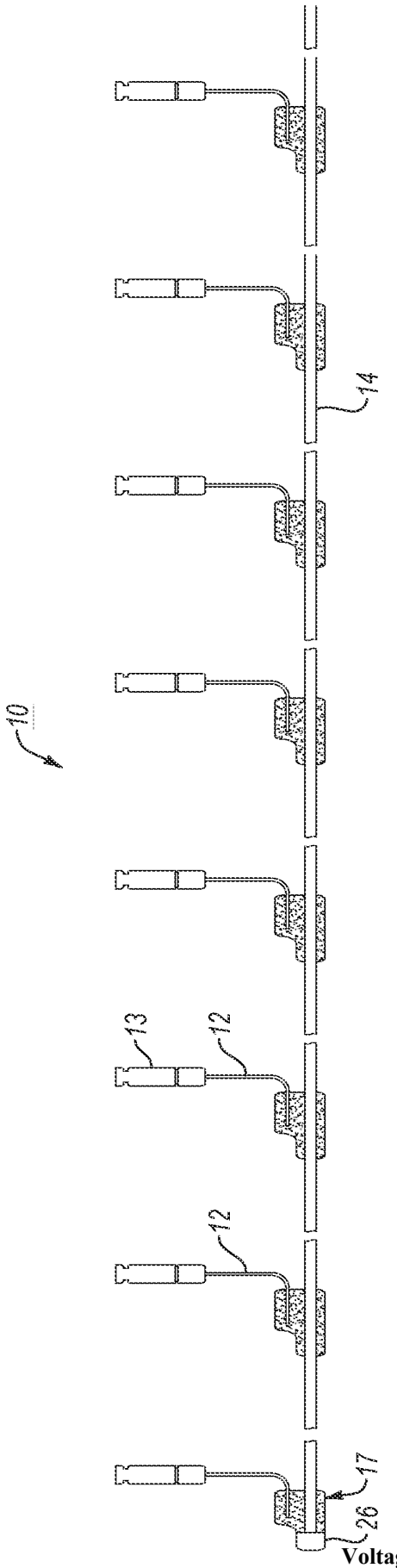


FIG. 6

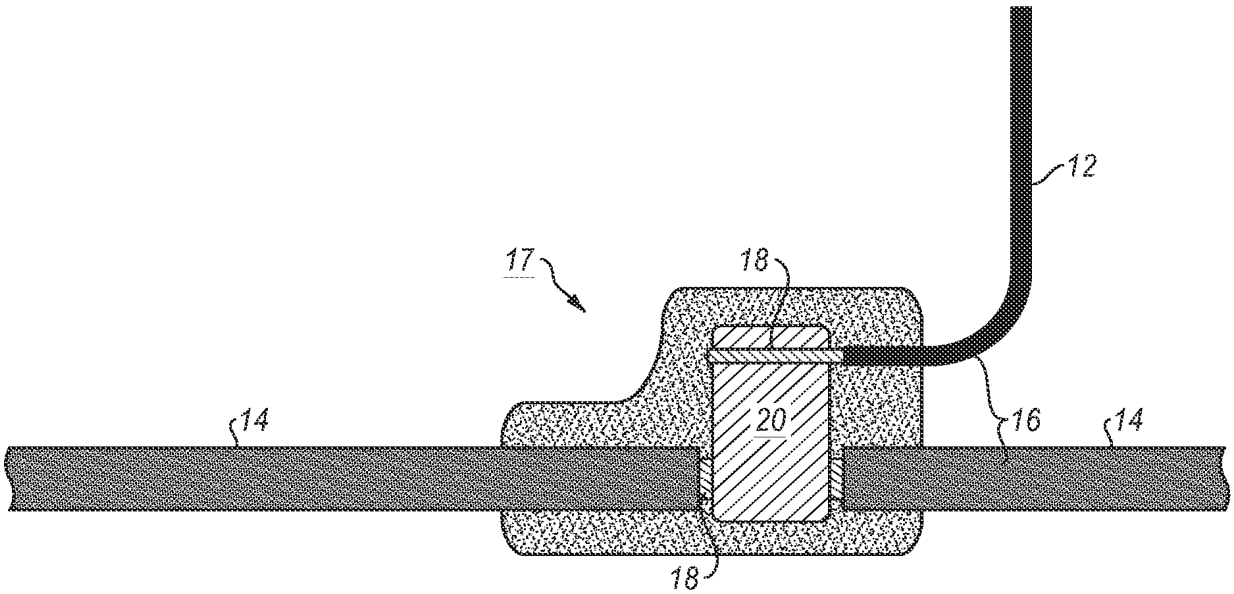


FIG. 7

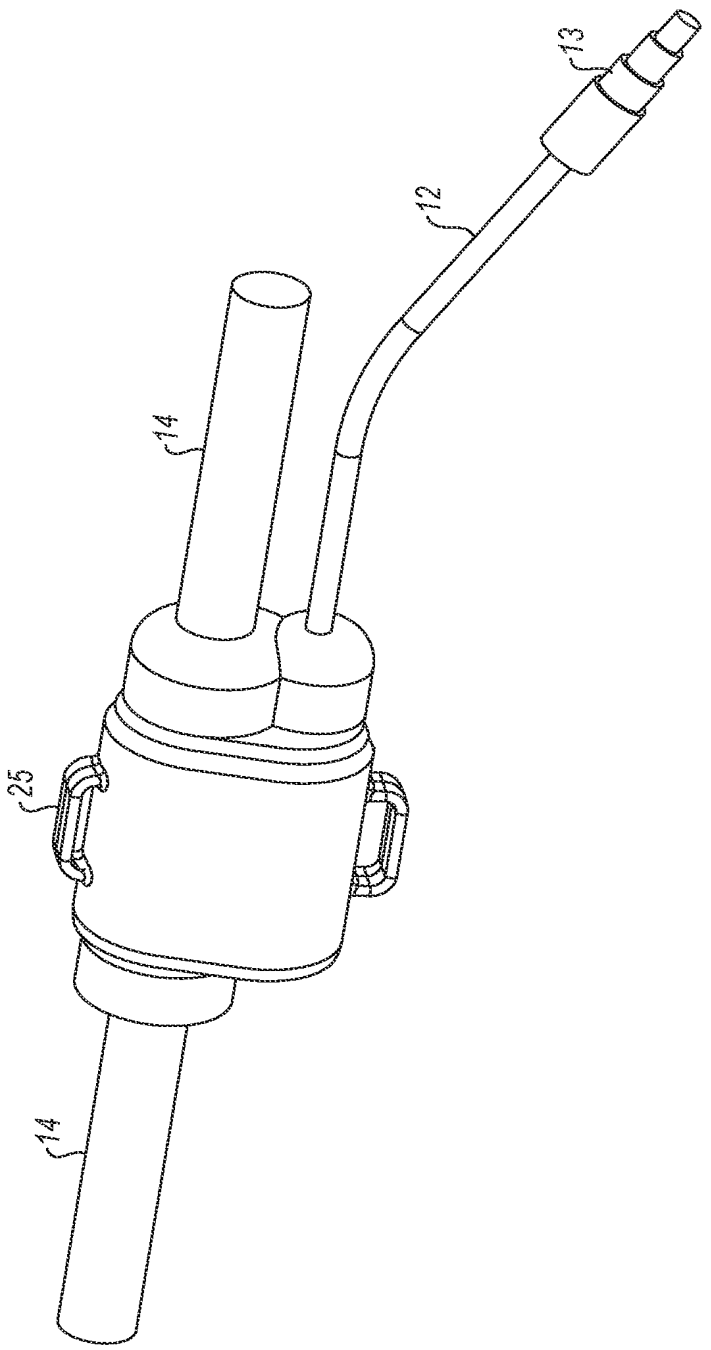


FIG. 8

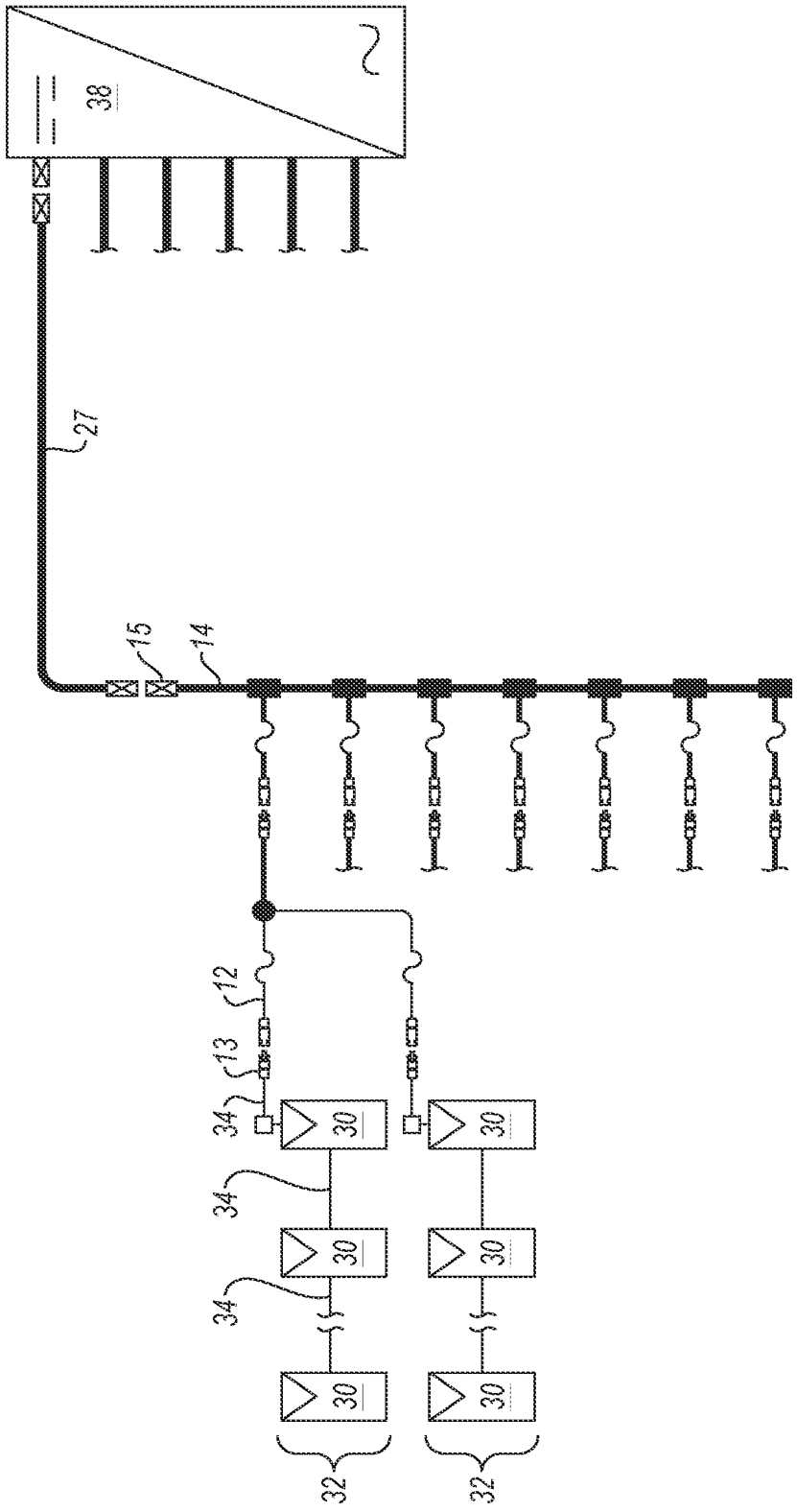


FIG. 9

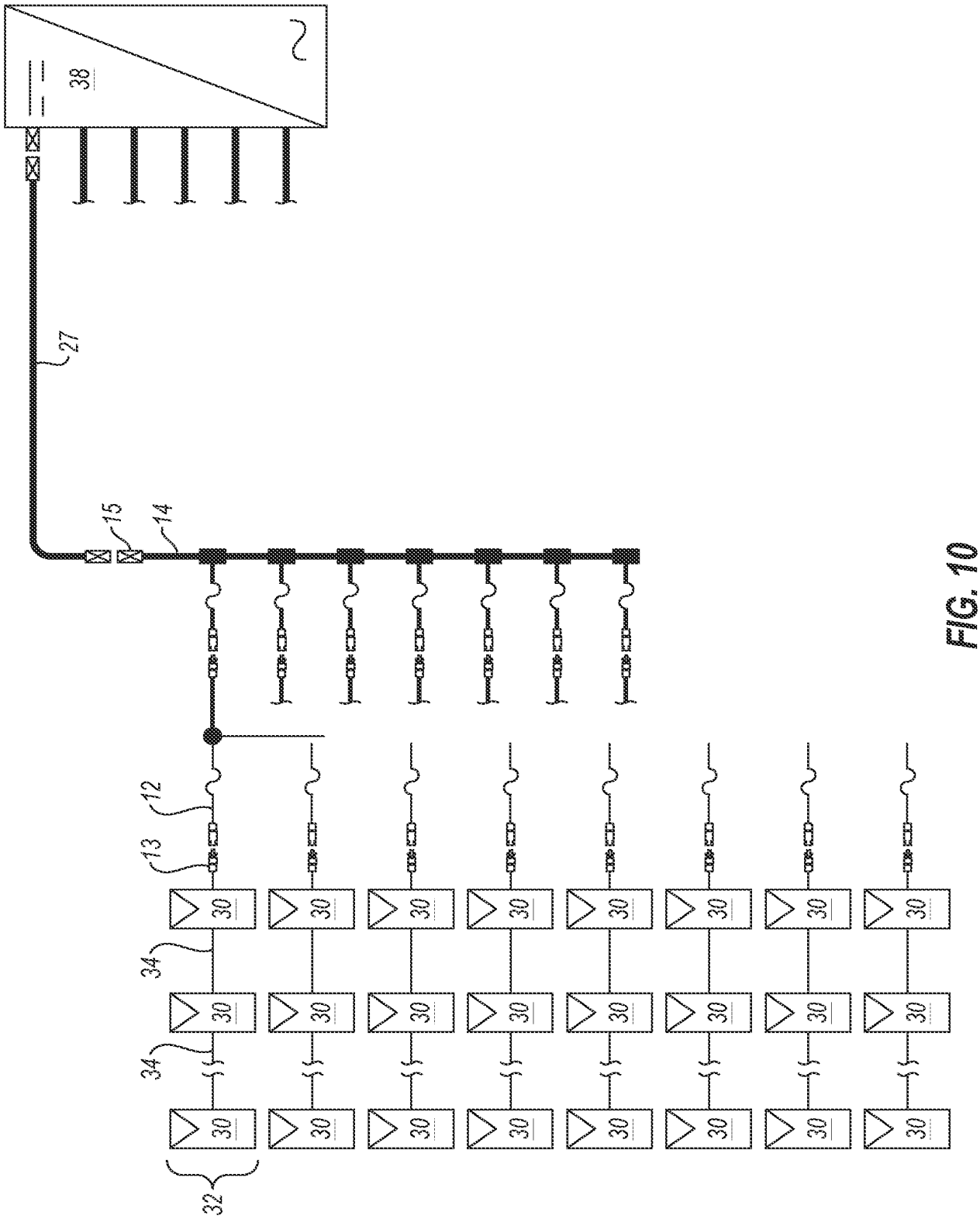


FIG. 10

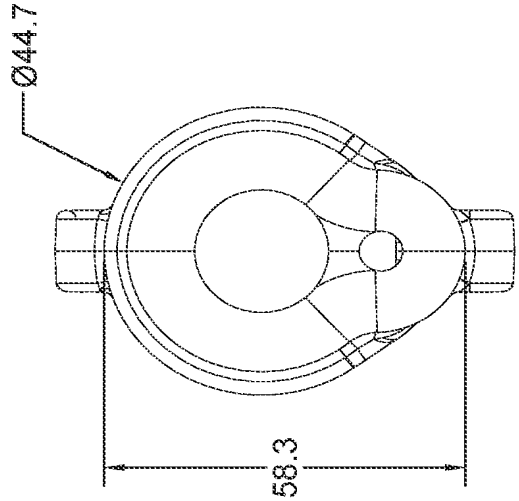


FIG. 12

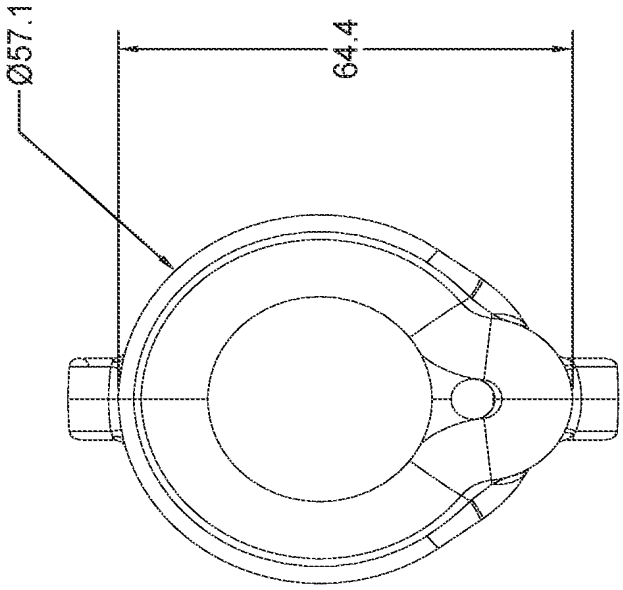


FIG. 14

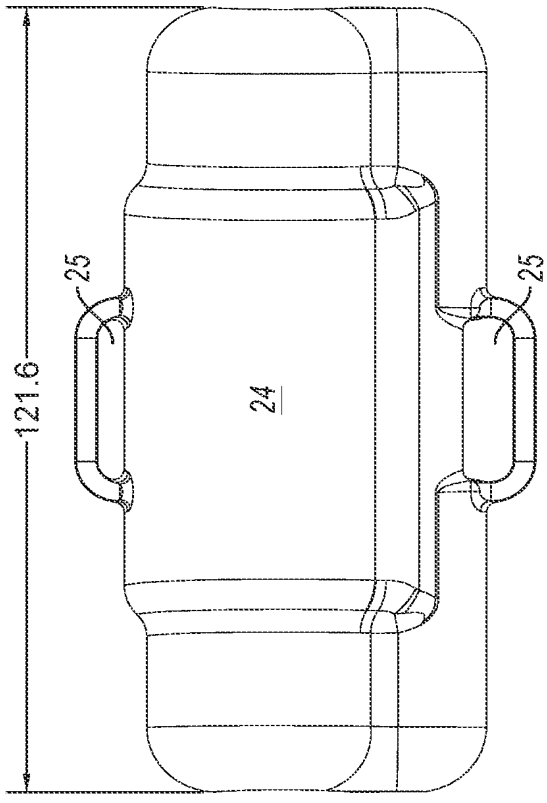


FIG. 11

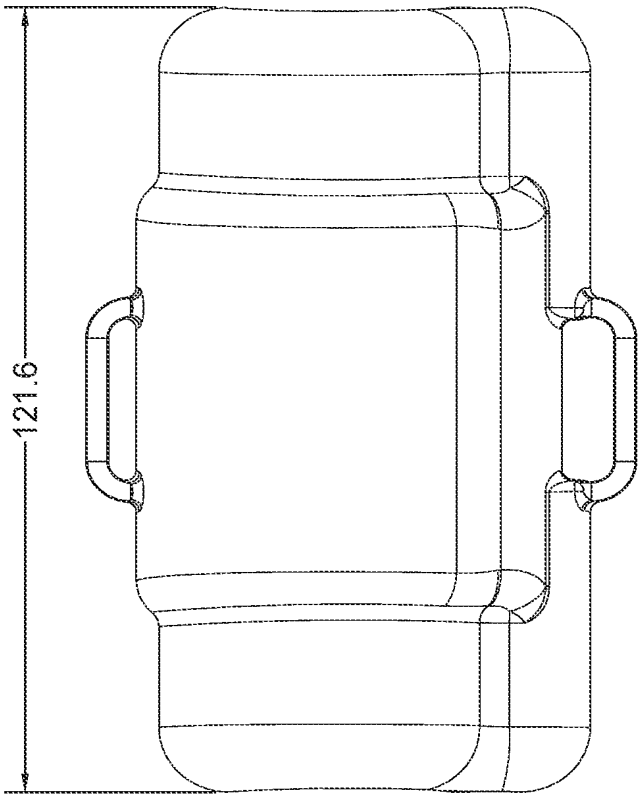


FIG. 13

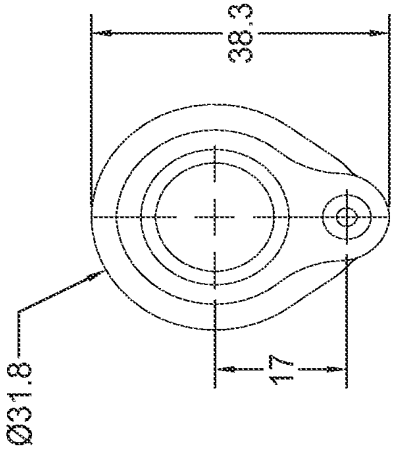


FIG. 16

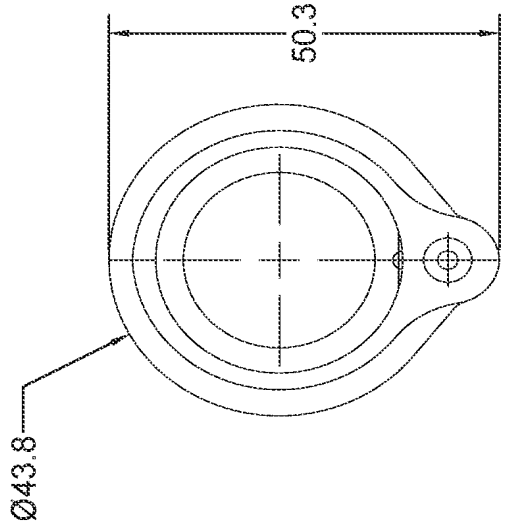


FIG. 18

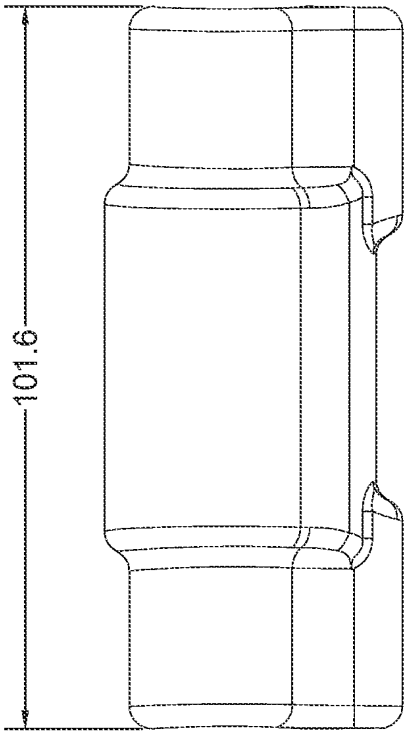


FIG. 15

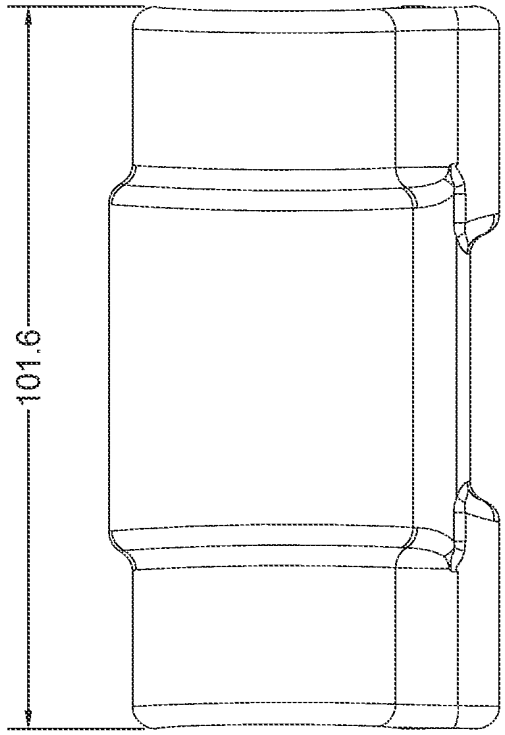


FIG. 17

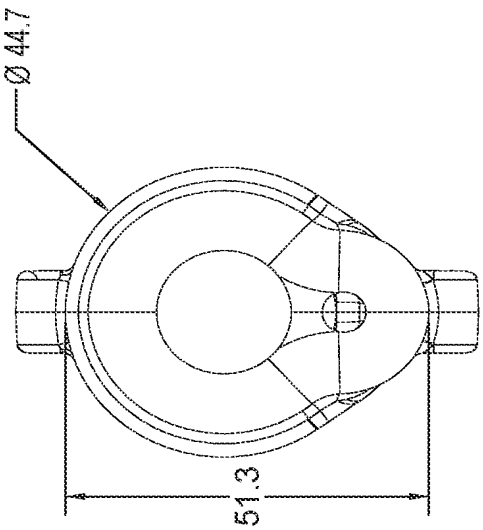


FIG. 20

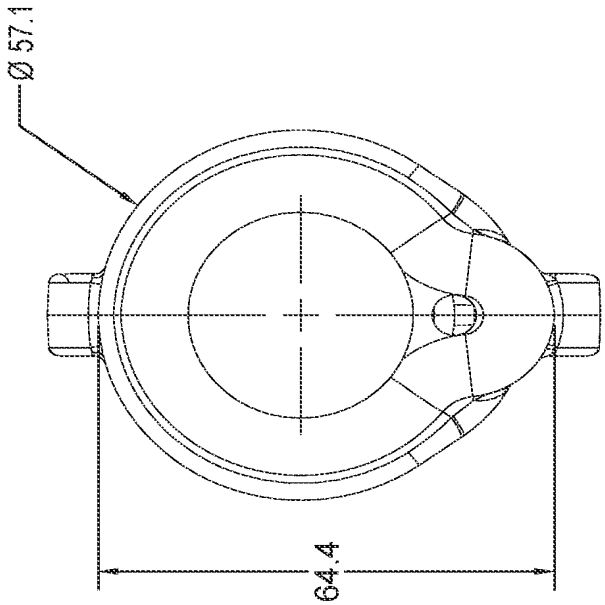


FIG. 22

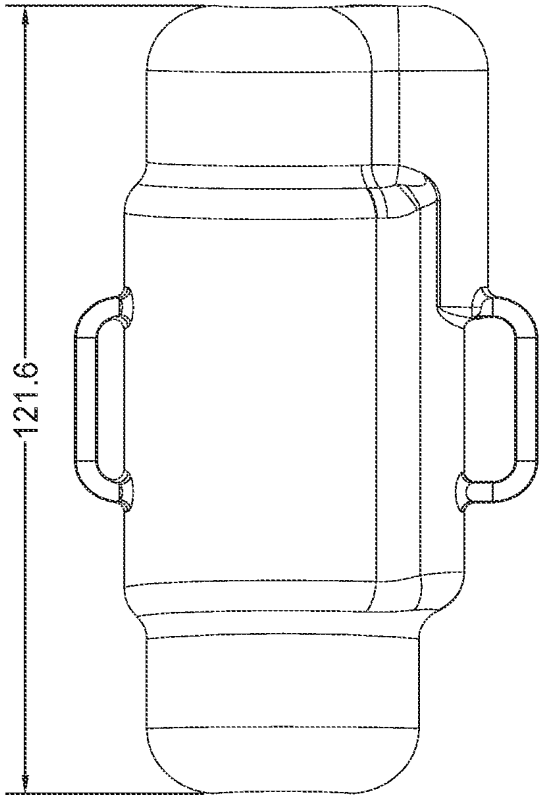


FIG. 19

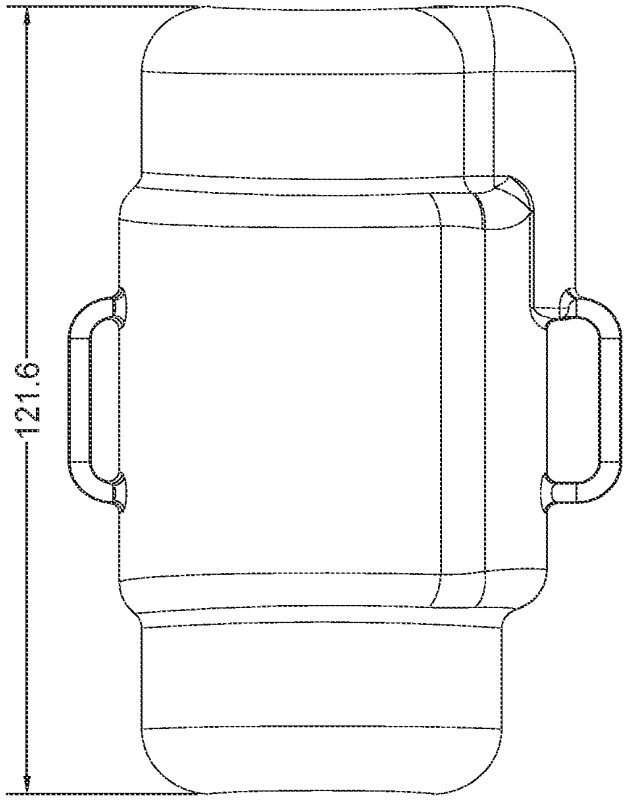


FIG. 21

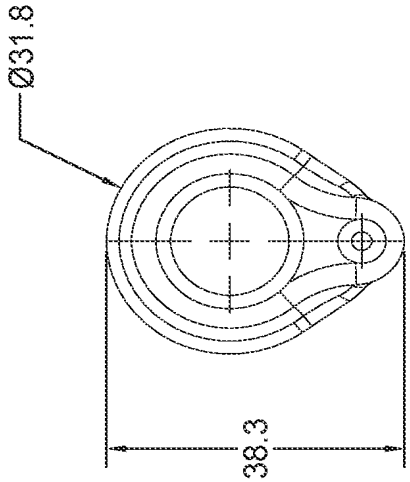


FIG. 24

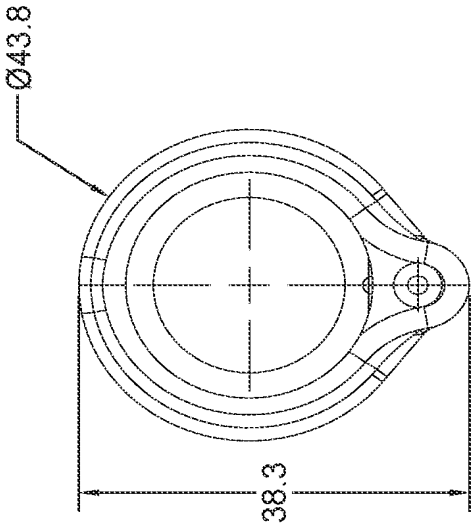


FIG. 26

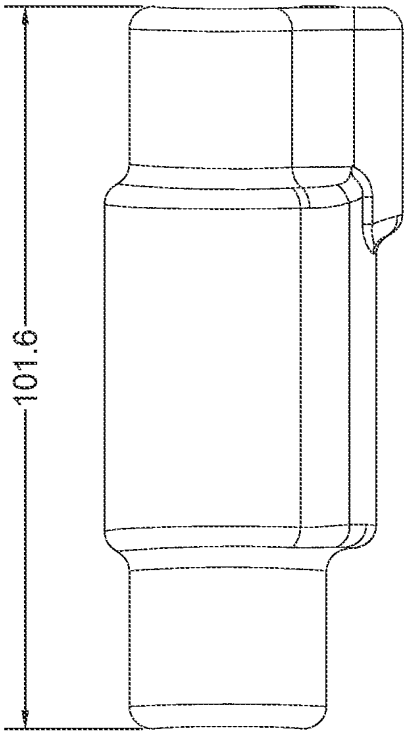


FIG. 23

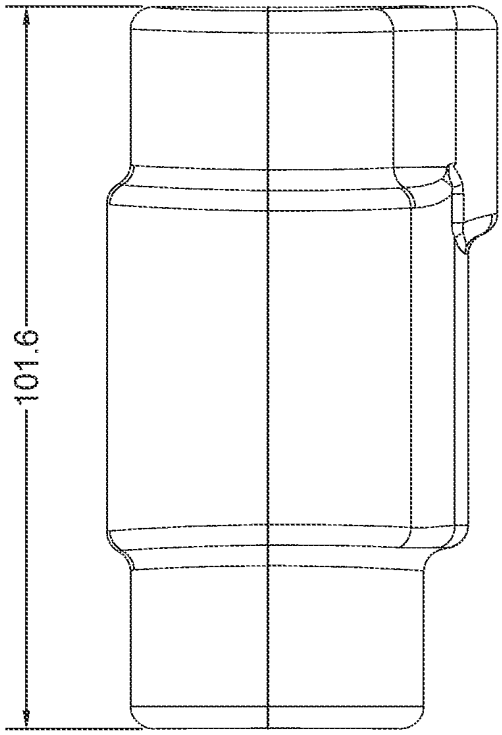


FIG. 25

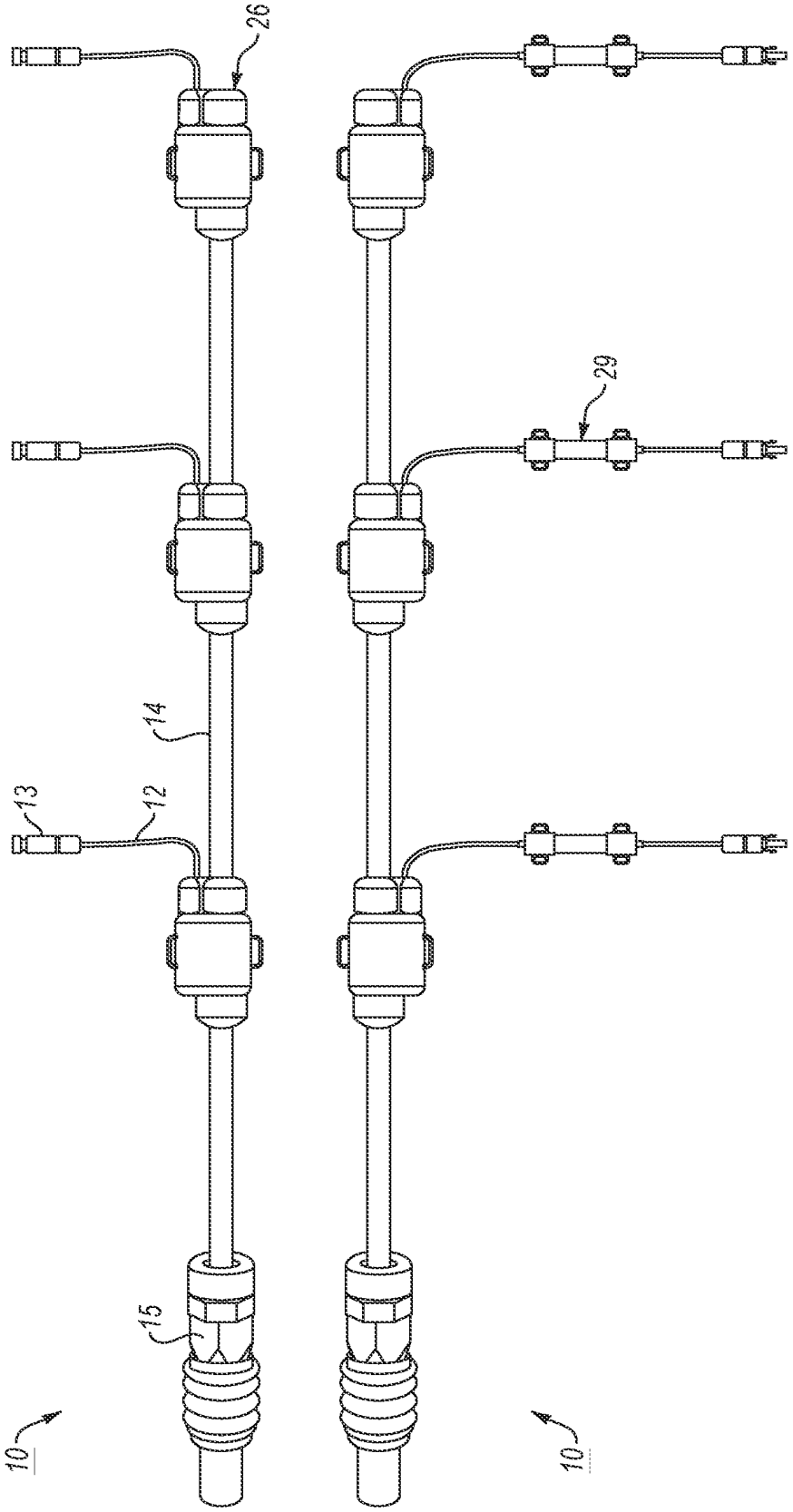


FIG. 27

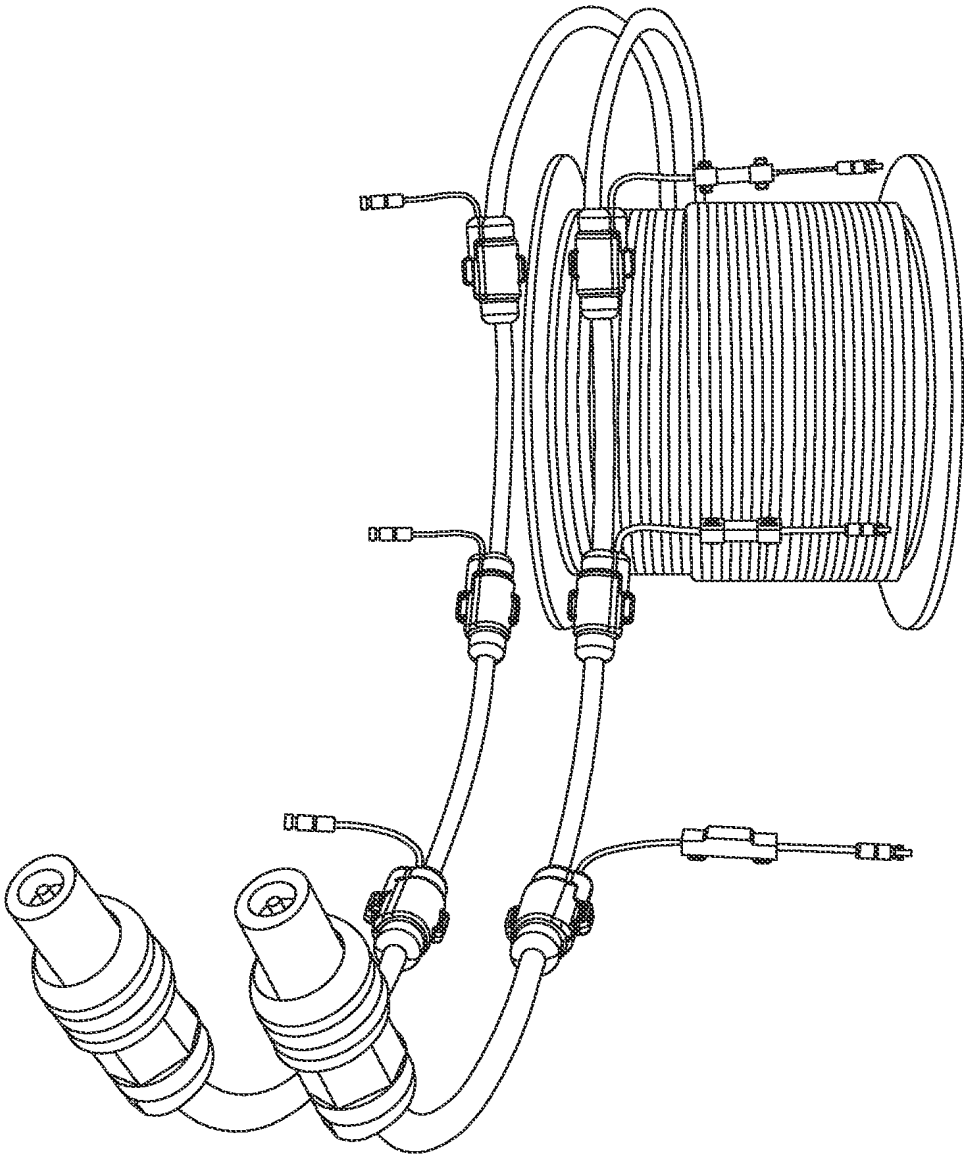


FIG. 28

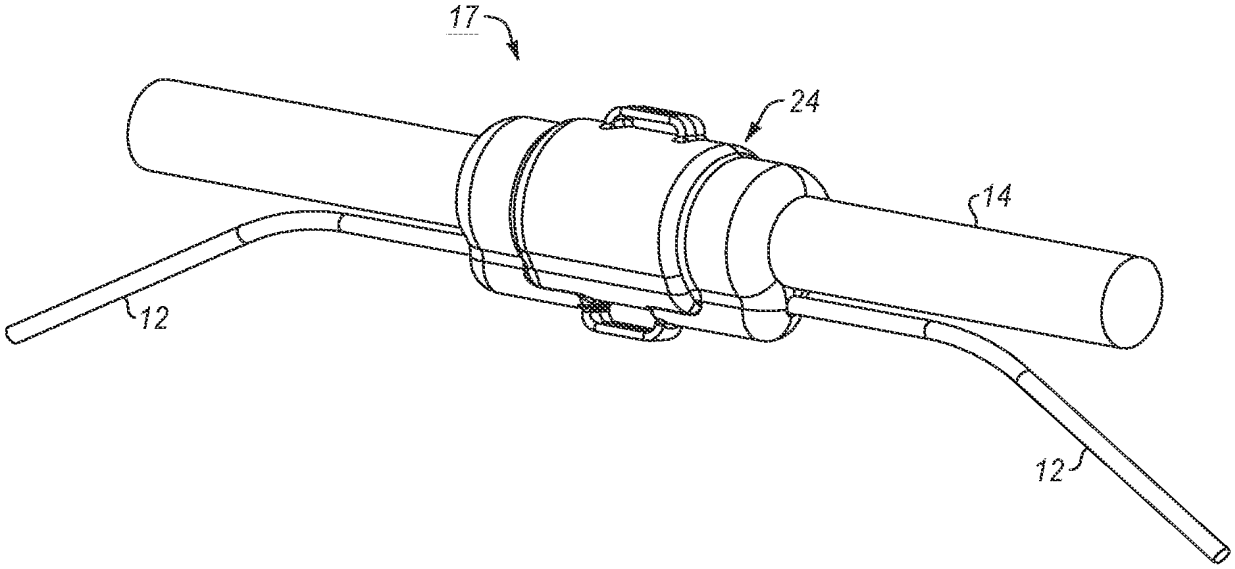


FIG. 29

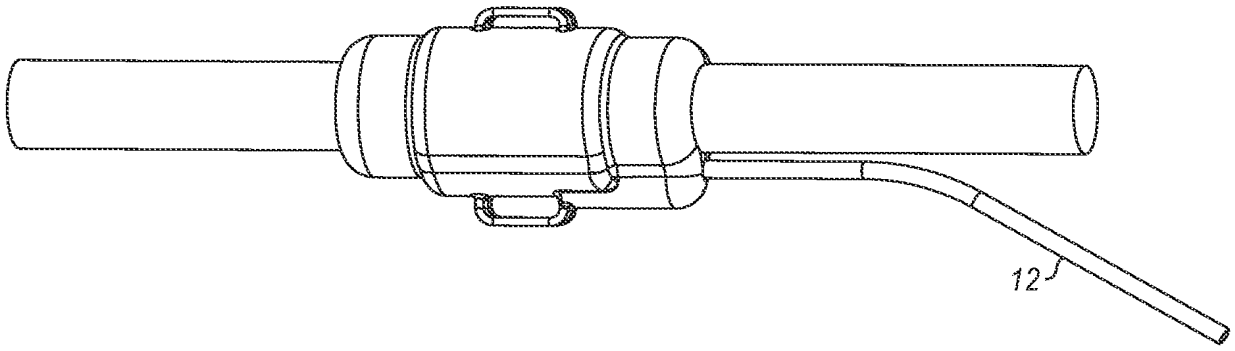


FIG. 30

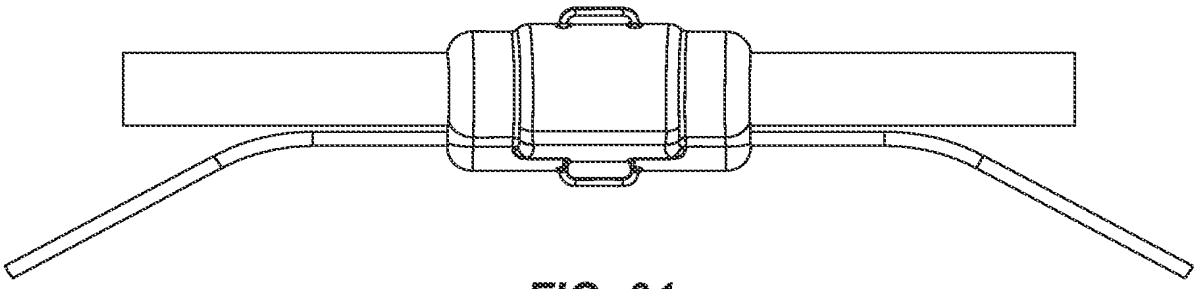


FIG. 31

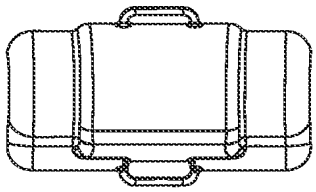


FIG. 32

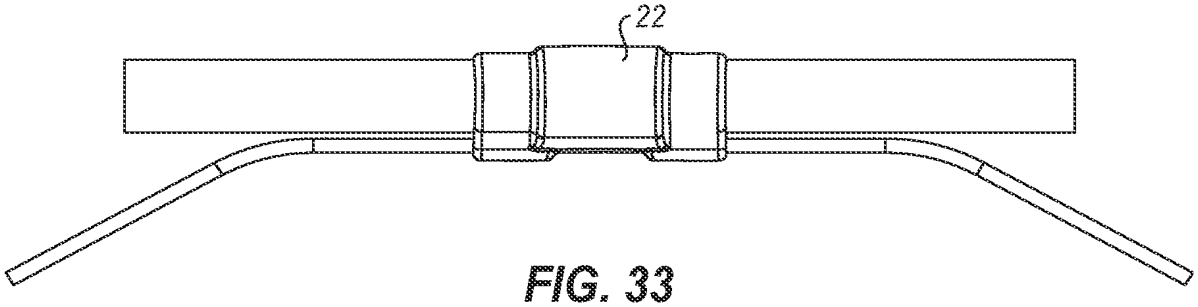


FIG. 33

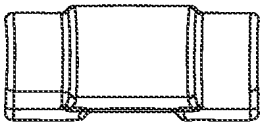


FIG. 34

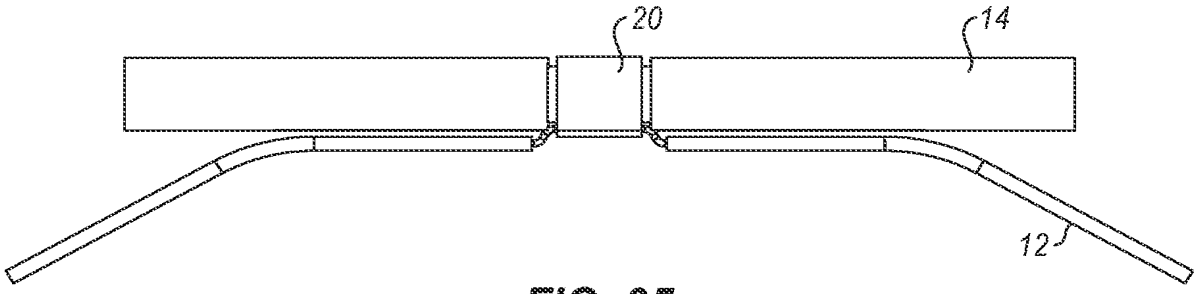


FIG. 35

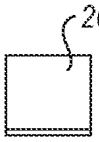


FIG. 36

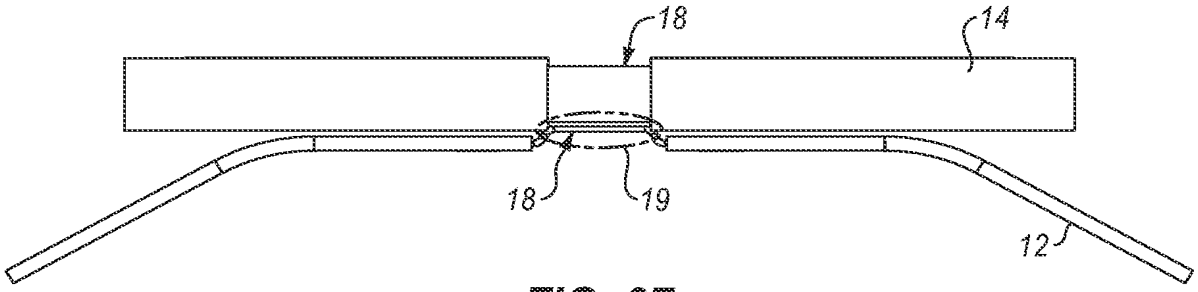


FIG. 37

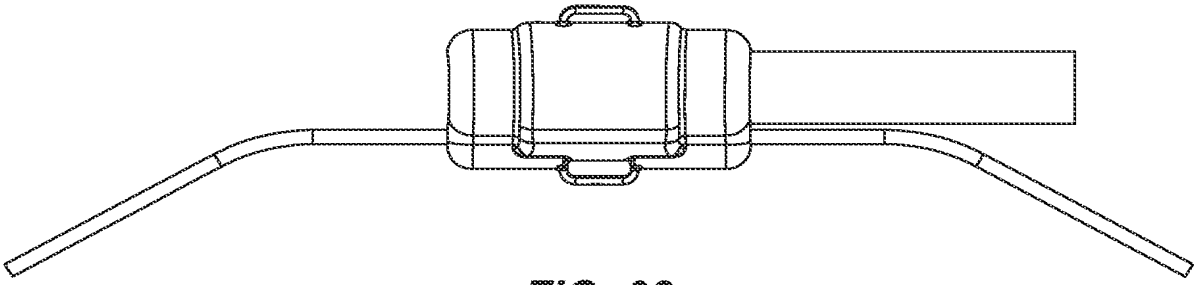


FIG. 38

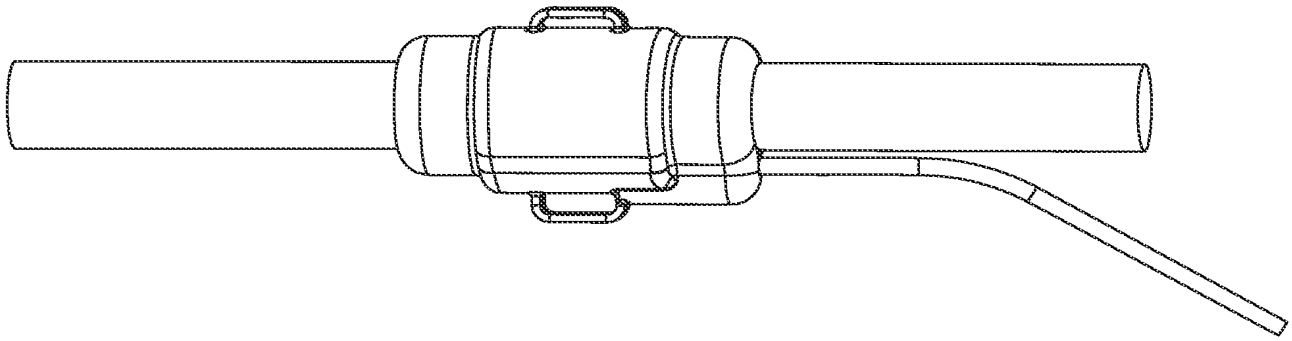


FIG. 39

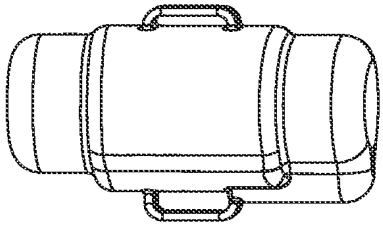


FIG. 40

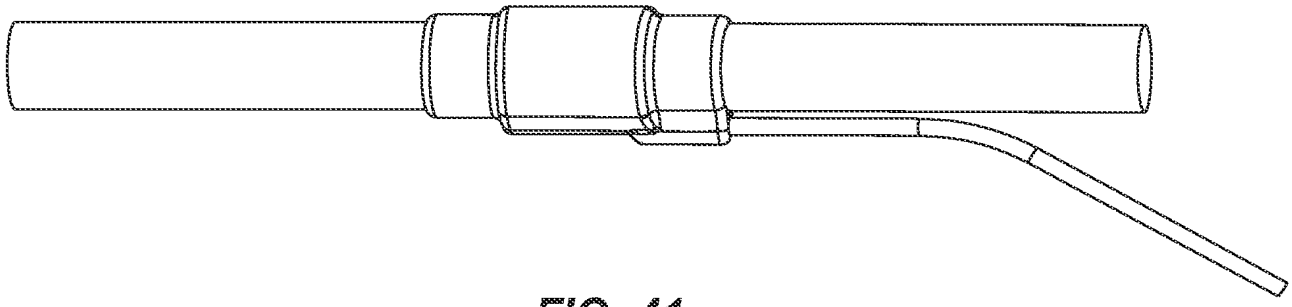


FIG. 41

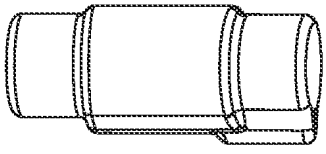


FIG. 42

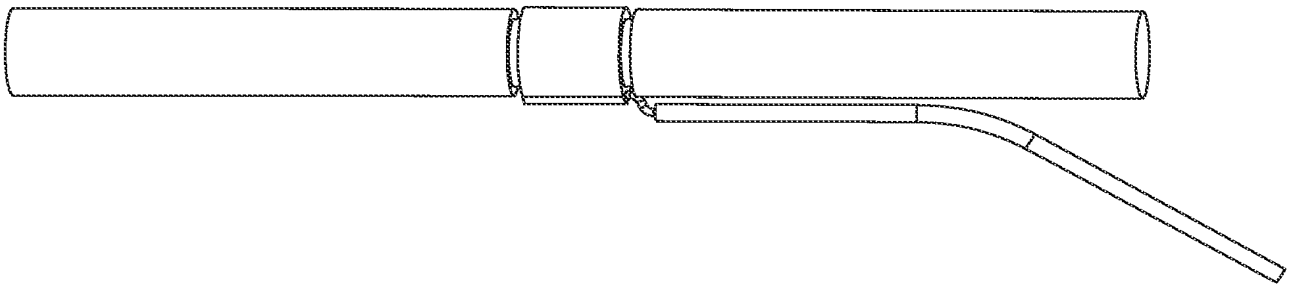


FIG. 43

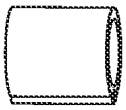


FIG. 44

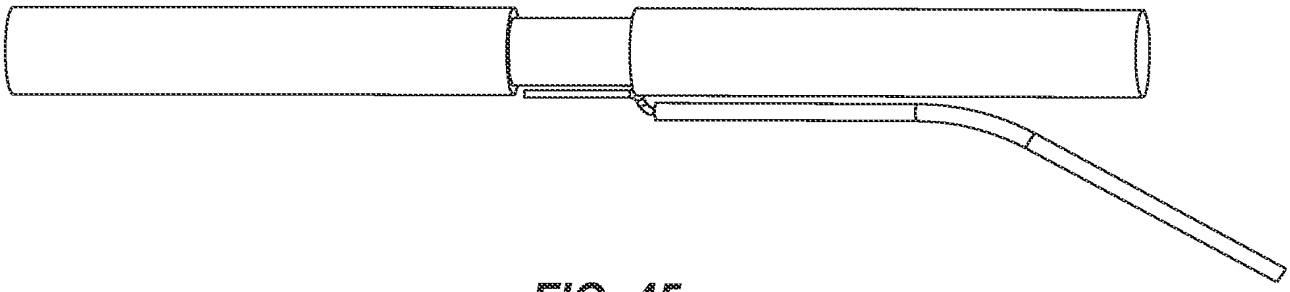


FIG. 45

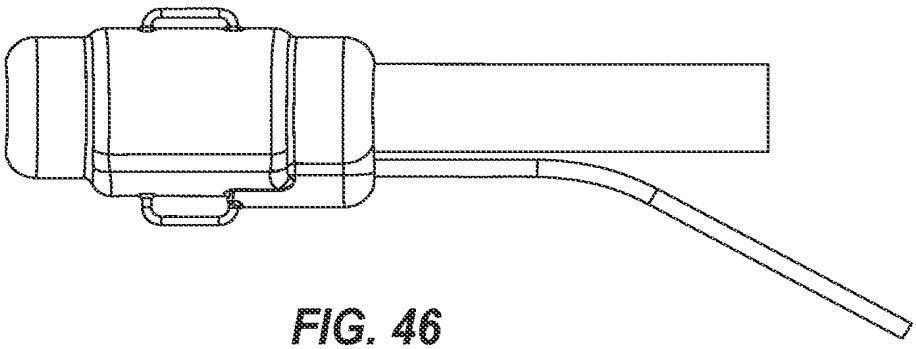


FIG. 46

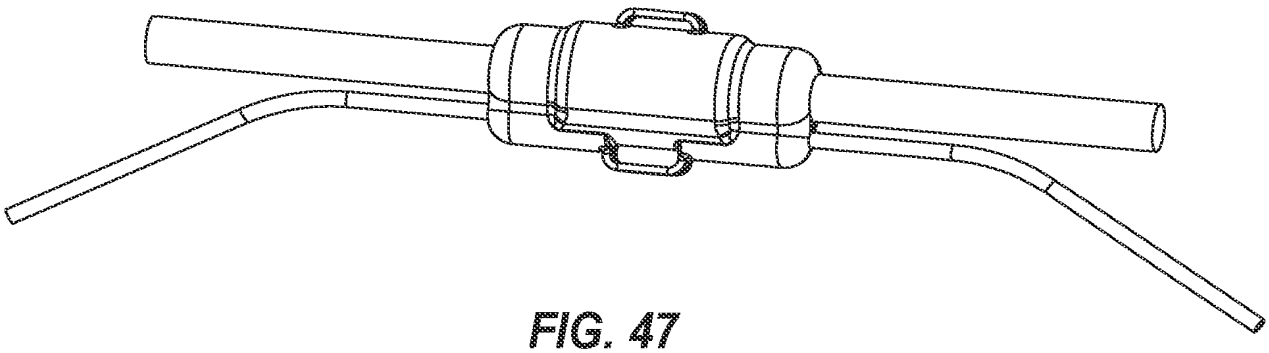


FIG. 47

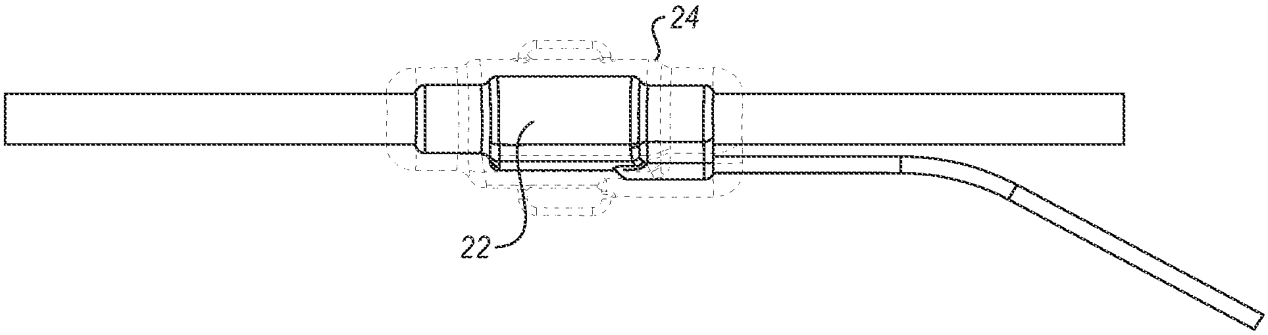


FIG. 48

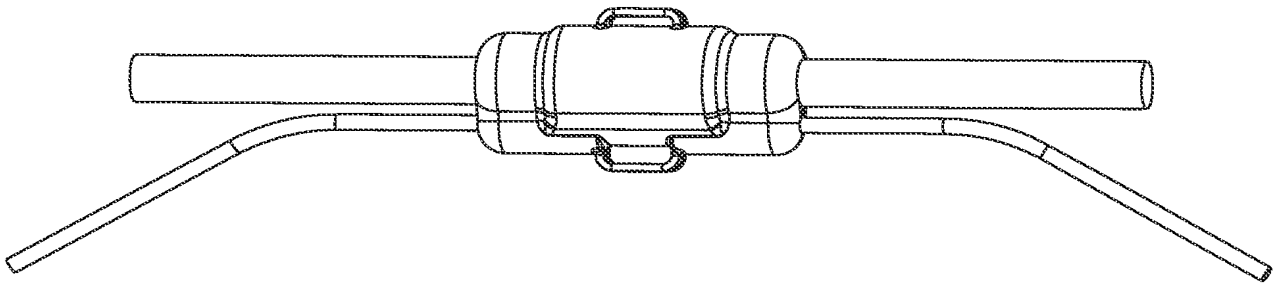


FIG. 49

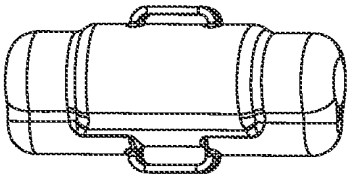


FIG. 50

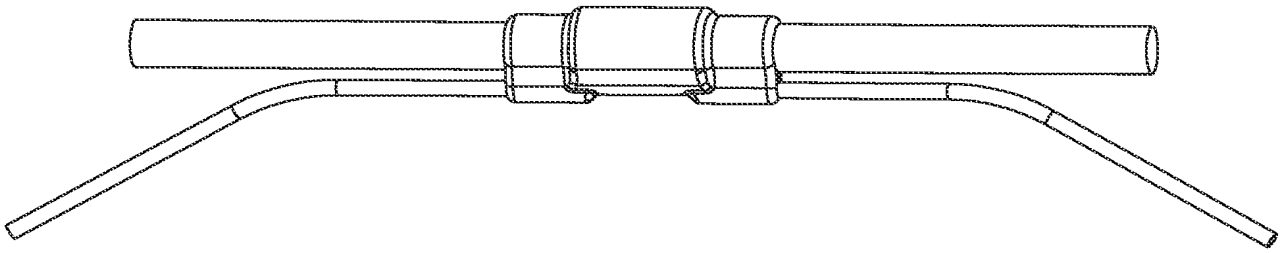


FIG. 51

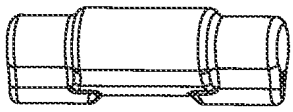


FIG. 52

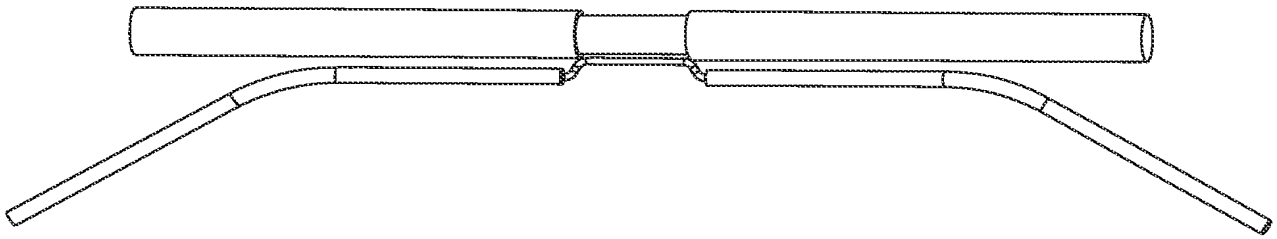


FIG. 53

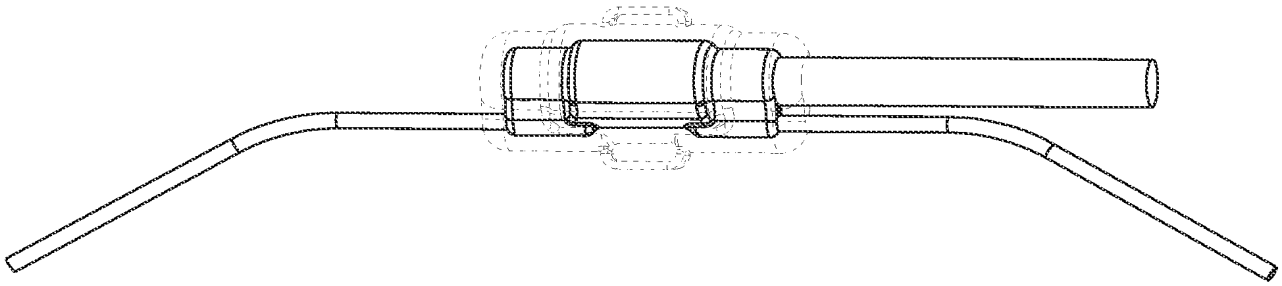


FIG. 54

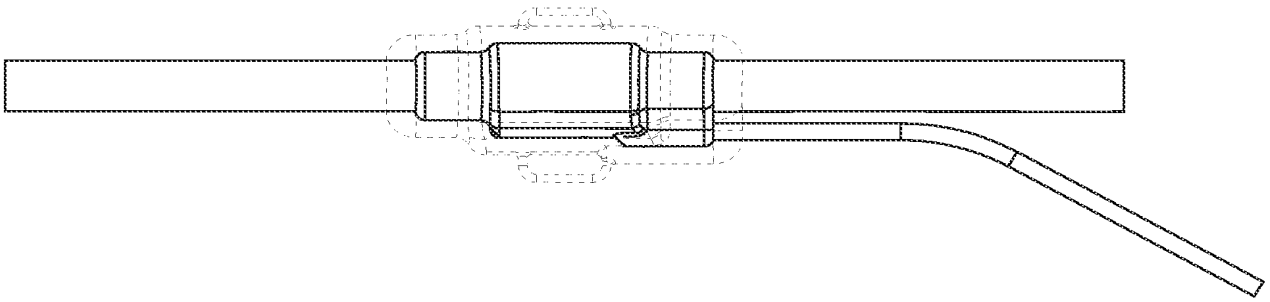


FIG. 55

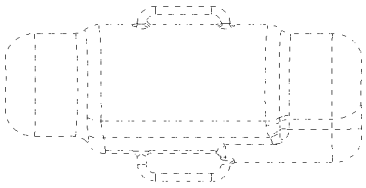


FIG. 56

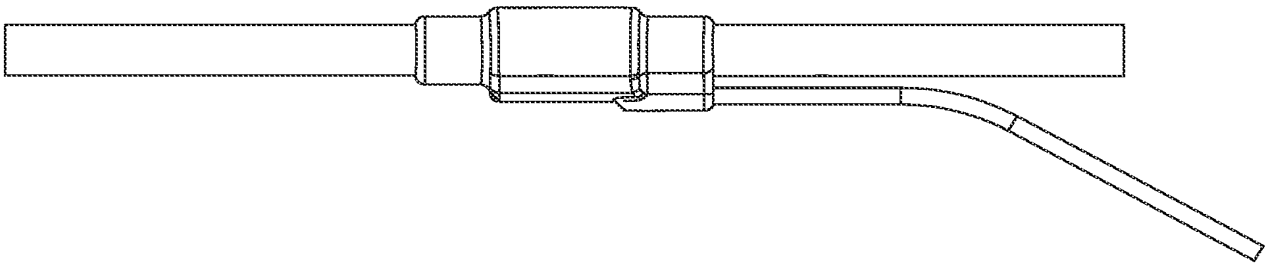


FIG. 57

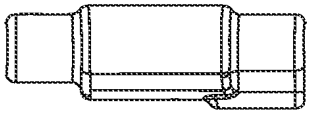


FIG. 58

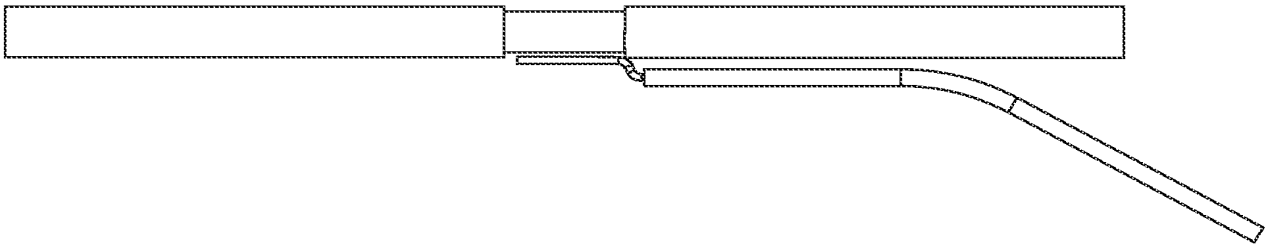


FIG. 59

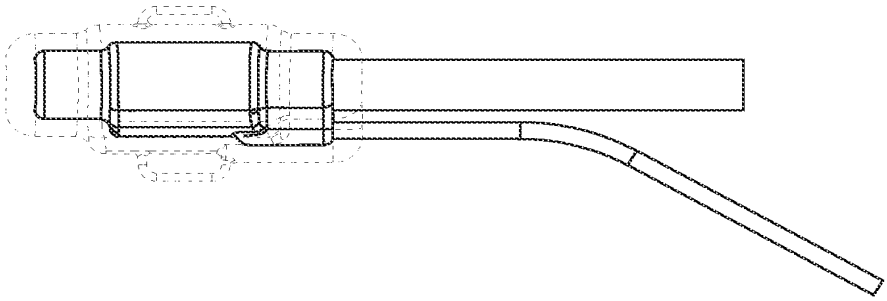


FIG. 60

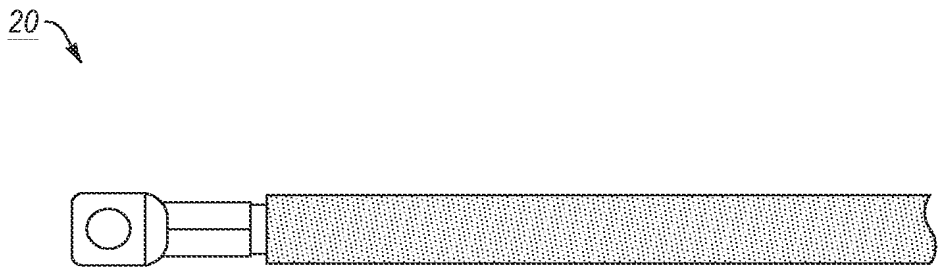


FIG. 61

UNITED STATES
PATENT AND TRADEMARK OFFICE

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Alexandria, VA 22313 - 1450
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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/301,609	**04/12/2023 05:24:20 PM ET**	**S4079.10001US03**

Title of Invention

LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	3509	FILED BY	Brian Gonzalez
PATENT CENTER #	61911874	FILING DATE	04/08/2021
CUSTOMER #	97149	FIRST NAMED INVENTOR	Dean Solon
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Eric Maschoff

Documents

TOTAL DOCUMENTS: 3

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
2023.04.12 Response to Notice_S4079.10001US03.pdf	3	Amendment after Notice of Allowance (Rule 312)	140 KB
2023.04.12 Replacement Figures_S4079.10001US03.pdf	26	Drawings-only black and white line drawings	1460 KB
2023.04.12 Notice Copy_S4079.10001US03.pdf	3	Applicant Response to Pre-Exam Formalities Notice	115 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
2023.04.12 Response to Notice_S4079.10001US03.pdf	B7A299C7CE2F1B0BDFABFB9C7426A28A8A16AD569E6F453C19B53413DAFF6B3879E688BDFF843EF077ED83904D6A52B93E483D9F5AC83C5C5E76C6C1EA9EF719
2023.04.12 Replacement Figures_S4079.10001US03.pdf	769E24D9D921864FB946A2894F69EFA67CEA799353328F4263BC44213B12B8986F1A0E033DCCBA2574F9234415B02F294BE66CC2AC4F80A64EDB4996A23280A7
2023.04.12 Notice Copy_S4079.10001US03.pdf	D109E98AB0535FD6C844266EC1D0FBD31BE239D539A948B45F99494C33818A2FA9CA0209D8179B523BA65BABAD8F7547C67036441AE1499211FE6A6C8AFE870A

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

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) 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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	Dean Solon	
Application No.:	17/301,609	Art Unit 1726
Filed:	April 8, 2021	
Conf. No.:	3509	
For:	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER	
Examiner:	Ryan Smith Cannon	
Customer No.:	97149	
Attorney Docket No.:	S4079.10001US03	

RESPONSE TO NOTICE TO FILE CORRECTED APPLICATION PAPERS

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

Dear Sir:

In response to the Notice to File Corrected Application Papers dated March 30, 2023, please amend the above-identified application as follows:

Amendments to the Drawings begin on page 2 of this paper and include replacement sheets. **Remarks** begin on page 3 of this paper.

Voltage, LLC
EX1021-35

AMENDMENTS TO THE DRAWINGS

The attached sheets of drawings, which includes Figures 1-61, replace the original sheets 1-26. The attached replacement sheets address the deficiencies noted in the Notice to File Corrected Application Papers dated March 30, 2023. No new matter has been added.

REMARKS

The amendments to the drawings address the deficiencies noted in the Notice to File Corrected Application Papers dated March 30, 2023. Applicant respectfully requests entry of the changes to the drawings before the issuance and publication of the patent. In the event that Examiner finds remaining impediment to the entry of this amendment, the Examiner is requested to contact the undersigned attorney.

Dated this 12th day of April, 2023.

Respectfully submitted,

/Eric L. Maschoff/

Eric L. Maschoff
Registration No. 36596
Attorney for Applicant
Telephone No. (435) 252-1360

Voltage, LLC
EX1021-37

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

97149 7590 03/22/2023
Maschoff Brennan
1389 Center Drive, Suite 300
Park City, UT 84098

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/301,609	04/08/2021	Dean Solon	S4079.10001US03	3509

TITLE OF INVENTION: LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0.00	$0.00	$480	06/22/2023

EXAMINER	ART UNIT	CLASS-SUBCLASS
CANNON, RYAN SMITH	1726	136-244000

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

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

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

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

1 MASCHOFF BRENNAN
2
3

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

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

(A) NAME OF ASSIGNEE: SHOALS TECHNOLOGIES GROUP, LLC

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Portland, Oregon

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

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

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

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

☑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 50-5394

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

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

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

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

Authorized Signature /Eric L. Maschoff/ Date March 30, 2023

Typed or printed name Eric L. Maschoff Registration No. 36596

Voltage, LLC
EX1021-38

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/301,609	03/30/2023 05:13:44 PM ET	S4079.10001US03

Title of Invention

LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	3509	FILED BY	Anika Corwell
PATENT CENTER #	61843627	AUTHORIZED BY	Eric Maschoff
CUSTOMER #	97149	FILING DATE	04/08/2021
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Dean Solon

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 5003	E20233TH14366256	Anika Corwell

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
2501	UTILITY ISSUE FEE	480.00	1	480.00
			TOTAL AMOUNT:	$480.00

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

New Applications Under 35 U.S.C. 111

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

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

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage

submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

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

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Alexandria, VA 22313 - 1450
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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/301,609	**03/30/2023 05:13:44 PM ET**	**S4079.10001US03**

Title of Invention

LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	3509	FILED BY	Anika Corwell
PATENT CENTER #	61843627	FILING DATE	04/08/2021
CUSTOMER #	97149	FIRST NAMED INVENTOR	Dean Solon
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Eric Maschoff

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
2023-03-30 Issue Fee Transmittal S4079.10001US03.pdf	1	Issue Fee Payment (PTO-85B)	183 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
2023-03-30 Issue Fee Transmittal S4079.10001US03.pdf	BFBF5A8099748E731DD7F16F8749FEF3346AA803534F0A9C70 DBEAFA565C5E996ED3E219063E564A4F868268D0C62BC59B9 0B1DF2FF27B2D42AE74F3BB2A0223

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

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) 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.

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/301,609	04/08/2021	Dean Solon	S4079.10001US03	3509

97149 7590 03/30/2023

Maschoff Brennan
1389 Center Drive, Suite 300
Park City, UT 84098

EXAMINER
CANNON, RYAN SMITH

ART UNIT	PAPER NUMBER
1726	

NOTIFICATION DATE	DELIVERY MODE
03/30/2023	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):

d@mabr.com

Voltage, LLC
EX1021-43

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Application No. : 17301609
Applicant : Solon
Filing Date : 04/08/2021
Date Mailed : 03/30/2023

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Notice of Allowance Mailed

This application has been accorded an Allowance Date and is being prepared for issuance. The application, however, is incomplete for the reasons below.

Applicant is given two (2) months from the mail date of this Notice within which to respond. This time period for reply is extendable under 37 CFR 1.136(a) for only TWO additional MONTHS.

The informalities requiring correction are indicated in the attachment(s). If the informality pertains to the abstract, specification (including claims) or drawings, the informality must be corrected with an amendment in compliance with 37 CFR 1.121 (or, if the application is a reissue application, 37 CFR 1.173). Such an amendment may be filed after payment of the issue fee if limited to correction of informalities noted herein. See Waiver of 37 CFR 1.312 for Documents Required by the Office of Patent Publication, 1280 Off. Gaz. Patent Office 918 (March 23, 2004). In addition, if the informality is not corrected until after payment of the issue fee, for purposes of 35 U.S.C. 154(b)(1)(iv), "all outstanding requirements" will be considered to have been satisfied when the informality has been corrected. A failure to respond within the above-identified time period will result in the application being ABANDONED.

See attachment(s).

A copy of this notice MUST be returned with the reply. Please address response to "Mail Stop Issue Fee, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450".

/Naran Hem/
Publication Branch
Office of Data Management
(571) 272-4200

Application No. 17301609 **Drawings filed: 04/08/2021**

IDENTIFICATION OF DRAWING DEFICIENCIES

- [ ] There is a hole or the image thereof within the illustration. FIG(s)
- [ ] The illustration is penetrated or traversed by a solid or broken line that is not intended to be part of the drawing, such as a dark line caused by a flaw in the copying process. FIG(s)
- [ ] An ink stamp or the image thereof obscures part of the illustration. FIG(s)
- [ ] The drawing is marred by black smudges, obliterations, or fax/copier marks (for example, speckles or dots in a substantial portion of the drawing). FIG(s)
- [ ] Figure numbers are duplicated or missing. FIG(s)
- [ ] Drawing sheet or figure is missing. FIG(s)
- [ ] Numbers, letters, or reference characters in the drawing have been crossed out or are illegibly handwritten. FIG(s)
- [X] The character of the lines, numbers, and letters is poor. FIG(s) 1-3
- [ ] The drawing's background shows that the original drawing was made on graph paper or other paper with a pattern or decoration. FIG(s)
- [ ] The FIG. number label is placed in a location that causes the drawing to be read upside down. FIG(s)
- [ ] Data, a reference number, or part of the drawing is truncated or missing, or a lead line has no reference number. FIG(s)
- [ ] The drawing and/or the FIG. label contain(s) foreign language. FIG(s)
- [X] This utility application contains a photograph of a view that is capable of being illustrated as a line drawing. FIG(s) 8, 27-60
- [ ] A petition under 37 CFR 1.84(a)(2) to accept color drawings has been granted, but the brief description of the drawings in the specification does not contain (or has not been amended to contain) the paragraph required by 37 CFR 1.84(a)(2)(iii).
- [ ] This reissue application contains added and/or amended drawings that are not labeled as “New” or “Amended” or “Canceled” as required by 37 CFR 1.173(b)(3). FIG(s)
- [ ] This Design reissue application contains a drawing that is labeled as “Canceled” but is not surrounded by brackets, or a drawing that is surrounded by brackets but is not labeled as “Canceled.” See 37 CFR 1.173(b)(3). FIG(s)
- [ ] OTHER:
- [ ] COMMENTS:

UNITED STATES PATENT AND TRADEMARK OFFICE

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

97149 7590 03/22/2023

Maschoff Brennan
1389 Center Drive, Suite 300
Park City, UT 84098

EXAMINER
CANNON, RYAN SMITH

ART UNIT	PAPER NUMBER
1726	

DATE MAILED: 03/22/2023

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/301,609	04/08/2021	Dean Solon	S4079.10001US03	3509

TITLE OF INVENTION: LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0.00	$0.00	$480	06/22/2023

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

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

HOW TO REPLY TO THIS NOTICE:

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

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 40% the amount of undiscounted fees, and micro entity fees are 20% the amount of undiscounted fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

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EX1021-46

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

97149 7590 03/22/2023
Maschoff Brennan
1389 Center Drive, Suite 300
Park City, UT 84098

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/301,609	04/08/2021	Dean Solon	S4079.10001US03	3509

TITLE OF INVENTION: LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0.00	$0.00	$480	06/22/2023

EXAMINER	ART UNIT	CLASS-SUBCLASS
CANNON, RYAN SMITH	1726	136-244000

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

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

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

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

1 _____
2 _____
3 _____

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

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

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

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

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

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

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

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

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

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

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

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

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/301,609	04/08/2021	Dean Solon	S4079.10001US03	3509

97149 7590 03/22/2023

Maschoff Brennan
1389 Center Drive, Suite 300
Park City, UT 84098

EXAMINER
CANNON, RYAN SMITH

ART UNIT	PAPER NUMBER
1726	

DATE MAILED: 03/22/2023

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

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

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

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

Voltage, LLC
EX1021-48

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

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

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

Privacy Act Statement

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

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

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

Notice of Allowability	Application No. 17/301,609	Applicant(s) Solon, Dean	
	Examiner Ryan S Cannon	Art Unit 1726	AIA (FITF) Status Yes

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

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

1. ☑ This communication is responsive to after-final amendment filed 3/10/2023.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are See Continuation Sheet . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/RYAN S CANNON/
Primary Examiner, Art Unit 1726

Continuation of 3. The allowed claim(s) is/are: 1-9,11-12,15-16 and 18-28

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Reasons for Allowance

The following is an examiner's statement of reasons for allowance: the prior art teaches lead assemblies suitable for use in solar power systems (see analysis in prior office actions), but does not teach or suggest a lead assembly or solar power system comprising a lead assembly with the limitations of claims 1, 16, and 20. Those claims, as well as their respective dependent claims, are free of the art and allowable.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ryan S Cannon whose telephone number is (571)270-7186. The examiner can normally be reached M-F, 8:30am-5:30pm MST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jeffrey Barton can be reached on (571) 272-1307. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Ryan S. Cannon
Primary Examiner
Art Unit 1726

/RYAN S CANNON/
Primary Examiner, Art Unit 1726

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/301,609	Solon, Dean
	Examiner	Art Unit
	Ryan S Cannon	1726

CPC - Searched*		
Symbol	**Date**	**Examiner**
H01L31/0422,0424,0482,0484,05	1/16/2014	ERS
E04D3/40	1/17/2014	ERS
H01L31/02013,02008,02021	7/1/2014	ERS
H02S40/00-38	5/23/2014	ERS
H01R4/187,18,70	11/30/2017	ERS
H01R3-13/All	4/17/2020	ERS
H01R11/11	4/17/2020	ERS
H01R4/021,023,5205	4/17/2020	ERS
H01R13/5205	4/17/2020	ers
H01R4/027,10	4/17/2020	ERS
H01R9/0509	4/17/2020	ERS
H02S40/30,36	6/16/2022	RS
H01R4/All	6/16/2022	RS
H01R9/All	6/16/2022	RS
H01R13/All	06/16/2022	RS
H01R24/All	06/16/2022	RS
H01R25/All	6/16/2022	RS

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

Voltage LLC
EX1021-54

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/301,609	Solon, Dean
	Examiner	**Art Unit**
	Ryan S Cannon	1726

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**
52	173.3	7/16/2013	ERS
136	243-265	7/16/2013	ERS

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

Voltage LLC
EX1021-55

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/301,609	Solon, Dean
	Examiner	Art Unit
	Ryan S Cannon	1726

Search Notes		
Search Notes	**Date**	**Examiner**
Keyword search in USPC subclasses, CPC subgroups, IPC subgroups (see EAST history for search strategy)	5/23/2017	ERS
Inventor search in DAV	5/24/2017	ERS
Keyword search in CPC subgroups (see EAST history for search strategy)	11/30/2017	ERS
Update inventor search in DAV	11/30/2017	ERS
Consulted Fritz Fleming in AU2836	9/13/2018	ERS
Keyword search in EAST databases (see EAST history for search strategy)	9/14/2018	ERS
Updated inventor search in DAV	9/18/2018	ERS
Updated inventor search in DAV	6/6/2019	ERS
Keyword search in EAST databases (see EAST history for search strategy)	6/6/2019	ERS
Search consult with Examiner James Harvey in AU 2833	4/16/2020	ERS
Keyword search in EAST databases (see EAST history for search strategy)	5/8/2020	ERS
Updated inventor search in DAV	5/8/2020	ERS
Updated inventor search in DAV	2/1/2021	ERS
Keyword search in CPC subgroups	6/16/2022	RS
Inventor search in DAV	6/16/2022	RS
Used AI "More Like This Document" tool in P2E2 Search on previously acquired art	2/27/2023	RSC
Updated inventor search	2/27/2023	RSC
Updated inventor search	3/13/2023	RSC

Voltage 1146
EX1021-56

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/301,609	Solon, Dean
	Examiner	Art Unit
	Ryan S Cannon	1726

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
H02S40	30	2/1/2021	ERS
H01R9	03,0509	2/1/2021	ERS
H01R4	70,187,18,70,021,023,5205	2/1/2021	ERS
H01R11	11	2/1/2021	ERS
H01R3	All	2/1/2021	ERS
H01R4	70	3/13/2023	RSC
H01R9	03	3/13/2023	RSC
H02S40	30	3/13/2023	RSC

Voltage LLC
EX1021-57

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/301,609	Solon, Dean
	Examiner	**Art Unit**
	Ryan S Cannon	1726

CPC						
Symbol					**Type**	**Version**
H02S	/	40	/	30	F	2014-12-01
H01R	/	9	/	03	I	2013-01-01
H01R	/	4	/	70	I	2013-01-01

CPC Combination Sets								
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	24	
/RYAN S CANNON/ Primary Examiner, Art Unit 1726	13 March 2023	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	29

U.S. Patent and Trademark Office

Part of Paper No.: 20230313

Voltage, LLC
EX1021-58

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/301,609	Solon, Dean
	Examiner	**Art Unit**
	Ryan S Cannon	1726

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H02S40/30	/	40	/	30
H01R9/03	/	9	/	03
H01R4/70	/	4	/	70

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	24	
/RYAN S CANNON/ Primary Examiner, Art Unit 1726	13 March 2023	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	29

U.S. Patent and Trademark Office

Part of Paper No.: 20230313

Voltage, LLC
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Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/301,609	Solon, Dean
	Examiner	**Art Unit**
	Ryan S Cannon	1726

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	10	11	15	23										
2	2	11	12	16	24										
3	3	12	15	17	25										
4	4	21	16	18	26										
5	5	22	18	19	27										
6	6	23	19	20	28										
7	7	24	20												
8	8	13	21												
9	9	14	22												

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	24	
/RYAN S CANNON/ Primary Examiner, Art Unit 1726	13 March 2023	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	29

U.S. Patent and Trademark Office

Part of Paper No.: 20230313

Voltage, LLC
EX1021-60

OK TO ENTER: /R.S.C./

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of :	Dean Solon	
Application No.:	17/301,609	Art Unit 1726
Filed:	April 8, 2021	
Conf. No.:	3509	
For:	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER	
Examiner:	Ryan Smith Cannon	
Customer No.:	97149	
Attorney Docket No.:	S4079.10001US03	

RESPONSE TO FINAL OFFICE ACTION DATED MARCH 3, 2023

In response to the Final Office Action dated March 3, 2023, please consider:

AMENDMENTS TO THE CLAIMS 2

REMARKS 7

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Bibliographic Data

Application No: 17/301,609

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /RYAN S CANNON/ (Examiner's Signature) | (Initials)

Title: LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
04/08/2021	136	1726	S4079.10001US03
RULE			

APPLICANTS

SHOALS TECHNOLOGIES GROUP, LLC, Portland, TN, UNITED STATES

INVENTORS

Dean Solon, Gallatin, TN, UNITED STATES

CONTINUING DATA

This application is a CON of 14849458 09/09/2015 PAT 10992254

14849458 has PRO of 62047773 09/09/2014

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

04/15/2021

**** SMALL ENTITY ****

STATE OR COUNTRY

UNITED STATES

ADDRESS

Maschoff Brennan
1389 Center Drive, Suite 300
Park City, UT 84098
UNITED STATES

FILING FEE RECEIVED

$830

PE2E SEARCH - Search History (Prior Art)

There are no Prior Art searches to show.

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N718	643	h02s40/30.cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/13 11:28 AM
N719	627	h01r9/03.cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/13 11:28 AM
N720	1514	h01r4/70.cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/13 11:28 AM
N721	2766	N720 OR N719 OR N718	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/13 11:29 AM
N722	3	N721 AND (drop ADJ line$1).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/13 11:30 AM
N723	3	N721 AND (feeder ADJ cable$1).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/13 11:30 AM
N724	5	N721 AND (feeder$1).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/13 11:30 AM
N725	310	N721 AND drop$1	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/13 11:31 AM
N726	24	N721 AND drop$1.clm.	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/13 11:31 AM
N727	3	N726 AND N724	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/13 11:31 AM

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of :	Dean Solon	
Application No.:	17/301,609	Art Unit 1726
Filed:	April 8, 2021	
Conf. No.:	3509	
For:	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER	
Examiner:	Ryan Smith Cannon	
Customer No.:	97149	
Attorney Docket No.:	S4079.10001US03	

RESPONSE TO FINAL OFFICE ACTION DATED MARCH 3, 2023

In response to the Final Office Action dated March 3, 2023, please consider:

AMENDMENTS TO THE CLAIMS 2

REMARKS 7

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AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions and listings of claims in the application:

1. **(Currently amended)** A lead assembly for use in a solar energy installation including:

a drop line terminating at a drop line connector, the drop line connector configured to connect with a central trunk of a wire harness, the central trunk of the wire harness having a plurality of branches that each are configured to electrically connect to a separate solar panel contained in an array of a plurality solar panels;

a feeder cable electrically coupled to the drop line at a nexus;

an undermold that fully encases the nexus, the undermold further comprising:

a first aperture extending completely through the undermold and having a first diameter, wherein the feeder cable extends through the first aperture along a first longitudinal axis; and

a second aperture extending partially through the undermold and having a second diameter different than the first diameter, wherein the drop line extends from the second aperture along a second longitudinal axis;

a third aperture extending partially through the undermold and having a third diameter different than the first diameter, wherein a second drop line extends from the third aperture along a third longitudinal axis; and

an overmold surrounding the undermold and forming an undermold-overmold interface at an outer surface of the undermold.

2. **(Original)** The lead assembly of claim 1 wherein the drop line includes a section of exposed wire at the nexus.

3. **(Original)** The lead assembly of claim 2 wherein the feeder cable includes a section of exposed wire at the nexus.

4. **(Original)** The lead assembly of claim 1 wherein the overmold defines at least one attachment aperture.

5. **(Original)** The lead assembly of claim 1, wherein the feeder cable terminates at a feeder cable connector.

6. **(Original)** The lead assembly of claim 5, wherein the feeder cable connector is configured to attach directly to an inverter.

7. **(Original)** The lead assembly of claim 5, wherein the feeder cable connector is configured to attach directly to a jumper cable, which in turn connects directly to an inverter.

8. **(Original)** The lead assembly of claim 1, wherein the first longitudinal axis and the second longitudinal axis are substantially parallel.

9. **(Original)** The lead assembly of claim 1, wherein the second diameter is smaller than the first diameter.

10. **(Cancelled).**

11. **(Currently amended).** The lead assembly of claim [[10]]1, wherein the third longitudinal axis is substantially concentric with the second longitudinal axis, and substantially parallel with the first longitudinal axis.

12. **(Original)** The lead assembly of claim 1, wherein the drop line includes a fuse.

13. **(Cancelled).**

14. **(Cancelled).**

15. **(Previously presented)** The lead assembly of claim 1, wherein said lead assembly combines power received from the plurality of solar panels and conducts that power directly to an inverter electrically connected to the feeder cable.

16. **(Currently amended)** A solar power system comprising:

a plurality of solar panels each electrically coupled to one of a plurality of branches of a wire harness to form a first solar array;

a lead assembly comprising:

a drop line electrically connected to a central trunk of the wire harness and configured to receive power from the plurality of solar panels;

a second drop line electrically connected to a central trunk of a second wire harness and configured to receive power from a plurality of solar panels in a second solar array;

a feeder cable, the feeder cable electrically connected to the drop line and the second drop line at a nexus; and

a primary mold that fully encases the nexus so as to substantially seal the nexus from external environmental conditions, the primary mold further comprising:

a first aperture extending completely through the primary mold and having a first diameter, wherein the feeder cable extends through the first aperture; ~~and~~

a second aperture extending partially through the primary mold and having a second diameter smaller than the first diameter, wherein the drop line extends into the second aperture and

a third aperture extending partially through the primary mold and having a third diameter smaller than the first diameter, wherein the second drop line extends into the third aperture.

17. **(Cancelled).**

18. **(Original)** The solar power system of claim 16, wherein the feeder cable is directly electrically connected to a component selected from the group consisting of a trunk buss jumper, an inverter, a connection unit, a recombiner, and a disconnect unit.

19. **(Original)** The solar power system of claim 16, further comprising a secondary mold surrounding the primary mold and forming an undermold-overmold interface at an outer surface of the primary mold.

20. (**Currently amended**) A solar power system comprising:

a plurality of solar panels electrically coupled by a wire harness to form a first solar array;

a lead assembly comprising:

a first drop line electrically connected to the wire harness and configured to receive power from the plurality of solar panels;

a feeder cable, the feeder cable electrically connected to the drop line at a nexus;

a primary mold that fully encases the nexus so as to substantially seal the nexus from external environmental conditions, the primary mold further comprising:

a first aperture extending completely through the primary mold and having a first diameter, wherein the feeder cable extends through the first aperture along a first longitudinal axis;

a second aperture extending partially through the primary mold and having a second diameter smaller than the first diameter, wherein the drop line extends into the second aperture along a second longitudinal axis; and

a second drop line electrically connected to a second wire harness that connects to a plurality of solar panels, the second drop line electrically connected to the feeder cable at ~~a second~~ the nexus fully encased by the primary mold, wherein the second drop line extends into a third aperture defined by the primary mold along a third axis.

21. **(New)** The lead assembly of claim 1, wherein the second drop line terminates at a second drop line connector, the second drop line connector configured to connect with a central trunk of a second wire harness, the central trunk of the second wire harness having a plurality of branches the each are configured to electrically connect to a separate solar panel contained in a second array of a plurality of solar panels.

22. **(New)** The lead assembly of claim 21, wherein the lead assembly is configured to combine electrical power received from the array of solar panels and the second array of solar panels at the nexus and to deliver the combined electrical power to an inverter that is in electrical communication with the feeder cable.

23. (**New)** The lead assembly of claim 1, wherein the second drop line includes a section of exposed wire at the nexus so as to be electrically connected to the feeder cable.

24. **(New)** The lead assembly of claim 1, wherein the drop line and the second drop line each includes a wire of between four (4) to eighteen (18) gauge.

25. **(New)** The lead assembly of claim 24, wherein the feeder cable includes a wire of between 250 MCM to 1000 MCM.

26. **(New)** The lead assembly of claim 23, wherein the electrical coupling between the feeder cable, the drop line and the second drop line at the nexus is secured with at least one of a compression lug, a solder connection, a splice, and a crimp.

27. **(New)** The lead assembly of claim 1, wherein the undermold is applied by injection molding.

28. **(New)** The lead assembly of claim 1, wherein the overmold is applied by injection molding.

REMARKS

The foregoing amendment amends claims 1, 11, 16, 18 and 20 and adds new claims 21-28. Claims 10 and 17 are cancelled without prejudice. Claims 1-9, 11-12, 15-16 and 18-28 are pending.

Applicant respectfully requests reconsideration of the application in view of the above amendments to the claims and the following remarks. Unless otherwise stated herein, amendments to the claims have been made at the discretion of the Applicant and not necessarily for reasons related to patentability.

Applicant reserves the right to pursue any previously pending claims or other claims that capture any subject matter supported by the present disclosure. Additionally, Applicant reserves the right, both during and after prosecution of this case, to modify or revoke the views expressed with regard to any cited reference.

Applicant includes dates in any Information Disclosure Statement (IDS) filed during the prosecution of this application solely to comply with the duty of disclosure required by the USPTO. Applicant expressly denies that any date listed in any IDS is an admission that a corresponding reference was published, accessible, disseminated, or otherwise qualified as prior art as of the listed date.

The following remarks are not intended to exhaustively identify all distinctions between any cited reference and the claims. The term "Applicant" is used generically herein to refer to any entity with authority to prosecute this application.

Allowable Subject Matter

Applicant notes, with appreciation, the Examiner's indication that claim 20 contains allowable subject matter. Applicant has made an amendment to claim 20 to correct an antecedent basis error. It is not believed that this corrective amendment affects the allowability of the claim.

The Office Action rejects claims 1-9, 12, 15-16 and 18-19 under 35 U.S.C. § 103. The Office Action indicates that claims 10, 11, and 17 are directed to patentable subject matter. In the interest of expediting prosecution and without conceding the contention that claims are anticipated or obvious, Applicant has herein amended independent claim 1 to incorporate the limitations of dependent claim 10 and has rewritten independent claim 16 to incorporate the limitations of

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dependent claim 17, thereby rendering the rejections moot. Applicant therefore respectfully requests that the rejections of independent claims 1 and 16 be withdrawn. Applicant expressly reserves the right to present claims similar or identical to the preamendment versions of the claims in another application.

By virtue of their dependence on claims 1 and 16 and for at least the reasons presented above, claims 2-9, 11-12, 15, 18-19 are also patentable. Thus, Applicant respectfully requests that the rejections of each of those dependent claims be withdrawn.

New Claims

Because new claims 21-28 depend directly or indirectly from independent claim 1 (indicated as allowable by virtue of incorporation of the limitations of dependent claim 10), they are allowable for at least the reasons already discussed. On that basis, Applicant respectfully requests that each of the new claims 21-28 also be allowed.

Charge Authorization

The Commissioner is hereby authorized to charge payment of any of the following fees that may be applicable to this communication, or credit any overpayment, to Deposit Account No. 50-5394: (1) any filing fees required under 37 C.F.R. § 1.16; (2) any patent application and reexamination processing fees under 37 C.F.R. § 1.17; and/or (3) any post issuance fees under 37 C.F.R. § 1.20. In addition, if any additional extension of time is required, which has not otherwise been requested, please consider this a petition therefor and charge any additional fees that may be required to Deposit Account No. 50-5394.

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CONCLUSION

In view of the foregoing, Applicant submits that the pending claims are allowable. In the event that Examiner finds remaining impediment to a prompt allowance of this application that may be clarified through a telephone interview or overcome by an Examiner's Amendment, Examiner is invited to contact the undersigned attorney.

Dated this 10th day of March, 2023.

Respectfully submitted,

/Eric L. Maschoff/

Eric L. Maschoff
Registration No. 36596
Attorney for Applicant
Telephone No. (435) 252-1360

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UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/301,609	**03/10/2023 06:27:19 PM ET**	**S4079.10001US03**

Title of Invention

LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	3509	FILED BY	Brian Gonzalez
PATENT CENTER #	61725533	FILING DATE	04/08/2021
CUSTOMER #	97149	FIRST NAMED INVENTOR	Dean Solon
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Eric Maschoff

Documents

TOTAL DOCUMENTS: 3

DOCUMENT		PAGES	DESCRIPTION	SIZE (KB)
2023.03.10 OA Response_S4079.10001US03.pdf		9	-	201 KB
2023.03.10 OA Response_S4079.10001US03-A.NE.pdf	(1-1)	1	Response After Final Action	124 KB
2023.03.10 OA Response_S4079.10001US03-CLM.pdf	(2-6)	5	Claims	135 KB
2023.03.10 OA Response_S4079.10001US03-REM.pdf	(7-9)	3	Applicant Arguments/Remarks Made in an Amendment	112 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
2023.03.10 OA Response_S4079.10001US03.pdf	EA39E629086B9B76118A9813279AA82BBD47258C05E6B7826A34566B83EDEE950743448C384298BA8567941 9B3E50732CDA30FC3184B265C23E4BB73A0C3842A
2023.03.10 OA Response_S4079.10001US03-A.NE.pdf	E1C273B35B8A8747F2B487EBE890CC3C0F14BE978F0DCC7A886B1B281D2569645CB19688C4246A957392FF1E971603F236F0465D2E2F0744613CB00C6AB4555E
2023.03.10 OA Response_S4079.10001US03-CLM.pdf	06D9198FE7E9F2B0FF3E0A6AE371E08D99CFA7895E7F0028244DC1DD467CDCE0A593B0779AA778B7AAFE85426C792264BFF1C5AB605B39298FE480C1E064B898
2023.03.10 OA Response_S4079.10001US03-REM.pdf	A90D4F1BBD16A69E3CD344FEAF38EC62FA20065 1146BA3AE77A251534EFB5512D5FDCB21E587B4A107EC8FD655767D99865369088AC6FD47C0C4F47031E161CC

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

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) 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.

UNITED STATES
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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/301,609	03/10/2023 06:27:19 PM ET	S4079.10001US03

Title of Invention

LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	3509	FILED BY	Brian Gonzalez
PATENT CENTER #	61725533	AUTHORIZED BY	Eric Maschoff
CUSTOMER #	97149	FILING DATE	04/08/2021
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Dean Solon

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 5003	E202330I28435138	Brian Gonzalez

PRE-AUTHORIZED ACCOUNT	PRE-AUTHORIZED CATEGORY
505394	37 CFR 1.17 (Patent application and reexamination processing fees); 37 CFR 1.21 (Miscellaneous fees and charges)

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
2202	EACH CLAIM IN EXCESS OF 20	40.00	4	160.00
			TOTAL AMOUNT:	$160.00

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New Applications Under 35 U.S.C. 111

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New International Application Filed with the USPTO as a Receiving Office

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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 17/301,609	Filing Date 04/08/2021	☐ 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	03/10/2023	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 24	Minus	** 24	= 0		x $40 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0		x $192 =	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.	SLIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/DEIDRE C KING-WOODWARD/
*** 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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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/301,609	04/08/2021	Dean Solon	S4079.10001US03	3509

97149 7590 03/03/2023

Maschoff Brennan
1389 Center Drive, Suite 300
Park City, UT 84098

EXAMINER
CANNON, RYAN SMITH

ART UNIT	PAPER NUMBER
1726	

NOTIFICATION DATE	DELIVERY MODE
03/03/2023	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):

d@mabr.com

Voltage, LLC
EX1021-78

Office Action Summary	Application No. 17/301,609	Applicant(s) Solon, Dean	
	Examiner Ryan S Cannon	Art Unit 1726	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 12/22/2022.

☐ 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) 1-12 and 15-20 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☑ Claim(s) 20 is/are allowed.

7) ☑ Claim(s) 1-9,12,15-16 and 18-19 is/are rejected.

8) ☑ Claim(s) 10-11 and 17 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 _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date 12/22/2022.

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

4) ☐ Other: _____.

Voltage, LLC
EX1021-79

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Response to Amendment

The amendment filed 12/22/2022 does not place the application in condition for allowance.

The previous anticipation rejections are withdrawn due to Applicant's amendment.

The previous obviousness rejections are revised to incorporate new claim limitations.

New analysis follows.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim(s) 1-3, 5-9, 15, 16, 18, and 19 is/are rejected under 35 U.S.C. 103 as being unpatentable over US Patent 6,268,559 to Yamawaki, and further in view of US Patent 3,852,516 to Vander Ploog (both of record).

Regarding claims 1-3, 5-9, and 15, the preamble for claim 1 recites a lead assembly for use in a solar energy installation. If the body of a claim fully and intrinsically sets forth all of the limitations of the claimed invention, and the preamble merely states, for example, the purpose or intended use of the invention, rather than any distinct definition of any of the claimed invention's limitations, then the preamble is not considered a limitation and is of no significance to claim construction. Pitney Bowes, Inc. v. Hewlett-Packard Co., 182 F.3d 1298, 1305, 51 USPQ2d 1161, 1165 (Fed. Cir. 1999). MPEP §2111.02.II.

As the body of the claim recites a structurally complete invention, the limitation that the lead assembly is for use in a solar energy installation is not given patentable weight.

Yamawaki teaches a lead assembly 16 including

- a drop line 31 terminating at a drop line connector (e.g. rightmost element 34 of Fig. 8A; Figs. 4-9, C9/L64-C10/L16, C11/L3-13)
- a feeder cable 32, the feeder cable electrically coupled to the drop line 31 at a nexus (illustrated as a node between phantom lines in Figs. 8A, 8B, 9A, C10/L17-32)
- an undermold 33e that fully encases the nexus (33e is illustrated in Fig. 9B as being fully encased by 33f, and therefore necessarily fully encases the nexus)
- an overmold 33f surrounding the undermold 33e and forming an undermold-overmold interface at an outer surface of the undermold (Fig. 9B illustrates a cutout of the relationship between 33e, 33f; only the thickness of 33f intercedes between the undermold 33e surface and the exterior, therefore the interface is present).

Per **claims 1 and 9**, the drop line has a first diameter (shown in the perspective view of Fig. 9B) and extends along a first longitudinal axis and the feeder cable has a second diameter and extends along a second longitudinal axis. While the second diameter is not specifically described as different or smaller than the first diameter, a skilled artisan would understand that the first and second diameter could have three relative configurations: both diameters are equal, the first diameter is smaller than the second diameter, and the second diameter is smaller than the first diameter. Therefore it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to form the second diameter different than or smaller than the first diameter because it would have been obvious to try.

The Supreme Court decided that a claim can be proved obvious merely by showing that the combination of known elements was obvious to try. In this regard, the Supreme Court explained that,

"[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has a good reason to pursue the known options within his or her technical grasp." An obviousness determination is not the result of a rigid formula disassociated from the consideration of the facts of the case. Indeed, the common sense of those skilled in the art demonstrates why some combinations would have been obvious where others would not. Therefore, choosing from a finite number of identified, predictable solutions, with a reasonable expectation for success, is likely to be obvious to a person if ordinary skill in the art. See *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421, USPQ2d 1385, 1395 – 97 (2007) (see MPEP § 2143, E.).

The undermold 33e is described as having rigidity (C10/L67-C11/L2), but is not specifically shown to have a first aperture and second aperture. Vander Ploog teaches a similar lead assembly having a similar undermold (18/20) having rigidity, also comprising an analogous feeder cable (12) and drop line (16) (C2/L56-65, C3/L9-11), wherein the mold comprises a first aperture extending completely through the undermold (the material of 20 displaced by the cable 12 is in the form of an aperture), such that the feeder cable extends through the first aperture along its analogous first longitudinal axis, and a second aperture extending partially through the undermold (the material of 20 displaced by line 16 is in the form of an aperture), such that the drop line extends into the second aperture along a second longitudinal axis. Vander Ploog teaches that it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to employ this undermold in order to provide electrical and mechanical protection to the nexus (C1/L53-56, C1/L61-C2/L6). The undermold of modified-Yamawaki would therefore possess the claimed first aperture and second aperture with the claimed properties.

The claim recites that the drop line connector is *configured to* connect with a central trunk of a wire harness, the central trunk of the wire harness having a plurality of branches that each connect to a

separate solar panel contained in an array of a plurality of solar panels. The language that the drop line connector is configured to provide a function or have a property implies an intended use. Intended use limitations are given weight to the extent that the prior art structure is capable of performing the intended use. See MPEP § 2111.02, 2112.01 and 2114-2115. The claim is drawn to a lead assembly. The claim is drawn to a lead assembly and its structure; the broadest reasonable interpretation of the claim does not require a wire harness as part of this structure, only the capability of the drop line connector to connect to a wire harness. The drop line connector 34 connects to a wiring harness (one of elements 25 in Fig. 5, 26 in Fig. 6, 27 in Fig. 7) connecting to a plurality of solar panels M. Figs. 4-7 show different structural and electrical configurations of such a harness. Therefore a skilled artisan would understand that the lead assembly of modified-Yamawaki is capable of performing the intended use.

Per **claims 2 and 3**, modified-Yamawaki teaches the limitations of claim 1. Yamawaki does not specifically teach that the drop line and the feeder cable each include a respective section of exposed wire at the nexus. However, it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to form sections of exposed wire, as Vander Ploog shows that such exposure is necessary for electrical connection at a nexus (coincident with 15 of Fig. 1, C2/47-55).

Per **claims 5-7**, modified-Yamawaki teaches the limitations of claim 1. The feeder cable 32 of Yamawaki terminates at a feeder cable connector 34 (Figs. 4-7, 8A, 8B, C11/L3-13). The limitation that the feeder cable connector is configured to attach directly to an inverter, or to attach directly to a jumper cable, which in turn connects directly to an inverter is an intended use limitation. Intended use limitations are given weight to the extent that the prior art structure is capable of performing the intended use. See MPEP § 2111.02, 2112.01 and 2114-2115. The cited passages of Yamawaki teach that the feeder cable connector is capable of electrically connecting a lead assembly and inverter (for instance, see Fig. 2, C7/L54-C8/L11).

Per **claim 8,** modified-Yamawaki teaches the limitations of claim 1. In the schematic view of Fig. 9, the first longitudinal axis and the second longitudinal axis are substantially parallel for a portion (Fig. 9A). Further, Vander Ploog teaches that the analogous first longitudinal axis and second longitudinal axis are substantially parallel in a region before the nexus in that invention (Fig. 1). Therefore it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to form the first longitudinal axis and second longitudinal axis to be substantially parallel because they are illustrated as such. The prior art can be modified or combined to reject claims as *prima facie* obvious as long as there is a reasonable expectation of success. See *In re Merck & Co., Inc.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986) (see MPEP § 2143.02).

Per **claim 15**, modified-Yamawaki teaches the limitations of claim 1. The limitation that the lead assembly combines power received from the plurality of solar panels and conducts that power directly to an inverter electrically connected to the feeder capable is at least in part a statement of intended use. Regardless, in an embodiment, the lead assembly 16 combines power received from a plurality of solar panels (MN in Fig. 2) and conducts that power to an inverter 13 electrically connected to the feeder cable (C7/L54-C8/L11). While a wire 18 intervenes between the lead assembly 16 and the inverter 13 in that embodiment, a skilled artisan would understand that the wire provides no function other than conduction of electricity, which is also provided by the wire assembly, and it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to omit that wire to establish a direct connection, as it would merely require the omission of an element while the function is retained. MPEP §2144.04.II.B.

Regarding claim 16, 18, and 19, Yamawaki teaches a solar power system comprising

- a plurality of solar panels M each electrically coupled to one of a plurality of branches of a wire harness to form a first solar array MN (see Marked-up Fig. 6 below; C8/L12-32, C9/L26-35)
- a lead assembly 16 comprising

- a drop line 31 (Figs. 8, 9) electrically connected to a central trunk of the wire harness (at 28b/34 in Fig. 6) and configured to receive power from the plurality of solar panels M (C9/L64-C10/L16)
- a feeder cable 32, the feeder cable electrically connected to the drop line 31 at a nexus (illustrated as a node between phantom lines in Figs. 8A, 8B, 9A, C10/L17-32)
- a primary mold 33e that fully encases the nexus (33e is illustrated in Fig. 9B as being fully encased by 33f, and therefore necessarily fully encases the nexus) so as to substantially seal the nexus from external environmental conditions (C13/L6-18).

The drop line has a first diameter (shown in the perspective view of Fig. 9B) and extends along a first longitudinal axis and the feeder cable has a second diameter and extends along a second longitudinal axis. While the second diameter is not specifically described as smaller than the first diameter, a skilled artisan would understand that the first and second diameter could have three relative configurations: both diameters are equal, the first diameter is smaller than the second diameter, and the second diameter is smaller than the first diameter. Therefore it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to form the second diameter smaller than the first diameter because it would have been obvious to try.

The Supreme Court decided that a claim can be proved obvious merely by showing that the combination of known elements was obvious to try. In this regard, the Supreme Court explained that, "[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has a good reason to pursue the known options within his or her technical grasp." An obviousness determination is not the result of a rigid formula disassociated from the consideration of the facts of the case. Indeed, the common sense of those skilled in the art demonstrates why some combinations would have been obvious where others would not. Therefore, choosing from a finite number of identified, predictable solutions, with a

reasonable expectation for success, is likely to be obvious to a person if ordinary skill in the art. See *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421, USPQ2d 1385, 1395 – 97 (2007) (see MPEP § 2143, E.).

The primary mold 33e is described as having rigidity (C10/L67-C11/L2), but is not specifically shown to have a first aperture and second aperture. Vander Ploog teaches a similar lead assembly having a similar primary mold (18/20) having rigidity and providing an environmental seal, also comprising an analogous feeder cable (12) and drop line (16) (C2/L56-65, C3/L9-11), wherein the mold comprises a first aperture extending completely through the primary mold (the material of 20 displaced by the cable 12 is in the form of an aperture), such that the feeder cable extends through the first aperture, and a second aperture extending partially through the primary mold (the material of 20 displaced by line 16 is in the form of an aperture), such that the drop line extends into the second aperture. Vander Ploog teaches that it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to employ this primary mold in order to provide electrical and mechanical protection to the nexus (C1/L53-56, C1/L61-C2/L6). The primary mold of modified-Yamawaki would therefore possess the claimed first aperture and second aperture with the claimed properties.

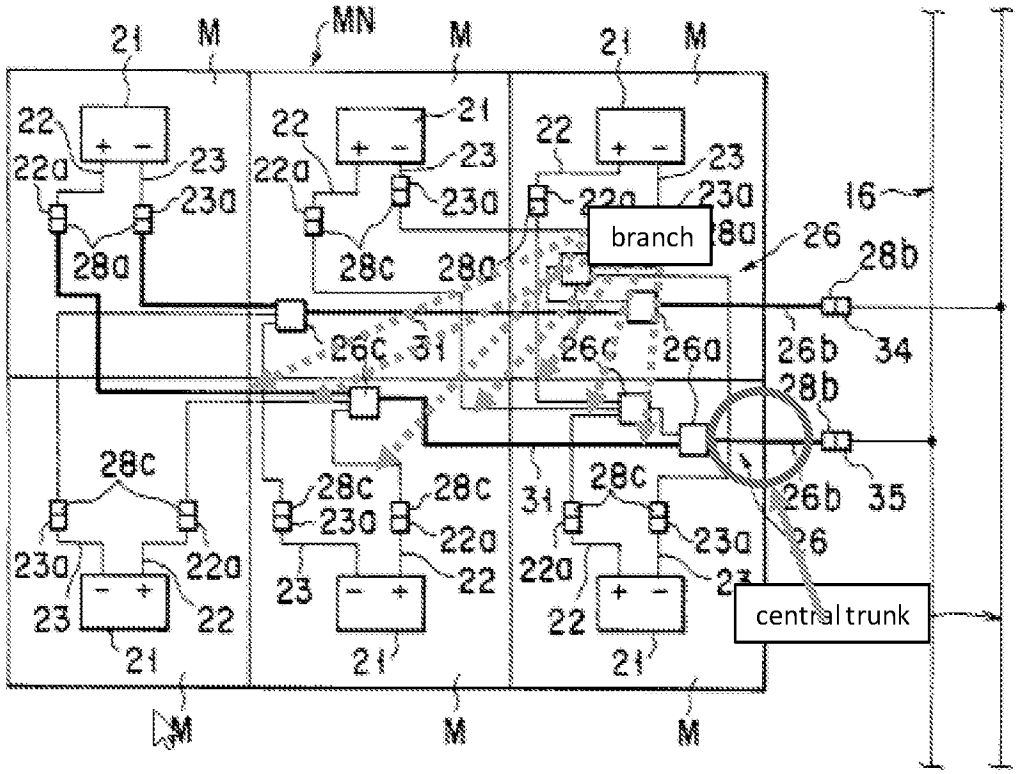


FIG. 6

Per **claim 18**, modified-Yamawaki teaches the limitations of claim 16. The feeder cable is directly electrically connected to a connection unit 18 (Fig. 2, C7/L54-59).

Per **claim 19**, modified-Yamawaki teaches the limitations of claim 16. The system further comprises a secondary mold 33f surrounding the primary mold 33e and forming an undermold-overmold interface at an outer surface of the primary mold (Fig. 9B illustrates a cutout of the relationship between 33e, 33f; only the thickness of 33f intercedes between the primary mold 33e surface and the exterior, therefore the interface is present).

Claim(s) 4 is/are rejected under 35 U.S.C. 103 as being unpatentable over Yamawaki and Vander Ploog as applied to claim 1 above, and further in view of US PGPub 2011/0011642 to Solon (of record).

Regarding claim 4, modified-Yamawaki teaches the limitations of claim 1. The references do not teach that the overmold defines at least one attachment aperture. Solon, however, teaches that it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to form an overmold (56) with an attachment aperture 52 so that zip ties or fasteners may secure an assembly (¶0026, 0029).

Claim(s) 12 is/are rejected under 35 U.S.C. 103 as being unpatentable over Yamawaki and Vander Ploog as applied to claim 1 above, and further in view of US PGPub 2010/0139733 to Jonczyk (of record).

Regarding claim 12, modified-Yamawaki teaches the limitations of claim 1. The references do no teach that the drop line includes a fuse. However, it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to include a fuse in the drop line because Jonczyk teaches such a fuse (e.g. 112 of Fig. 9) in a similar drop line in order to protect the circuits the assembly may be connected to (¶0002, 0037, 0038).

Allowable Subject Matter

Claims 10, 11, and 17 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The prior art does not teach or suggest a lead assembly having structure and function of claim 10, or a system having the structure and function of claim 17.

Claim 20 allowed. The prior art does not anticipate or render obvious the subject matter of that claim.

Response to Arguments

Applicant's arguments filed 12/22/2022 have been fully considered but they are not persuasive. Although art previously made of record is relied upon in the rejections of the claims above, the reasoning, in particular with respect to the new claim limitations, is new.

Claim 1 recites that the drop line connector is *configured to* connect with a central trunk of a wire harness, the central trunk of the wire harness having a plurality of branches that each connect to a separate solar panel contained in an array of a plurality of solar panels. The language that the drop line connector is configured to provide a function or have a property implies an intended use. Intended use limitations are given weight to the extent that the prior art structure is capable of performing the intended use. See MPEP § 2111.02, 2112.01 and 2114-2115. The claim is drawn to a lead assembly. The claim is drawn to a lead assembly and its structure; the broadest reasonable interpretation of the claim does not require a wire harness as part of this structure, only the capability of the drop line connector to connect to a wire harness. The drop line connector 34 connects to a wiring harness (one of elements 25 in Fig. 5, 26 in Fig. 6, 27 in Fig. 7) connecting to a plurality of solar panels M. Figs. 4-7 show different structural and electrical configurations of such a harness. Therefore a skilled artisan would understand that the lead assembly of modified-Yamawaki is capable of performing the intended use.

The rejection of claim 16 above relies upon a specific embodiment taught by Yamakawi to address the new claim limitations.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date

of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ryan S Cannon whose telephone number is (571)270-7186. The examiner can normally be reached M-F, 8:30am-5:30pm MST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jeffrey Barton can be reached on (571) 272-1307. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Ryan S. Cannon
Primary Examiner
Art Unit 1726

/RYAN S CANNON/
Primary Examiner, Art Unit 1726

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/301,609	Solon, Dean
	Examiner	Art Unit
	Ryan S Cannon	1726

CPC - Searched*		
Symbol	**Date**	**Examiner**
H01L31/0422,0424,0482,0484,05	1/16/2014	ERS
E04D3/40	1/17/2014	ERS
H01L31/02013,02008,02021	7/1/2014	ERS
H02S40/00-38	5/23/2014	ERS
H01R4/187,18,70	11/30/2017	ERS
H01R3-13/All	4/17/2020	ERS
H01R11/11	4/17/2020	ERS
H01R4/021,023,5205	4/17/2020	ERS
H01R13/5205	4/17/2020	ers
H01R4/027,10	4/17/2020	ERS
H01R9/0509	4/17/2020	ERS
H02S40/30,36	6/16/2022	RS
H01R4/All	6/16/2022	RS
H01R9/All	6/16/2022	RS
H01R13/All	06/16/2022	RS
H01R24/All	06/16/2022	RS
H01R25/All	6/16/2022	RS

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

Voltage LLC
EX1021-92

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/301,609	Solon, Dean
	Examiner	**Art Unit**
	Ryan S Cannon	1726

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**
52	173.3	7/16/2013	ERS
136	243-265	7/16/2013	ERS

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

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/301,609	Solon, Dean
	Examiner	Art Unit
	Ryan S Cannon	1726

Search Notes		
Search Notes	**Date**	**Examiner**
Keyword search in USPC subclasses, CPC subgroups, IPC subgroups (see EAST history for search strategy)	5/23/2017	ERS
Inventor search in DAV	5/24/2017	ERS
Keyword search in CPC subgroups (see EAST history for search strategy)	11/30/2017	ERS
Update inventor search in DAV	11/30/2017	ERS
Consulted Fritz Fleming in AU2836	9/13/2018	ERS
Keyword search in EAST databases (see EAST history for search strategy)	9/14/2018	ERS
Updated inventor search in DAV	9/18/2018	ERS
Updated inventor search in DAV	6/6/2019	ERS
Keyword search in EAST databases (see EAST history for search strategy)	6/6/2019	ERS
Search consult with Examiner James Harvey in AU 2833	4/16/2020	ERS
Keyword search in EAST databases (see EAST history for search strategy)	5/8/2020	ERS
Updated inventor search in DAV	5/8/2020	ERS
Updated inventor search in DAV	2/1/2021	ERS
Keyword search in CPC subgroups	6/16/2022	RS
Inventor search in DAV	6/16/2022	RS
Used AI "More Like This Document" tool in P2E2 Search on previously acquired art	2/27/2023	RSC
Updated inventor search	2/27/2023	RSC

Voltage LLC
EX1021-94

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/301,609	Solon, Dean
	Examiner	Art Unit
	Ryan S Cannon	1726

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
H02S40	30	2/1/2021	ERS
H01R9	03,0509	2/1/2021	ERS
H01R4	70,187,18,70,021,023,5205	2/1/2021	ERS
H01R11	11	2/1/2021	ERS
H01R3	All	2/1/2021	ERS

Voltage LLC
EX1021-95

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-22)
Approved for use through 05/31/2024. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	17301609
Filing Date	2021-04-08
First Named Inventor	Dean Solon
Art Unit	1726
Examiner Name	Ryan Smith Cannon
Attorney Docket Number	S4079.10001US03

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	8604342		2013-12-10	Solon	
	2	8911264		2014-12-16	Goyal et al.	
	3	1831002		1931-11-10	Hickey	
	4	8937249		2015-01-20	Solon	

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U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.S.C./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17301609
	Filing Date	2021-04-08
	First Named Inventor	Dean Solon
	Art Unit	1726
	Examiner Name	Ryan Smith Cannon
	Attorney Docket Number	S4079.10001US03

	1	2012/083785	WO		2012-06-28	DONGGUAN ANWELL DIGITAL MACHINERY CO., LTD.	English Abstract	
	2	2983361	FR		2013-05-31	MICHEL et al.	English Abstract	
	3	202006007613	DE		2006-08-17	BECK MANFRED	English Abstract	
	4	202797033	CN		2013-03-13	JIANGSU JIUDING SOLAR ENERGY SYSTEM CO LTD	English Abstract	
	5	1990/011608	WO		1990-10-04	SKYLINE HOLDING AG	English Abstract	
	6	2012/023748	WO		2012-02-23	MS TECHVISION CO., LTD.	English Abstract	
	7	102008027189	DE		2009-01-15	PFEFFER ROLAND	English Abstract	

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	PRNewswire, Molded In-line Fuse From Amphenol Protects Against Ground Fault Damage, published May 4, 2012, retrieved December 22, 2022 from: https://www.prnewswire.com/news-releases/molded-in-line-fuse-from-amphenol-protects-against-ground-fault-damage-150186315.html	

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.S.C./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17301609
	Filing Date	2021-04-08
	First Named Inventor	Dean Solon
	Art Unit	1726
	Examiner Name	Ryan Smith Cannon
	Attorney Docket Number	S4079.10001US03

EXAMINER SIGNATURE			
Examiner Signature	/RYAN S CANNON/	Date Considered	02/24/2023

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	17301609
Filing Date	2021-04-08
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Examiner Name	Ryan Smith Cannon
Attorney Docket Number	S4079.10001US03

CERTIFICATION STATEMENT

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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.

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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	/ERIC L. MASCHOFF/	Date (YYYY-MM-DD)	2022-12-22
Name/Print	Eric Maschoff	Registration Number	36596

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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 inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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Attorney Docket Number	S4079.10001US03

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	8604342		2013-12-10	Solon	
	2	8911264		2014-12-16	Goyal et al.	
	3	1831002		1931-11-10	Hickey	
	4	8937249		2015-01-20	Solon	

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	Application Number	17301609
	Filing Date	2021-04-08
	First Named Inventor	Dean Solon
	Art Unit	1726
	Examiner Name	Ryan Smith Cannon
	Attorney Docket Number	S4079.10001US03

	1	2012/083785	WO		2012-06-28	DONGGUAN ANWELL DIGITAL MACHINERY CO., LTD.	English Abstract	
	2	2983361	FR		2013-05-31	MICHEL et al.	English Abstract	
	3	202006007613	DE		2006-08-17	BECK MANFRED	English Abstract	
	4	202797033	CN		2013-03-13	JIANGSU JIUDING SOLAR ENERGY SYSTEM CO LTD	English Abstract	
	5	1990/011608	WO		1990-10-04	SKYLINE HOLDING AG	English Abstract	
	6	2012/023748	WO		2012-02-23	MS TECHVISION CO., LTD.	English Abstract	
	7	102008027189	DE		2009-01-15	PFEFFER ROLAND	English Abstract	

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	PRNewswire, Molded In-line Fuse From Amphenol Protects Against Ground Fault Damage, published May 4, 2012, retrieved December 22, 2022 from: https://www.prnewswire.com/news-releases/molded-in-line-fuse-from-amphenol-protects-against-ground-fault-damage-150186315.html	

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See attached certification statement.

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A certification statement is not submitted herewith.

SIGNATURE

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Signature	/ERIC L. MASCHOFF/	Date (YYYY-MM-DD)	2022-12-22
Name/Print	Eric Maschoff	Registration Number	36596

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of :	Dean Solon	
Application No.:	17/301,609	Art Unit 1726
Filed:	April 8, 2021	
Conf. No.:	3509	
For:	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER	
Examiner:	Ryan Smith Cannon	
Customer No.:	97149	
Attorney Docket No.:	S4079.10001US03	

RESPONSE TO OFFICE ACTION DATED JUNE 22, 2022

In response to the Office Action dated June 22, 2022, please consider:

AMENDMENTS TO THE CLAIMS 2
REMARKS 6

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EX1021-106

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions and listings of claims in the application:

1. **(Currently Amended)** A lead assembly for use in a solar energy installation including:

a drop line terminating at a drop line connector, the drop line connector configured to connect with a central trunk of a wire harness, the central trunk of the wire harness having a plurality of branches that each electrically connect to a separate solar panel contained in an array of a plurality solar panels;

a feeder cable electrically coupled to the drop line at a nexus;

an undermold that fully encases the nexus, the undermold further comprising:

a first aperture extending completely through the undermold and having a first diameter, wherein the feeder cable extends through the first aperture along a first longitudinal axis; and

a second aperture extending partially through the undermold and having a second diameter different than the first diameter, wherein the drop line extends from the second aperture along a second longitudinal axis; and

an overmold surrounding the undermold and forming an undermold-overmold interface at an outer surface of the undermold.

2. **(Original)** The lead assembly of claim 1 wherein the drop line includes a section of exposed wire at the nexus.

3. **(Original)** The lead assembly of claim 2 wherein the feeder cable includes a section of exposed wire at the nexus.

4. **(Original)** The lead assembly of claim 1 wherein the overmold defines at least one attachment aperture.

5. **(Original)** The lead assembly of claim 1, wherein the feeder cable terminates at a feeder cable connector.

6. **(Original)** The lead assembly of claim 5, wherein the feeder cable connector is configured to attach directly to an inverter.

7. **(Original)** The lead assembly of claim 5, wherein the feeder cable connector is configured to attach directly to a jumper cable, which in turn connects directly to an inverter.

8. **(Original)** The lead assembly of claim 1, wherein the first longitudinal axis and the second longitudinal axis are substantially parallel.

9. **(Original)** The lead assembly of claim 1, wherein the second diameter is smaller than the first diameter.

10. **(Original)** The lead assembly of claim 1, further comprising a third aperture extending partially through the undermold and having a third diameter different than the first diameter, wherein a second drop line extends from the third aperture along a third longitudinal axis.

11. **(Original)** The lead assembly of claim 10, wherein the third longitudinal axis is substantially concentric with the second longitudinal axis, and substantially parallel with the first longitudinal axis.

12. **(Original)** The lead assembly of claim 1, wherein the drop line includes a fuse.

13. **(Cancelled).**

14. **(Cancelled).**

15. **(Currently Amended)** The lead assembly of claim [[14]]1, wherein said lead assembly combines power received from the plurality of solar panels and conducts that power directly to an inverter electrically connected to the feeder cable.

16. **(Currently amended)** A solar power system comprising:

a plurality of solar panels each electrically coupled ~~by~~ to one of a plurality of branches of a wire harness to form a first solar array;

a lead assembly comprising:

a drop line electrically connected to a central trunk of the wire harness and configured to receive power from the plurality of solar panels;

a feeder cable, the feeder cable electrically connected to the drop line at a nexus; and

a primary mold that fully encases the nexus so as to substantially seal the nexus from external environmental conditions, the primary mold further comprising:

a first aperture extending completely through the primary mold and having a first diameter, wherein the feeder cable extends through the first aperture ~~along a first longitudinal axis~~; and

a second aperture extending partially through the primary mold and having a second diameter smaller than the first diameter, wherein the drop line extends into the second aperture ~~along a second longitudinal axis~~.

17. **(Original)** The solar power system of claim 16, further comprising a second drop line electrically connected to a second wire harness that connects to a plurality of solar panels, the second drop line electrically connected to the feeder cable at a second nexus fully encased by the primary mold, wherein the second drop line extends into a third aperture defined by the primary mold along a third longitudinal axis.

18. **(Original)** The solar power system of claim 16, wherein the feeder cable is directly electrically connected to a component selected from the group consisting of a trunk buss jumper, an inverter, a connection unit, a recombiner, and a disconnect unit.

19. **(Original)** The solar power system of claim 16, further comprising a secondary mold surrounding the primary mold and forming an undermold-overmold interface at an outer surface of the primary mold.

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20. (**New**) A solar power system comprising:

a plurality of solar panels electrically coupled by a wire harness to form a first solar array;

a lead assembly comprising:

a first drop line electrically connected to the wire harness and configured to receive power from the plurality of solar panels;

a feeder cable, the feeder cable electrically connected to the drop line at a nexus;

a primary mold that fully encases the nexus so as to substantially seal the nexus from external environmental conditions, the primary mold further comprising:

a first aperture extending completely through the primary mold and having a first diameter, wherein the feeder cable extends through the first aperture along a first longitudinal axis;

a second aperture extending partially through the primary mold and having a second diameter smaller than the first diameter, wherein the drop line extends into the second aperture along a second longitudinal axis; and

a second drop line electrically connected to a second wire harness that connects to a plurality of solar panels, the second drop line electrically connected to the feeder cable at a second nexus fully encased by the primary mold, wherein the second drop line extends into a third aperture defined by the primary mold along a third axis.

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REMARKS

The foregoing amendment amends claims 1, 15 and 16 and adds new claim 20. Claims 13-14 are cancelled without prejudice. Claims 1-12 and 15-20 are pending.

Applicant respectfully requests reconsideration of the application in view of the above amendments to the claims and the following remarks. Unless otherwise stated herein, amendments to the claims have been made at the discretion of the Applicant and not necessarily for reasons related to patentability.

Applicant reserves the right to pursue any previously pending claims or other claims that capture any subject matter supported by the present disclosure. Additionally, Applicant reserves the right, both during and after prosecution of this case, to modify or revoke the views expressed with regard to any cited reference.

Applicant includes dates in any Information Disclosure Statement (IDS) filed during the prosecution of this application solely to comply with the duty of disclosure required by the USPTO. Applicant expressly denies that any date listed in any IDS is an admission that a corresponding reference was published, accessible, disseminated, or otherwise qualified as prior art as of the listed date.

The following remarks are not intended to exhaustively identify all distinctions between any cited reference and the claims. The term "Applicant" is used generically herein to refer to any entity with authority to prosecute this application.

Prior Art Rejections

The Office Action rejects claims 1-3, 8, and 9 under 35 U.S.C. § 102 over *Vander Ploog* (U.S. Patent No. 3,852,516) and also rejects claims 1, 4, 8, and 9 under 35 U.S.C. § 102 over *Zahnen* (U.S. Patent No. 6,265,665).

The Office Action also rejects claims 1-3, 5-9, 13-16, 18 and 19 under 35 U.S.C. § 103 over *Yamawaki* (U.S. Patent No. 6,268,559) in view of *Vander Ploog* (U.S. Patent No. 3,852,516) and rejects claim 4 under 35 U.S.C. § 103 over *Yamawaki* in view of *Vander Ploog* and in further view of *Solon* (U.S. Publication No. 2011/0011642). The Office Action also rejects claim 12 under 35 U.S.C. § 103 over *Yamawaki* and *Vander Ploog* in further view of *Jonczyk* (U.S. Publication No. 2010/0139733) and rejects claim 10 under 35 U.S.C. § 103 over *Zahnen* in further view of

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Keeven (U.S. Publication No. 2009/0088032). The Office Action also rejects claims 1-3, 5-8, 10, and 11 under 35 U.S.C. § 103 over *Umeoka* (JP2003-293536A) in view of *Bellacicco* (U.S. Publication No. 2012/0125395).

Applicant respectfully traverses these rejections in view of the amendments made herein for at least the reason that the Office Action fails to present a *prima facie* case that independent claims 1 and 16 are anticipated, or rendered obvious, because none of the prior art – either individually or in combination – teach of suggest all of the elements recited in those claims. For example, independent claim 1 now requires that a lead assembly include "a drop line terminating at a drop line connector, the drop line connector configured to connect with a central trunk of a wire harness, the central trunk of the wire harness having a plurality of branches that each electrically connect to a separate solar panel contained in an array of a plurality solar panels." None of the references disclose such an arrangement. In particular, *Yamawaki* fails to disclose such an arrangement, as is clearly seen in Figure 3 of that reference (reproduced below for convenience):

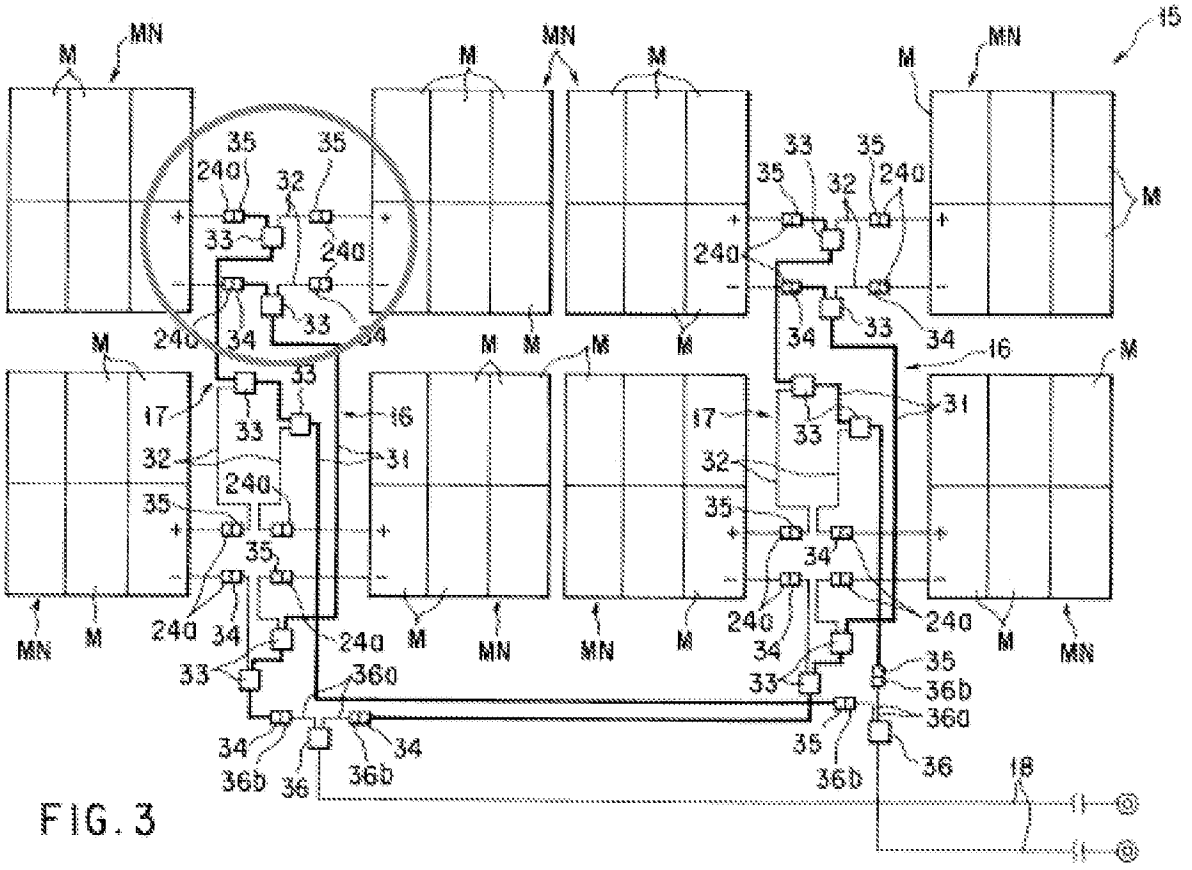


FIG. 3

As shown, at best, *Yamawaki* suggests that a branch junction 33 provide a direct connection to a module unit MN. In particular, nowhere does the reference suggest that the branch junction 33 provide a means for connecting to a wire harness, which in turn includes a plurality of branches that each connect to a separate solar panel, as is now claimed.

Independent claim 16 has been amended to require a similar limitation.

Because the Office Action fails to present a *prima facie* case that claims 1 or 16 are anticipated (or rendered obvious), the rejections are improper. Applicant therefore respectfully requests that the rejections of claims 1 and 16 under 35 U.S.C. § 102 and § 103 be withdrawn.

Claims 2-12, 15 and 17-19 variously depend on claims discussed above. Thus, in light of the remarks presented above, the Office Action does not present a *prima facie* case that these claims are not patentable. Applicant therefore respectfully requests that the rejections of each of those claims be withdrawn.

Allowable Subject Matter

The Office Action objects to claim 17 as being dependent on a rejected base claim, but indicates that dependent claim 17 would be allowable if rewritten in independent form to include all of the elements of the base claim and any intervening claims. Applicant has presented new claim 20 in independent form to incorporate each of the elements of the base claim. Applicant therefore respectfully requests that claim 20 be allowed as indicated in the office action.

Charge Authorization

The Commissioner is hereby authorized to charge payment of any of the following fees that may be applicable to this communication, or credit any overpayment, to Deposit Account No. 50-5394: (1) any filing fees required under 37 C.F.R. § 1.16; (2) any patent application and reexamination processing fees under 37 C.F.R. § 1.17; and/or (3) any post issuance fees under 37 C.F.R. § 1.20. In addition, if any additional extension of time is required, which has not otherwise been requested, please consider this a petition therefor and charge any additional fees that may be required to Deposit Account No. 50-5394.

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CONCLUSION

In view of the foregoing, Applicant submits that the pending claims are allowable. In the event that Examiner finds remaining impediment to a prompt allowance of this application that may be clarified through a telephone interview or overcome by an Examiner's Amendment, Examiner is invited to contact the undersigned attorney.

Dated this 22 day of December, 2022.

Respectfully submitted,

/Eric L. Maschoff/

Eric L. Maschoff
Registration No. 36596
Attorney for Applicant
Telephone No. (435) 252-1360

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EX1021-114

Espacenet

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Removable disposable protective electrical device for photovoltaic solar electric energy production installation, has casing for insulating circuit breaker fuse and electrical connections from external atmosphere

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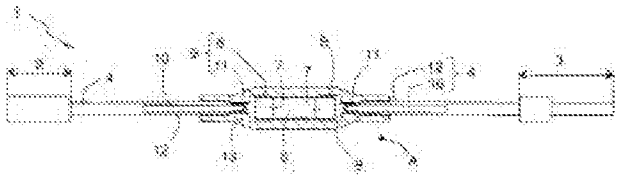
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Abstract of FR2983361 (A1)



The device (1) has two connectors (2, 3) electrically insulated from an external atmosphere (A) in an electrical circuit. Two electrical connections (9, 10) connect the connectors to two terminals (7) of a circuit breaker fuse (6), respectively. A casing (12) electrically insulates the circuit breaker fuse and the electrical connections from the external atmosphere. The casing separates the circuit breaker fuse and the electric connections from the external atmosphere in a water-tight manner. The circuit breaker fuse is fixed in the casing.

Voltage, LLC
EX1021-115

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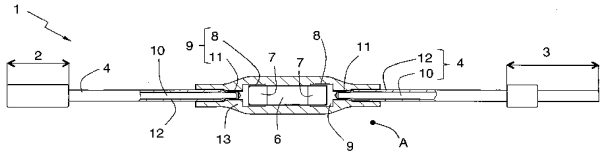
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(54) DISPOSITIF ELECTRIQUE AMOVIBLE DE PROTECTION A USAGE UNIQUE ET SON UTILISATION DANS UNE INSTALLATION DE PRODUCTION PHOTOVOLTAIQUE D'ENERGIE ELECTRIQUE D'ORIGINE SOLAIRE.

(57) Un dispositif électrique amovible de protection à usage unique (1) comprend un fusible de coupe-circuit (6), ainsi que des premier et deuxième connecteurs (2, 3) de connexion isolée électriquement de l'atmosphère extérieure (A), dans un circuit électrique. Un premier raccordement électrique (9, 10) raccorde le premier connecteur (2) à la première borne (7) du fusible (6). Un deuxième raccordement électrique (9, 10) raccorde le deuxième connecteur (3) à la deuxième borne (7) du fusible (6). Une enveloppe (12, 13) isole électriquement le fusible (6) et les premier et deuxième raccordements électrique (9, 10) de l'atmosphère extérieure (A).



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Voltage, LLC
EX1021-116

Dispositif électrique amovible de protection à usage unique et son utilisation dans une installation de production photovoltaïque d'énergie électrique d'origine solaire

Domaine technique de l'invention

L'invention se rapporte au domaine de la protection électrique de matériels, notamment contre les risques de détérioration accompagnant les surintensités accidentelles. Plus précisément, l'invention concerne un dispositif électrique amovible de protection à usage unique, du type comprenant un fusible de coupe-circuit possédant des première et deuxième bornes.

L'invention concerne également une utilisation d'un dispositif électrique à usage unique dans une installation de production photovoltaïque d'énergie électrique d'origine solaire.

État de la technique

Les coupe-circuits sont des dispositifs classiques de protection contre les effets destructeurs d'une surintensité, qu'une telle surintensité résulte d'un court-circuit ou bien d'une autre cause. Parmi ces coupe-circuits figurent les fusibles, qui sont des dispositifs à usage unique se détruisant dès leur premier fonctionnement et qui sont destinés à être remplacés après ce premier fonctionnement.

Le raccordement électrique d'un fusible dans un circuit se fait généralement au moyen d'un porte-fusible tel, qu'il est aisé d'y monter le fusible de manière amovible puis d'en retirer ce fusible lors du remplacement de celui-ci. Les porte-fusibles d'une même installation électrique sont généralement

regroupés. Ils le sont en particulier quand les fusibles protégeant l'installation doivent être enfermés à l'intérieur d'une ou plusieurs armoires électriques.

Or, de telles armoires électriques sont employées dans de nombreuses situations, en particulier lorsque l'installation électrique se trouve en tout ou partie à l'extérieur et que les fusibles la protégeant doivent être placés à l'abri de l'humidité et des intempéries, ce qui est le cas dans les centrales photovoltaïques de production d'électricité.

Dans bien des situations, le regroupement des porte-fusibles dans une armoire implique de tirer des lignes électriques de raccordement jusqu'à cette armoire. Ces lignes et leur installation ont un coût. Les raccordements à une armoire se traduisent en outre par un allongement des chemins parcourus par les courants et donc par de plus grandes pertes électriques lors du fonctionnement.

Par ailleurs, seul un personnel agréé peut, bien souvent, ouvrir les armoires électriques renfermant les fusibles en fonction. Un fusible à remplacer n'est alors accessible qu'à ce personnel agréé qu'il est plus difficile et plus coûteux de faire intervenir qu'un personnel moins qualifié, alors que le changement en tant que tel d'un fusible est une opération de technicité modeste.

Objet de l'invention

L'invention a au moins pour but de permettre une mise en œuvre plus simple et/ou moins coûteuse de la protection contre les surintensités, dans certaines installations électriques au moins.

Selon l'invention, ce but est atteint grâce à un dispositif électrique amovible de protection à usage unique du type précité qui comporte :

- des premier et deuxième connecteurs de connexion isolée électriquement de l'atmosphère extérieure, dans un circuit électrique,
- un premier raccordement électrique raccordant le premier connecteur à la première borne du fusible,
- un deuxième raccordement électrique raccordant le deuxième connecteur à la deuxième borne du fusible,
- ainsi qu'une enveloppe isolant électriquement le fusible et les premier et deuxième raccordements électriques de l'atmosphère extérieure.

Le dispositif électrique de protection à usage unique défini ci-dessus est prévu pour assurer une protection contre les effets d'une surintensité dans une branche, en étant connecté en série dans cette branche. Son emploi permet la mise en place d'une protection contre les effets d'une surintensité dans une branche même si cette branche est dépourvue de porte-fusible. S'affranchir de la nécessité d'un porte-fusible peut permettre des économies telles que des économies en matériels et des économies d'installation.

En outre, le dispositif électrique de protection à usage unique selon l'invention peut aisément être installé sans être regroupé avec d'autres coupe-circuits de protection contre les surintensités, notamment au sein d'une armoire électrique, ce qui peut également conduire à des économies telles que des économies en matériels, des économies d'installation, des économies consécutives à de moindres pertes électriques et/ou des économies de maintenance. Lorsqu'il est connecté à l'extérieur d'une armoire électrique, un dispositif électrique de protection à usage unique selon l'invention peut être plus facilement remplacé et il peut l'être par un personnel qui ne possède pas l'agrément autorisant l'accès au contenu des armoires électriques ou, à tout le moins, de certaines d'entre elles.

Par ailleurs, l'emploi d'un dispositif électrique de protection à usage unique selon l'invention peut procurer une liberté quant au choix de l'endroit où installer ce dispositif. Cela se traduit par une plus grande facilité d'emploi.

Le dispositif électrique de protection à usage unique défini précédemment peut incorporer une ou plusieurs autres caractéristiques avantageuses, isolément ou en combinaison, en particulier parmi celles définies ci-après.

Avantageusement, l'enveloppe sépare de manière étanche à l'eau le fusible et les premier et deuxième raccordements électriques de l'atmosphère extérieure. De préférence, les premier et deuxième connecteurs sont des connecteurs de connexion étanche à l'eau dans un circuit électrique. Lorsque tel est le cas, le dispositif électrique de protection à usage unique peut être installé hors d'une armoire électrique, même s'il est alors exposé à la pluie.

Avantageusement, le fusible est indémontable hors de l'enveloppe sans détérioration.

Avantageusement, le dispositif électrique de protection à usage unique comporte une gangue qui renferme un contenu comportant le fusible et une partie au moins des premier et deuxième raccordements électriques. De préférence, la gangue est surmoulée sur ce contenu.

Avantageusement, la gangue est surmoulée directement au moins sur une partie du fusible.

Avantageusement, la gangue est isolante électriquement et fait partie de ladite enveloppe.

Avantageusement, le premier raccordement électrique au moins comporte l'âme conductrice d'un câble de raccordement électrique au premier

connecteur. De préférence, ce câble comprend une gaine étanche à l'eau dans laquelle passe l'âme conductrice. De préférence, ladite gangue est étanche à l'eau. De préférence, elle est surmoulée sur un tronçon de la gaine, de manière étanche à l'eau.

Avantageusement, chacun des premier et deuxième connecteurs est formé par un embout choisi parmi les parties femelle et mâle complémentaires d'un raccord électrique de branchement rapide par engagement de ses parties femelle et mâle l'une dans l'autre.

Avantageusement, l'un des premier et deuxième connecteurs est un embout femelle du raccord électrique, tandis que l'autre connecteur parmi ces premier et deuxième connecteurs est un embout mâle complémentaire de l'embout femelle.

L'invention a également pour objet l'utilisation d'un dispositif de protection à usage unique tel que défini précédemment, dans une installation de production photovoltaïque d'énergie électrique d'origine solaire. Selon cette utilisation, le dispositif électrique à usage unique est connecté de manière amovible, en série dans une branche comportant au moins un module photovoltaïque de production d'électricité à partir d'un rayonnement solaire reçu.

Description sommaire des dessins

D'autres avantages et caractéristiques ressortiront plus clairement de la description qui va suivre d'un mode particulier de réalisation de l'invention donné à titre d'exemple non limitatif et représenté aux dessins annexés, parmi lesquels :

- la figure 1 est une vue en perspective d'un dispositif électrique de protection à usage unique conforme à l'invention ;

- la figure 2 est une vue latérale, avec arrachement, du dispositif électrique de protection à usage unique représenté à la figure 1 ; et
- la figure 3 est un schéma électrique d'une portion d'une installation de production photovoltaïque d'énergie électrique d'origine solaire, dans laquelle plusieurs exemplaires du dispositif électrique de protection à usage unique des figures 1 et 2 sont utilisés pour assurer des protections contre des surintensités, conformément à l'invention.

Description d'un mode préférentiel de l'invention

Sur la figure 1 est représenté un dispositif électrique amovible de protection à usage unique 1, dont la fonction est celle d'un coupe-circuit, c'est-à-dire d'interrompre la continuité électrique d'une branche en cas de surintensité dans cette branche.

Avant de pouvoir remplir sa fonction, le dispositif de protection 1 doit être raccordé en série dans une branche électrique, ce pour quoi il comporte deux connecteurs 2 et 3 de connexion étanche et isolée électriquement dans une telle branche. Le connecteur 2 est formé par un embout femelle de branchement rapide connu en soi, qui est destiné à recevoir une partie mâle complémentaire et à former avec celle-ci un raccord électrique étanche à l'eau, avec isolation électrique par rapport à l'extérieur. Le connecteur 3 est formé par un embout mâle de branchement rapide connu en soi, qui destiné à être engagé dans une partie femelle complémentaire pour former avec celle-ci un raccord électrique étanche à l'eau. Les connecteurs 2 et 3 sont avantageusement complémentaires, ce qui est le cas dans l'exemple représenté. De préférence, ils satisfont à la norme française NF EN 50521. Par exemple, les connecteurs 2 et 3 peuvent être choisis parmi ceux commercialisés dans la gamme MC3 et dans la gamme MC4 de la société Multi-Contact AG (Stockbrunnenrain 8, CH-4123 Allschwil ; internet : www.multi-contact.com). Il peut également s'agir des connecteurs mis sur le

marché sous la marque SOLARLOK, par la société Tyco Electronics Corporation.

Un premier câble électrique flexible 4 raccorde le connecteur 2 à une première extrémité d'un sous-ensemble intermédiaire 5 constitutif du dispositif de protection 1. Un deuxième câble électrique flexible 4, de même structure que le premier, raccorde le connecteur 3 à une deuxième extrémité de ce sous-ensemble intermédiaire 5, à l'opposé de la première extrémité de ce dernier.

Ainsi qu'on peut le voir à la figure 2, le sous-ensemble intermédiaire 5 comprend un unique fusible 6 connu en soi, sur chaque borne 7 duquel est sertie une douille 8 constitutive de l'un de deux éléments conducteurs 9 identiques en métal, par exemple en laiton. Chaque élément conducteur 9 comporte une cosse 11 sertie sur l'âme conductrice 10 de l'un des câbles 4, et raccorde électriquement l'une des bornes 7 du fusible 6 à cette âme conductrice 10.

De chaque borne 7 du fusible 6 à l'un des connecteurs 2 et 3, il existe donc un raccordement électrique qui comprend successivement un élément conducteur 9 et l'âme 10 d'un câble 4.

Chaque câble 4 possède une gaine isolante 12 dans laquelle son âme 10 passe de manière à être isolée latérallement de l'atmosphère extérieure A et qui est étanche à l'eau. Les gaines isolantes 12 des câbles 4 font partie d'une enveloppe isolante et étanche à l'eau, qui compte également une gangue isolante 13. Cette dernière est moulée d'un seul tenant autour du fusible 6, des éléments conducteurs 9 et d'un tronçon d'extrémité de chaque câble 4, de manière à les renfermer et les séparer de l'atmosphère extérieure A. Plus précisément, la gangue isolante 13 est surmoulée sur son contenu

formant un noyau central. Notamment, elle est surmoulée en partie sur le fusible 6.

La gangue 13 est étanche à l'eau en même temps qu'elle réalise une isolation électrique entre son contenu et l'atmosphère extérieure A. Cette gangue 13 est surmoulée sur un tronçon d'extrémité de chaque gaine 12, de manière étanche à l'eau, en sorte qu'il y a un recouvrement étanche de chaque gaine 12 sur une partie de sa longueur, par la gangue 13. Dans la zone de jonction entre une gaine 12 et la gangue 13, l'étanchéité à l'eau peut résulter d'un mariage chimique entre le matériau de l'une et celui de l'autre, ces matériaux étant choisis pour leur affinité chimique, c'est-à-dire pour leur capacité à se lier chimiquement entre eux. De manière complémentaire ou alternative, l'étanchéité à la jonction de la gangue 13 et d'une gaine 12 peut également résulter d'un serrage de la première sur la seconde dans la zone de recouvrement, consécutivement au phénomène de retrait dans la gangue 13 dans la phase de solidification et de refroidissement suivant son moulage.

La gangue 13 peut être réalisée en tout matériau étanche approprié, notamment en un polymère et, par exemple, en Poly(oxyde de phénylène) encore appelé Polyoxyphénylène (PPO), qui possède des propriétés diélectriques élevées aussi bien que des qualités de résistance aux chocs thermiques et aux intempéries.

Sur la figure 3 est partiellement représentée une installation de production d'énergie électrique qui utilise le rayonnement solaire comme source primaire d'énergie et qui comprend plusieurs ensembles de panneaux ou modules photovoltaïques individuels 20 de production d'électricité à partir d'un rayonnement solaire reçu. Les modules photovoltaïques 20 d'un même ensemble sont raccordés en série de manière à se succéder au sein d'une chaîne 21. A cette fin, chaque module photovoltaïque 20 est équipé d'une

paire de connecteurs complémentaires, qui sont un connecteur femelle 2 et un connecteur mâle 3.

Chaque chaîne 21 de modules photovoltaïques 20 constitue une partie de la longueur de l'une de plusieurs branches en parallèle, dans chacune desquelles un dispositif de protection à usage unique 1 est connecté en série. Une extrémité de chaque chaîne 21 est raccordée à la terre. L'autre extrémité de chaque chaîne 21 est raccordée à une ligne de collecte 22, par l'intermédiaire de l'un des dispositifs de protection à usage unique 1 qui sont dispersés en extérieur.

La ligne de collecte 22 est équipée d'une succession de connecteurs distants entre eux, qui sont tous des connecteurs femelle 2 dans l'exemple représenté, mais qui peuvent être choisis autrement parmi des connecteurs complémentaires des connecteurs 2 et 3.

Dans l'installation de production d'énergie électrique de la figure 3, chaque dispositif de protection à usage unique 1 est connecté au moyen de ses deux connecteurs 2 et 3, dont un est associé à un connecteur complémentaire 2 ou 3 du dernier module photovoltaïque 20 d'une chaîne 21 et dont l'autre est associé à un connecteur complémentaire 2 équipant la ligne de collecte 22. L'association de deux connecteurs complémentaires 2 et 3 par engagement de l'un dans l'autre forme un raccord électrique qui est référencé 23 à la figure 3.

Toujours à la figure 3, la référence 24 désigne une ligne d'un réseau public de distribution d'énergie électrique en courant alternatif, à laquelle des montages d'adaptation électrique 25 et 26 raccordent la ligne de collecte 22. Divers appareillages électrique sont connectés dans les montages 25 et 26, dont un trouvera un exemple dans le guide UTE C 15-712-1 « Installations photovoltaïques raccordées au réseau public de distribution », paru le 1er

juillet 2010 (édité et diffusé par l'Union Technique de l'Electricité – Tour Chantecoq – 5, rue Chantecoq – 92808 Puteaux Cedex – France ; Internet : http://www.ute-fr.com/).

On a constaté que les fusibles 7 des dispositifs de protection 1 s'échauffent moins du fait des courants les traversant que les mêmes fusibles montés dans des porte-fusibles classiques. On pense que cela résulte d'un meilleur refroidissement tenant à ce que la gangue 13 facilite la dissipation de chaleur. On pense également que le surmoulage de cette gangue 13 sur le fusible intervient dans ce meilleur refroidissement, qui est avantageux en ce qu'un moindre échauffement des fusibles se traduit par un accroissement de leur durée de vie.

Si une surintensité se produit dans une chaîne 21 de modules photovoltaïques 20, le fusible 6 du dispositif de protection à usage unique 1 raccordant cette chaîne 21 fond et il s'y produit une rupture de la continuité électrique, ce qui coupe la surintensité. Chaque dispositif électrique de protection 1 est à usage unique, c'est-à-dire jetable ou non réutilisable, ce qui signifie qu'il est détérioré et doit être remplacé et jeté dès son premier fonctionnement comme coupe-circuit. En effet, le fonctionnement d'un dispositif de protection 1 conduit à sa destruction.

Le démontage d'un dispositif de protection 1 usagé consiste à débrancher ses deux connecteurs 2 et 3, le cas échéant en suivant des préconisations du fabricant de ces connecteurs, ce qui est très aisé à réaliser. On procède de la manière inverse pour installer un dispositif de protection 1 opérationnel à la place d'un dispositif 1 usagé, une fois ce dernier retiré.

L'invention ne se limite pas au mode de réalisation décrit précédemment. En particulier, la gangue 13 peut ne pas être surmoulée, même s'il est avantageux qu'elle le soit. Par exemple, la gangue 13 peut résulter de

l'assemblage des différentes parties d'un boîtier ou d'une coque, au lieu d'être surmoulée.

Par ailleurs, un ou chaque élément 9 peut être supprimé et, par exemple, remplacé par une soudure de l'âme 10 du câble 4 correspondant directement sur une borne 7. Lorsque tel est le cas, on peut avantageusement choisir un fusible 6 dont chaque borne est équipée d'une patte prévue pour être soudée à un conducteur.

En outre, l'invention n'est pas limitée à une application dans le domaine de la production photovoltaïque d'énergie électrique, même si elle trouve avantageusement application dans ce domaine.

Revendications

1. Dispositif électrique amovible de protection à usage unique, comprenant un fusible de coupe-circuit (6) possédant des première et deuxième bornes (7), caractérisé en ce qu'il comporte :

- des premier et deuxième connecteurs (2, 3) de connexion isolée électriquement de l'atmosphère extérieure (A), dans un circuit électrique,
- un premier raccordement électrique (9, 10) raccordant le premier connecteur (2) à la première borne (7) du fusible (6),
- un deuxième raccordement électrique (9, 10) raccordant le deuxième connecteur (3) à la deuxième borne (7) du fusible (6),
- ainsi qu'une enveloppe (12, 13) isolant électriquement le fusible (6) et les premier et deuxième raccordements électriques (9, 10) de l'atmosphère extérieure (A).

2. Dispositif de protection à usage unique selon la revendication 1, caractérisé en ce que l'enveloppe (12, 13) sépare de manière étanche à l'eau le fusible (6) et les premier et deuxième raccordements électriques (9, 10) de l'atmosphère extérieure (A), les premier et deuxième connecteurs (2, 3) étant des connecteurs de connexion étanche à l'eau dans un circuit électrique.

3. Dispositif de protection à usage unique selon l'une quelconque des revendications précédentes, caractérisé en ce que le fusible (6) est indémontable hors de l'enveloppe (12, 13) sans détérioration.

4. Dispositif de protection à usage unique selon l'une quelconque des revendications précédentes, caractérisé en ce qu'il comporte une gangue (13) qui renferme un contenu (6, 9) et qui est surmoulée sur ce contenu

comportant le fusible (6) et une partie au moins des premier et deuxième raccordements électriques (9, 10).

5. Dispositif de protection à usage unique selon la revendication 4, caractérisé en ce que la gangue (13) est surmoulée directement au moins sur une partie du fusible (6, 9).

6. Dispositif de protection à usage unique selon l'une quelconque des revendications 4 et 5, caractérisé en ce que la gangue (13) est isolante électriquement et fait partie de ladite enveloppe.

7. Dispositif de protection à usage unique selon l'une quelconque des revendications 4 à 6, caractérisé en ce que le premier raccordement électrique au moins (9, 10) comporte l'âme conductrice (10) d'un câble (4) de raccordement électrique au premier connecteur, ce câble (4) comprenant une gaine étanche à l'eau (12) dans laquelle passe l'âme conductrice (10), ladite gangue (13) étant étanche à l'eau et étant surmoulée sur un tronçon de la gaine (12), de manière étanche à l'eau.

8. Dispositif de protection à usage unique selon l'une quelconque des revendications précédentes, caractérisé en ce que chacun des premier et deuxième connecteurs est formé par un embout choisi parmi les parties femelle et mâle complémentaires (2, 3) d'un raccord électrique (23) de branchement rapide par engagement de ses parties femelle et mâle (2, 3) l'une dans l'autre.

9. Dispositif de protection à usage unique selon la revendication 8, caractérisé en ce que l'un des premier et deuxième connecteurs est un embout femelle (2) du raccord électrique (23), l'autre connecteur parmi ces premier et deuxième connecteurs étant un embout mâle (3) complémentaire de l'embout femelle (2).

10. Utilisation d'un dispositif de protection à usage unique (1) selon l'une quelconque des revendications précédentes, dans une installation de production photovoltaïque d'énergie électrique d'origine solaire, le dispositif électrique à usage unique (1) étant connecté de manière amovible en série dans une branche comportant au moins un module photovoltaïque (20) de production d'électricité à partir d'un rayonnement solaire reçu.

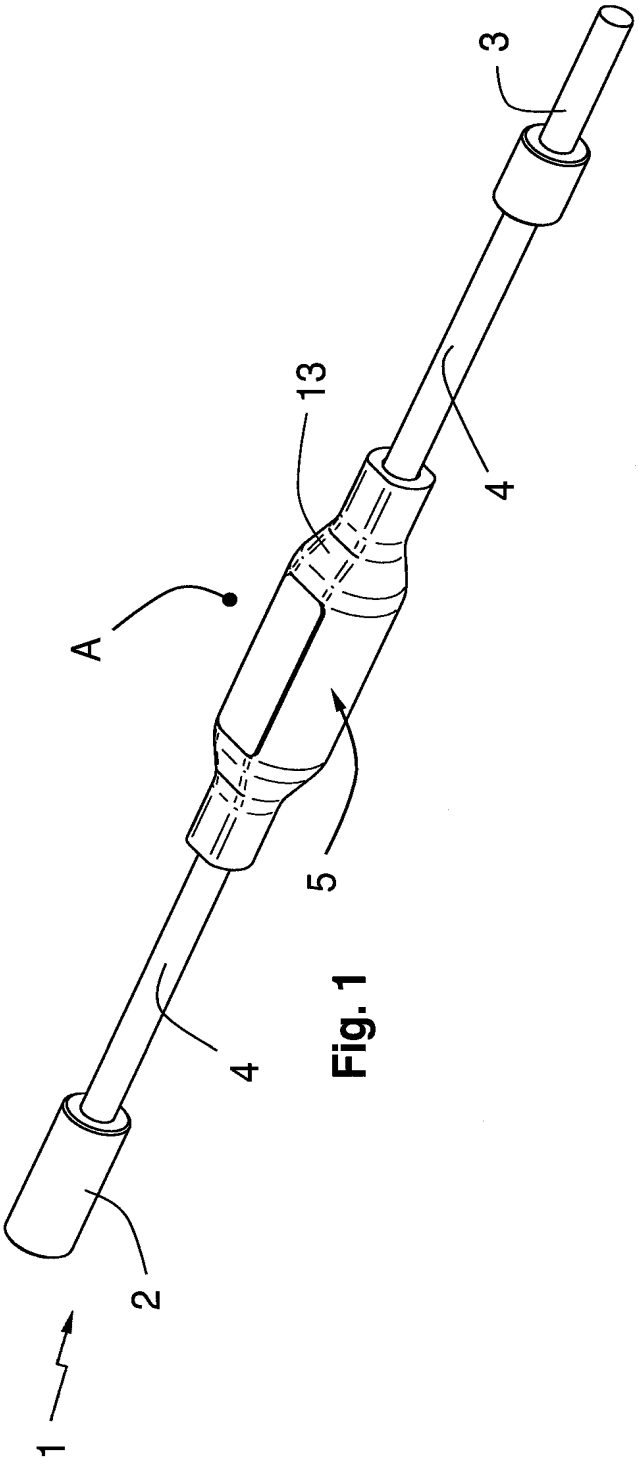


Fig. 1

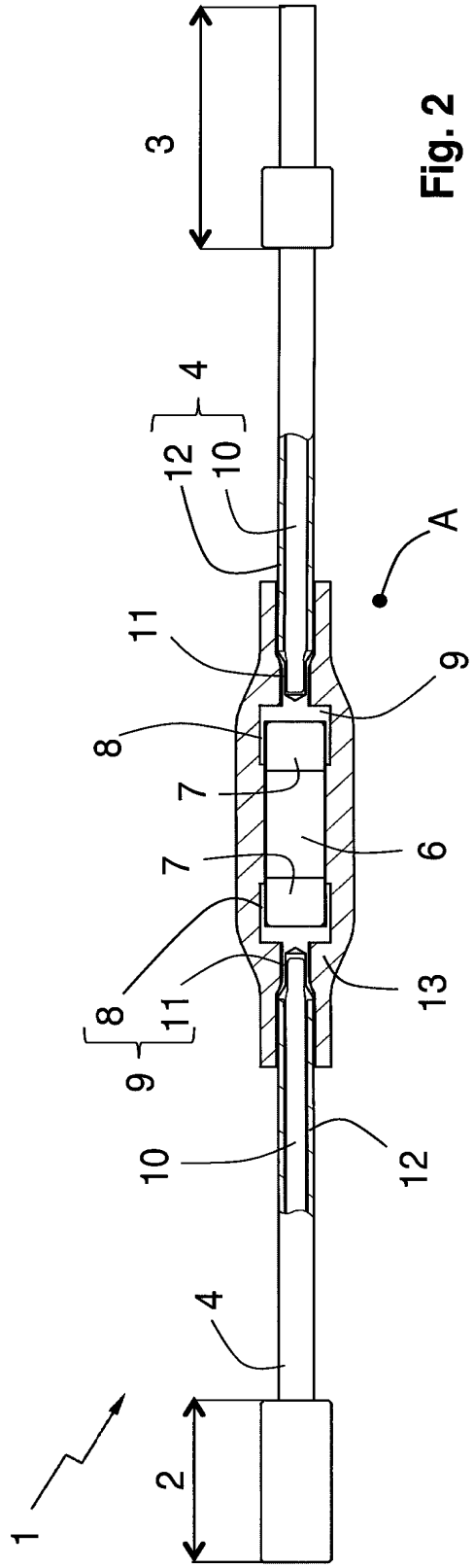


Fig. 2

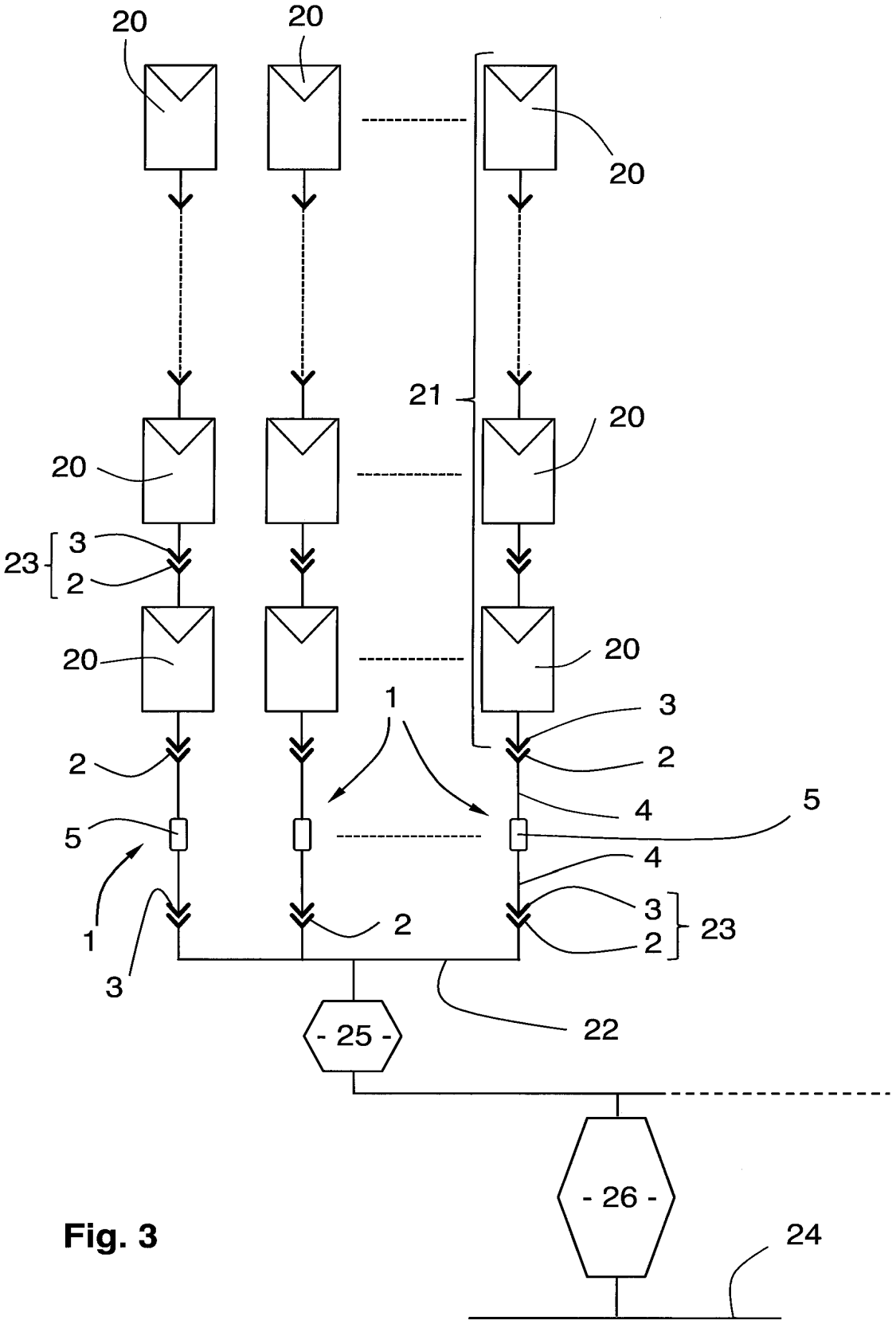


Fig. 3

RÉPUBLIQUE FRANÇAISE

INSTITUT NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE

RAPPORT DE RECHERCHE PRÉLIMINAIRE

établi sur la base des dernières revendications déposées avant le commencement de la recherche

N° d'enregistrement national

FA 759184
FR 1103619

DOCUMENTS CONSIDÉRÉS COMME PERTINENTS		Revendication(s) concernée(s)	Classement attribué à l'invention par l'INPI
Catégorie	Citation du document avec indication, en cas de besoin, des parties pertinentes		
X	GB 2 125 637 A (RAYCHEM CORP) 7 mars 1984 (1984-03-07)	1-9	H01R13/696 H01R13/518
Y	* page 4, ligne 9 - ligne 63; figures 1,2 *	10	H02B1/04

X	"FUSED MALE/FEMALE CONNECTOR ADAPTOR", RESEARCH DISCLOSURE, MASON PUBLICATIONS, HAMPSHIRE, GB, no. 298, 1 février 1989 (1989-02-01), page 93, XP000052077, ISSN: 0374-4353	1-9	
Y	* le document en entier *	10	

Y	JP 11 040838 A (SHARP KK) 12 février 1999 (1999-02-12) * alinéa [0051]; figure 12 *	10	

A	DE 44 44 151 A1 (HAGEN BATTERIE AG [DE]) 13 juin 1996 (1996-06-13) * colonne 2, ligne 38 - ligne 67; figure 2 *	1-10	
	-----		DOMAINES TECHNIQUES RECHERCHÉS (IPC)
A	DE 20 2006 007613 U1 (BECK MANFRED [DE]) 17 août 2006 (2006-08-17) * alinéa [0020] - alinéa [0023]; figures 1-3 *	1-10	H01H

Date d'achèvement de la recherche	Examinateur
27 juillet 2012	Dobbs, Harvey

CATÉGORIE DES DOCUMENTS CITÉS

X : particulièrement pertinent à lui seul
Y : particulièrement pertinent en combinaison avec un autre document de la même catégorie
A : arrière-plan technologique
O : divulgation non-écrite
P : document intercalaire

T : théorie ou principe à la base de l'invention
E : document de brevet bénéficiant d'une date antérieure à la date de dépôt et qui n'a été publié qu'à cette date de dépôt ou qu'à une date postérieure.
D : cité dans la demande
L : cité pour d'autres raisons

& : membre de la même famille, document correspondant

EPO FORM 1503 12.99 (P04C14)

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ANNEXE AU RAPPORT DE RECHERCHE PRÉLIMINAIRE RELATIF A LA DEMANDE DE BREVET FRANÇAIS NO. FR 1103619 FA 759184

La présente annexe indique les membres de la famille de brevets relatifs aux documents brevets cités dans le rapport de recherche préliminaire visé ci-dessus.
Les dits membres sont contenus au fichier informatique de l'Office européen des brevets à la date du 27-07-2012
Les renseignements fournis sont donnés à titre indicatif et n'engagent pas la responsabilité de l'Office européen des brevets, ni de l'Administration française

Document brevet cité au rapport de recherche	Date de publication	Membre(s) de la famille de brevet(s)	Date de publication
GB 2125637 A	07-03-1984	CA 1216015 A1	30-12-1986
		DE 3380000 D1	06-07-1989
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DE 4444151 A1	13-06-1996	AUCUN	
DE 202006007613 U1	17-08-2006	AUCUN	

EPO FORM P0465

Pour tout renseignement concernant cette annexe : voir Journal Officiel de l'Office européen des brevets, No.12/82

Espacenet

Bibliographic data: DE102008027189 (A1) — 2009-01-15

Safety element for photovoltaic arrangement, has two electrical contacts, which are spaced from each other by electrically isolating fuse body

Inventor(s): WILLER BERND [DE] ± (WILLER, BERND)

Applicant(s): PFEFFER ROLAND [DE]; WILLER BERND [DE] ± (PFEFFER, ROLAND, ; WILLER, BERND)

Classification: **- international:** ***H01H37/04; H01H85/044; H01R13/68***
- cooperative: H01H35/146 (EP); H01H37/76 (EP); H01R13/635 (EP); H01R13/68 (EP)

Application number: DE20081027189 20080606

Priority number(s): DE20071032473 20070710 ; DE20081009554 20080216 ; DE20081027189 20080606

Abstract of DE102008027189 (A1)

The safety element has two electrical contacts (3), which are spaced from each other by an electrically isolating fuse body. The fuse body is sensitive to heat and impact in such a manner that it is destroyed during effect of extensive mechanical forces and with extreme heat input. The contacts are connected by separable electrical fastening element. A compressive force element of prestressed pressure is clamped between the two ends of the fuse body.

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H01R 13/68 (2006.01)

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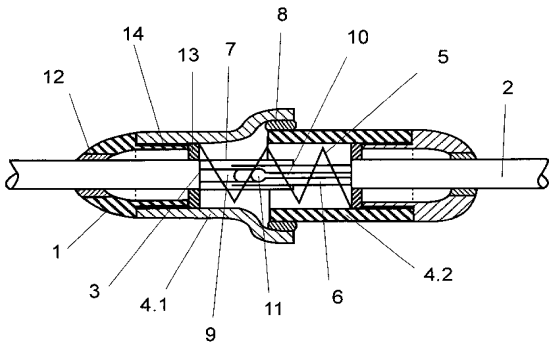
(74) Vertreter:
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Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

(54) Bezeichnung: **Sicherheitselement für Fotovoltaikanlagen**

(57) Zusammenfassung: Die Erfindung betrifft ein Sicherheitselement für Fotovoltaikanlagen, das einzelne Solar-Panels einer Fotovoltaikanlage in Gefahrfällen elektrisch voneinander trennt. Es ist sowohl für Freifeldanlagen als auch auf Dächer montierte Anlagen zum Schutz bei Bränden oder bei mechanischen Einwirkungen, die z. B. durch umfallende Bäume oder Kraftfahrzeugunfälle ausgelöst werden können, geeignet.
Das Sicherheitselement verfügt über zwei elektrische Kontakte (3), die durch einen elektrisch isolierenden Sicherungskörper (4) voneinander beabstandet sind. Dieser ist derart stoß- und wärmeempfindlich, dass er bei Einwirkung von erheblichen mechanischen Kräften und bei außergewöhnlichem Wärmeeintrag zerstört wird. Die Kontakte (3) sind mittels eines aus einem Steckerstift (10) udn einer Buchse (9) bestehenden trennbaren elektrischen Verbindungselements verbunden. Zwischen den beiden Enden des Sicherungskörpers (4) ist eine Druckfeder (5) eingespannt. Im Gefahrenfall zerbricht der Sicherungskörper (4) oder er wird getrennt. Die Feder (5) drückt die Kontakte (3) weit auseinander und der Steckerstift (10) wird aus der Buchse (9) gezogen. Die Feder (5) fällt anschließend ab. Dadurch wird der Stromkreis sicher geöffnet.



Beschreibung

[0001] Die Erfindung betrifft ein Sicherheitselement für Fotovoltaikanlagen, das einzelne Solar-Panels einer Fotovoltaikanlage in Gefahrenfällen elektrisch voneinander trennt. Das erfindungsgemäße Sicherheitselement ist gleichfalls für andere, frei verdrahtete Elektroanlagen im Innen- und Außenbereich geeignet.

[0002] In den letzten Jahren wurden fotovoltaische Solarzellen ständig weiterentwickelt; so konnte ihr Wirkungsgrad weiter erhöht und ihr Preis deutlich gesenkt werden. Da in vielen Ländern, insbesondere auch in Deutschland, sowohl die Anschaffung von Fotovoltaikanlagen als auch die Abnahme des von diesen erzeugten Stromes subventioniert wird, wird die Anschaffung von Fotovoltaikanlagen immer attraktiver. Die Folge ist, dass nicht nur die Anzahl von Fotovoltaikanlagen stetig zunimmt, sondern die Anlagen auch im Durchschnitt größer werden, d. h. es werden pro Anlage immer mehr Panels auf Dächern bzw. im Freifeld montiert.

[0003] Solar-Panels sind im Normalfall in Serie geschaltet. Demzufolge können am Ende der Kette bei starkem Sonneneinfall Spannungen von bis zu 1000 V Gleichspannung (VDC) und Ströme von 8 bis 16 A oder in Zukunft sogar höher auftreten. Aufgrund dessen besteht in Gefahrfällen, wie z. B. beim Brand eines Dachstuhls, auf dem eine Solaranlage installiert ist, oder bei der Kollision eines Kraftfahrzeugs mit einer Freifeldanlage, für die Rettungskräfte oder die in den Unfall verwickelten Personen eine akute Gefahr, mit lebensgefährlichen elektrischen Spannungen bzw. Strömen in Kontakt zu kommen.

[0004] Momentan beschränken sich die Sicherheitsvorkehrungen für Fotovoltaikanlagen im Freifeld darauf, dass diese eingezäunt werden. Bei auf Dächern installierten Fotovoltaikanlagen wurde bislang auf Sicherheitsvorkehrungen verzichtet, da diese ohnehin schwer erreichbar sind.

[0005] Aufgrund der ständigen Zunahme der Anzahl und der Größe von Fotovoltaikanlagen erhöht sich auch das Risiko, dass Personen durch von Fotovoltaikanlagen verursachte Stromschläge Schaden nehmen und schlimmstenfalls sogar getötet werden.

[0006] Demnach ist es notwendig, zusätzliche Sicherheitsvorkehrungen für den Betrieb von Fotovoltaikanlagen zu treffen.

[0007] Aus dem Stand der Technik sind deshalb Lösungsvorschläge bekannt, die das Ziel haben, die Gefahr von Stromschlägen durch Fotovoltaikanlagen zu verringern oder die zumindest zu diesem Zweck eingesetzt werden können.

[0008] So wird in JP 11040838 A vorgeschlagen, eine Temperatursicherungseinheit in die ausgehende Leitung von Solarzellenmodulen mit dem Ziel zu schalten, die während eines Brandes bzw. nach einem Brand für das Rettungs- bzw. Servicepersonal bestehende Gefahr von Stromschlägen zu verringern. Die Funktionsweise der Temperatursicherungseinheit ist jedoch nicht näher spezifiziert.

[0009] In der Schrift ist nirgendwo ausgeführt, wie die über der Reihenschaltungen der Solar-Panels auftretende Spannung von bis zu 1000 V sicher getrennt werden soll.

[0010] In DE 20 2006 007 613 U1 wird eine Fotovoltaikanlage beschrieben, bei der in der elektrischen Verbindungsleitung zwischen den Fotovoltaikelementen und der elektrischen Übergabestelle eine thermische Sicherung eingebracht ist, die im Brandfall eine elektrische Trennung bewirkt. Die thermische Sicherung besteht aus einem Schmelzdraht, der mit einer Schutzhülse umgeben und mit einer Zugfeder vorgespannt ist. Beim Überschreiten einer kritischen Temperatur erweicht der Draht und wird aufgrund der Federvorspannung auseinander gerissen.

[0011] In beiden Schriften werden ausschließlich thermische Sicherungen berücksichtigt. Ein umfassender Schutz kann aber nur durch eine sowohl mechanisch als auch thermisch auslösende Sicherung erreicht werden. Damit ist einerseits auch die elektrische Trennung bei Unfällen mit mechanischer Einwirkung sichergestellt, anderseits können im Brandfall Sicherheitselemente außerhalb des Brandherdes von Hand ausgelöst werden. Ganz entscheidend ist in diesem Zusammenhang, dass die Zuleitungskontakte auch nach einer mechanischen Einwirkung weiterhin isoliert sind, sodass die Gefahr von Stromschlägen praktisch ausgeschlossen ist.

[0012] In DE 17 55 996 A wird eine Sicherheitsvorrichtung für Fahrzeuge gezeigt, bei der mindestens ein Glas- oder Keramikröhrchen mit einem Massekörper verbunden ist, wobei jeweils im Röhrchen und am Massekörper ein elektrischer Kontakt befestigt ist. Dabei sind das mindestens eine Röhrchen und der Massekörper derart angeordnet oder mit einer Feder vorgespannt, dass die Kontakte aufeinander gepresst werden, wenn die Sicherheitsvorrichtung starken Beschleunigungen ausgesetzt wird.

[0013] Bei dieser Sicherungsvorrichtung wird bei starken Beschleunigungen ein interner Kontakt geschlossen. Für einen Einsatz in Solaranlagen ist jedoch eine elektrische Trennung erforderlich. Die Sicherheitsvorrichtung ist auch nicht für einen direkten Aufprall konstruiert. Des Weiteren wird in der Schrift nirgendwo angeregt, die Sicherheitsvorrichtung temperaturempfindlich zu gestalten.

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[0014] Aufgabe der Erfindung ist es, ein anforderungsgerechtes Sicherheitselement für Fotovoltaikanlagen zu schaffen, das beim Überschreiten einer Temperaturgrenze, wie z. B. im Falle eines Brandes oder bei Einwirkung eines mechanischen Stoßes bzw. Schlages, sicher eine dauerhafte elektrische Trennung der einzelnen Solar-Panels vom Wechselrichter bewirkt. Bei ausgelöster Sicherung sollen deren Kontakte nach wie vor elektrisch isoliert sein. Das Sicherheitselement soll außerdem einen vergleichsweise kleinen Innenwiderstand haben.

[0015] Diese Aufgabe wird erfindungsgemäß durch die kennzeichnenden Merkmale des Anspruchs 1 gelöst; vorteilhafte Ausgestaltungen und Verwendungen der Erfindung ergeben sich aus den Ansprüchen 2 bis 10.

[0016] Ausgegangen wird von einem Sicherheitselement für Fotovoltaikanlagen, das über zwei elektrische Kontakte verfügt, die durch einen elektrisch isolierenden Sicherungskörper voneinander beabstandet sind. Nach Maßgabe der Erfindung ist der Sicherungskörper derart stoß- und wärmeempfindlich, dass er bei Einwirkung von erheblichen mechanischen Kräften und bei außergewöhnlichem Wärmeeintrag zerstört wird. Die Kontakte sind mittels eines trennbaren elektrischen Verbindungselements verbunden. Zwischen den beiden Enden des Sicherungskörpers ist ein auf Druck vorgespanntes Druckkraftelement eingespannt.

[0017] Es ist vorgesehen, dass der Sicherungskörper aus zwei keramischen Rohrsegmenten besteht, die durch eine Metallschicht zusammengefügt sind. Diese metallische Verbindung hat einen niedrigeren Schmelzpunkt als das Material der beiden Rohrsegmente. Eine sichere mechanische Verbindung der beiden Rohrsegmente kann dadurch erreicht werden, dass ein Rohrsegment an einem Ende aufgeweitet und das andere Segment in den aufgeweiteten Bereich des ersten Segmentes eingeschoben ist. Die ineinandergreifenden Segmente sind an den berührenden Flächen mit Metall beschichtet, wobei beide Metalllagen entweder direkt oder unter Zuhilfenahme eines Lotes miteinander verbunden bzw. verschmolzen sind. Metallisierungen an anderen Bereichen der Segmente, insbesondere an innen liegenden Bereichen, sind zu vermeiden, da sonst die Gefahr elektrischer Überschläge von innen nach außen besteht.

[0018] In einer bevorzugten Variante ist die trennbare elektrische Verbindung als eine aus einem Steckerstift und einer Buchse bestehende Steckverbindung ausgeführt. Der Steckerstift ist mit dem einen der beiden Kontakte und die Buchse mit dem anderen der beiden Kontakte verbunden. Am Ende des Steckerstiftes ist ein Steckerkopf ausgeformt, der, solange die Sicherung noch nicht ausgelöst ist, in die Buchse eingreift.

[0019] Mit der Verbindung können selbst bei der Verwendung von kleinen und kostengünstigen Federn kleine Übergangswiderstände erreicht werden; auch eine übermäßige Erwärmung der Feder ist ausgeschlossen.

[0020] Sowohl der Steckerstift als auch die Buchse sind mit jeweils einer elektrisch isolierenden Hülse umgeben. Die Hülsen sind jeweils länger als der zugehörige Steckerstift bzw. der Stift auf dem sich die Buchse befindet, d. h., die Hülsen weisen bezüglich der Stifte einen Überstand aus. Bei nicht ausgelöstem Sicherheitselement greifen die Enden der beiden Hülsen ineinander. Dies wird z. B. dadurch erreicht, dass die Hülsen verschieden große Durchmesser haben und somit ineinander geschoben werden können.

[0021] Bei Wärmeeinwirkung erweicht bzw. schmilzt das Lot und beide Segmente sind mit vergleichsweise geringer Kraft voneinander trennbar. In diesem Fall, aber auch durch Zerschlagen des keramischen Sicherungskörpers, drückt das nun frei werdende Druckkraftelement die elektrischen Kontakte auseinander. Dabei wird der Steckerstift aus der Buchse gezogen und somit die elektrische Trennung bewirkt. Die Trennung erfolgt sehr schnell, wodurch die Bildung von ausgeprägten Lichtbögen vermieden wird. Ein ausgelöstes Sicherheitselement ist am zerstörten Sicherungskörper und an den meist herabhängenden Kontakten auch aus der Ferne gut erkennbar.

[0022] Da sowohl die Buchse als auch der Steckerstift durch die isolierenden Hülsen weitestgehend verdeckt sind, ist auch bei zerstörtem Sicherungskörper die Gefahr eines Stromschlages nahezu vollständig ausgeschlossen.

[0023] Das erfindungsgemäße Sicherheitselement kann als eigenständiges Bauteil oder in Verbindung mit Solar-Steckverbindern (d. h. Steckverbindern, die speziell in Solaranlagen zum Anschluss der Module eingesetzt sind) verwendet werden. Hierzu wird entweder ein erfindungsgemäßes Sicherheitselement in den Stecker bzw. die Buchse des Solar-Steckverbinders integriert oder der Solar-Steckverbinder wird direkt als die trennbare elektrische Verbindung des Sicherheitselements verwendet.

[0024] Zur Verwendung des Solar-Steckverbinders als trennbare elektrische Verbindung ist der Sicherungskörper so groß gewählt, dass er den kompletten Solar-Steckverbinder umfasst. Der Stecker des Steckverbinders ist mit einer Seite des Sicherungskörpers und die Buchse mit der anderen Seite des Sicherungskörpers kraftschlüssig verbunden. Solar-Steckverbinder sind immer mit einer Verriegelungsvorrichtung versehen, die ein unbeabsichtigtes Lösen der Verbindung verhindert. Bei der Verwendung von Solar-Steckverbindern in Sicherheitsele-

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menten würden sie jedoch ein Auslösen des Sicherheitselements verhindern. Die Verriegelungseinrichtungen werden deshalb entweder nachträglich vom Steckverbinder entfernt oder die für die Verwendung in Sicherheitselementen vorgesehenen Steckverbinder werden vorzugsweise von vornherein ohne Verriegelungseinrichtung gefertigt.

[0025] Der Einsatz von bereits zertifizierten Solar-Steckverbindern in Sicherheitselementen hat den Vorteil, dass aufwendige Zertifizierungen für das Sicherheitselement entfallen.

[0026] Zur unkomplizierten Montage werden z. B. zwei Rohrsegmente, die an der späteren Nahtstelle vormetallisiert sind und zwischen denen eine Feder eingebracht ist, derart zusammengesteckt, dass sie den Solar-Steckverbinder umfassen, wobei ein Rohrsegment mit dem Stecker und das andere mit der Buchse des Solar-Steckverbinders kraftschlüssig (z. B. durch Eingreifen in Nuten) verbunden ist. Zum Verbinden der Rohrsegmente werden beide Metallisierungen (z. B. durch eine Lötlampe) miteinander verschmolzen; währenddessen werden beide Segmente mittels einer Halteklammer zusammengepresst.

[0027] Die Erfindung wird nachfolgend anhand eines Ausführungsbeispiels näher erläutert; hierzu zeigt in schematischer Darstellung die Figur das keramische Sicherheitselement im Schnitt.

[0028] Das Sicherheitselement **4** besteht aus dem rohrförmigen, auf einer Seite aufgeweiteten Segment **4.1** und dem rohrförmigen Segment **4.2**, die in dargestellter Weise ineinander eingreifen. Beide Segmente sind in einer Warnfarbe eingefärbt. In beiden äußeren Enden der Segmente **4.1** und **4.2** sind die Kabelverschraubungen **1** mittels der Gewinde **14** eingeschraubt. Die beiden Solarkabel **2** sind durch jeweils eine der Kabelverschraubungen **1** geführt; die Kabeldurchführungen sind mit den Dichtringen **12**, die durch das Einschrauben der Kabelverschraubungen **1** in der Sicherungskörper **4** zusammengedrückt werden, abgedichtet.

[0029] Die dem Auseinanderdrücken der Segmente **4.1** und **4.2** dienende Metallfeder **5** ist zwischen den ringförmigen Anschlagscheiben **13**, die jeweils auf den Stirnseiten der Kabelverschraubungen **1** aufliegen, eingespannt. Zwischen den Segmenten **4.1** und **4.2** befindet sich eine Metallschicht **8** aus einer Zinnlegierung, die diese miteinander verbindet.

[0030] Die beiden von den Segmenten **4.1**/**4.2** umfassten Enden der Solarkabel **2** bilden jeweils die Kontakte **3**, wobei an einem der Kontakte **3** der Steckerstift **10** und am andern die Buchse **9** angebracht ist. Sowohl der Steckerstift **10** als auch die Buchse **9** bestehen aus korrosionsbeständigem Messing. Optional können sie auch vergoldet sein. Am Ende des Steckerstifts **10** ist der mit Kontaktlamellen versehene Steckerkopf **11** ausgeformt. Solange der Sicherungskörper **4** intakt ist, greift der Steckerkopf **11** in die Buchse **9** ein. Die Verbindung zwischen dem Steckerkopf **11** und der Buchse **9** ist mit geringer Kraftwirkung lösbar.

[0031] Die Buchse **9** ist von der Hülse **7** und der Steckerstift **10** von der Hülse **6** umschlossen. Die beiden Hülsen stehen gegenüber der Buchse **9** bzw. dem Steckerstift **10** mehrere Millimeter über. Die Hülse **7** hat einen größeren Durchmesser als die Hülse **6**, sodass bei nicht ausgelöstem Sicherheitselement die Hülse **6** in die Hülse **7** eingreift.

[0032] Die Erweichungstemperatur der für die Metallschicht **8** verwendeten Metalllegierung und die Federvorspannung sind so ausgelegt, dass beim Überschreiten von einer für einen Brandfall typischen Temperaturgrenze die Segmente **4.1** und **4.2** getrennt werden. Ein mechanischer Stoß bzw. Schlag, z. B. bewirkt durch Rettungskräfte, führt zum Zerbrechen des keramischen Sicherungskörpers **4**; auf Grund der Federvorspannung wird der Steckerkopf **11** aus der Buchse **9** gezogen. Außerdem werden der Steckerstift **10** und die Buchse **9** sowie die beiden Kontakte **3** weit auseinander gedrückt.

[0033] Die Segmente **4.1** und **4.2** bzw. die Bruchstücke des Sicherungskörpers **4** und die Feder **5** fallen ab. Der Steckerstift **10** und die Buchse **9** sind jedoch nach wie vor durch die Schutzhülsen **6**, **7** überdeckt. Infolgedessen ist die Gefahr eines Stromschlages durch Berühren des Stifts **10** bzw. der Buchse **9** praktisch ausgeschlossen.

[0034] Die Positionierung der Sicherheitselemente ist innerhalb der Fotovoltaikanlage und auch ohne Weiters außerhalb, gleichwohl bevorzugt aber in ihrer Nähe, möglich. Bei einer Freifeldanlage ist es vorteilhaft, die Sicherheitselemente direkt an der Außenseite der Trägergerüste anzubringen, sodass bei einer ungewollten mechanischen Einwirkung, z. B. durch einen Kraftfahrzeugunfall, möglichst viele Sicherheitselemente ausgelöst werden. Bei einer Dachanlage ist es hingegen sinnvoll, die Sicherheitselemente am Rand der Fotovoltaikanlage, z. B. an der Dachkante, anzubringen, sodass sie vom Rettungspersonal zielgerichtet und problemlos, z. B. mit Hilfe von geeignetem Feuerwehr-Werkzeug oder auch durch einen Löschstrahl, ausgelöst werden können.

[0035] Das vorgestellte Sicherheitselement ist kostengünstig als Serienprodukt herstellbar, langzeitstabil und kann als Kabelzwischenstück an beliebigen Stellen der Verkabelung der einzelnen Solar-Panels eingefügt werden. Im Übrigen ist der Sicherungskörper **4** so ausgelegt, dass er Hagelschlag widersteht.

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Bezugszeichenliste

1	Kabelverschraubungen
2	Solarkabel
3	Kontaktfläche
4	Keramikkörper (Sicherungskörper)
4.1.	aufgeweitetes rohrförmiges Segment
4.2.	rohrförmiges Segment
5	Druckfeder
6	Schutzhülse für Stecker
7	Schutzhülse für Buchse
8	Metallschicht (Lot)
9	Buchse
10	Steckerstift
11	Steckerkopf
12	Dichtring
13	Ringscheibe
14	Gewinde (Außengewinde Kabelverschraubung, Innengewinde Keramikrohr)

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ZITATE ENTHALTEN IN DER BESCHREIBUNG

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Zitierte Patentliteratur

- JP 11040838 A **[0008]**
- DE 202006007613 U1 **[0010]**
- DE 1755996 A **[0012]**

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Patentansprüche

1. Sicherheitselement für Fotovoltaikanlagen, das in gleicher Weise auch für andere frei verdrahtete Elektroanlagen im Innen- und Außenbereich verwendet werden kann, mit zwei elektrischen Kontakten (**3**), die durch einen elektrisch isolierenden Sicherungskörper (**4**) voneinander beabstandet sind, **dadurch gekennzeichnet**, dass der Sicherungskörper (**4**) derart stoß- und wärmeempfindlich ist, dass er bei Einwirkung von erheblichen mechanischen Kräften und bei außergewöhnlichem Wärmeeintrag zerstört wird, wobei die Kontakte (**3**) mittels eines trennbaren elektrischen Verbindungselement verbunden sind und ein auf Druck vorgespanntes Druckkraftelement (**5**) zwischen den beiden Enden des Sicherungskörpers (**4**) eingespannt ist.

2. Sicherheitselement nach Anspruch 1, dadurch gekennzeichnet, dass der Sicherungskörper (**4**) aus zwei stoßempfindlichen, rohrförmigen Segmenten (**4.1**, **4.2**) aus Keramik besteht, die mittels einer Metallschicht (**8**) zusammengefügt sind, wobei das Metall einen niedrigeren Schmelzpunkt als das keramische Material der beiden Segmente (**4.1**, **4.2**) hat.

3. Sicherheitselement nach Anspruch 2, dadurch gekennzeichnet, dass das eine Rohrsegment (**4.1**) an einem Ende aufgeweitet ist und ein Ende des anderen Rohrsegments (**4.2**) in den aufgeweiteten Bereich eingreift, wobei die Innenseite des aufgeweiteten Bereichs des einen Teilabschnitts mit der Außenseite des eingreifenden Endes des anderen Teilabschnitts mittels der Metallschicht (**8**) verbunden ist.

4. Sicherheitselement nach Anspruch 1 bis 3, dadurch gekennzeichnet, dass die trennbare elektrische Verbindung aus einem Steckerstift (**10**), der mit dem einen der beiden Kontakte (**3**), und aus einer Buchse (**9**), die mit dem anderen der beiden Kontakte (**3**) verbunden ist, besteht, wobei am Ende des Steckerstifts (**10**) ein Steckerkopf (**11**) ausgeformt ist, der bei nicht ausgelöstem Sicherheitselement in die Buchse (**9**) eingreift.

5. Sicherheitselement nach Anspruch 4, dadurch gekennzeichnet, dass der Steckerkopf (**11**) Kontaktlamellen aufweist.

6. Sicherheitselement nach Anspruch 4 und 5, dadurch gekennzeichnet, dass die Buchse (**9**) und der Steckerstift (**10**) vergoldet sind.

7. Sicherheitselement nach Anspruch 4 bis 6, dadurch gekennzeichnet, dass sowohl der Steckerstift (**10**) als auch die Buchse (**9**) mit jeweils einer elektrisch isolierenden Hülse (**6**, **7**), die jeweils zum Steckerstift (**10**) und zur Buchse (**9**) einen Überstand haben, umgeben sind, wobei bei nicht ausgelöstem Sicherheitselement eine der beiden Hülsen in die andere greift.

8. Sicherheitselement nach Anspruch 1 bis 3, dadurch gekennzeichnet, dass als trennbare elektrische Verbindung ein Solar-Steckverbinder verwendet ist, dessen Verriegelungsvorrichtung entweder entfernt wurde oder der von vornherein ohne eine solche gefertigt ist, wobei jeweils eine Seite des Sicherungskörpers (**4**) mit dem Stecker und die andere Seite des Sicherungskörpers (**4**) mit der Buchse des Solar-Steckverbinders kraftschlüssig verbunden ist.

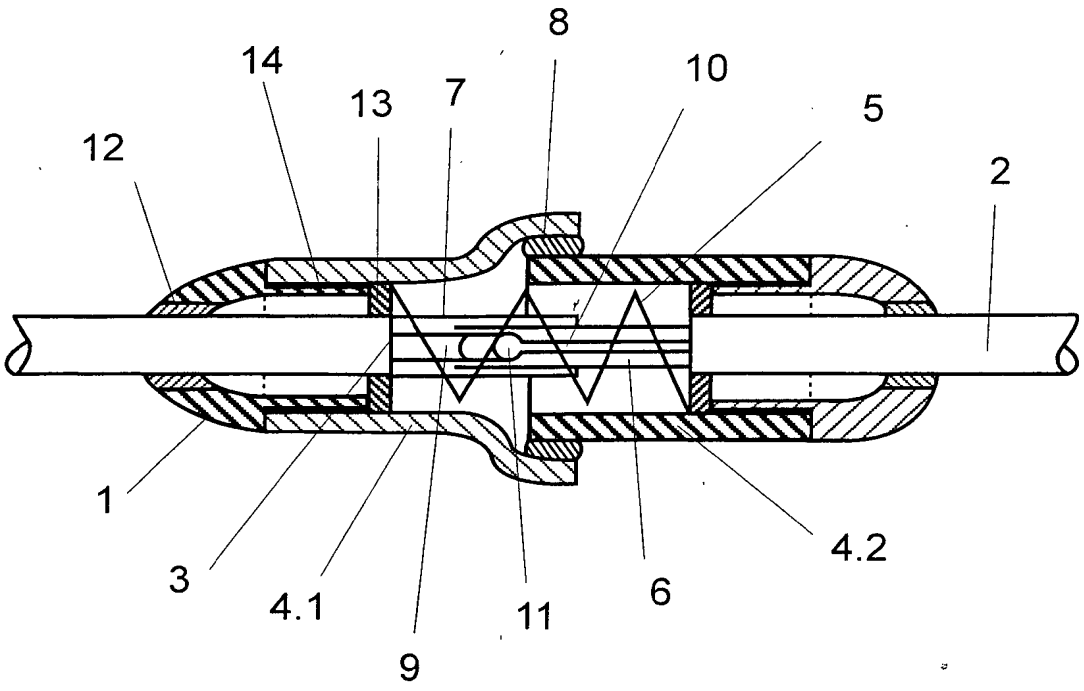
9. Verwendung des Sicherheitselements nach den Ansprüchen 1 bis 7 als Bestandteil eines Solar-Steckverbinders.

10. Verwendung des Sicherheitselements nach Anspruch 9, dadurch gekennzeichnet, dass das Sicherheitselement entweder im Stecker oder in der Buchse des Solar-Steckverbinders integriert ist.

Es folgt ein Blatt Zeichnungen

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Anhängende Zeichnungen



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(12) 특허협력조약에 의하여 공개된 국제출원

(19) 세계지식재산권기구
국제사무국

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

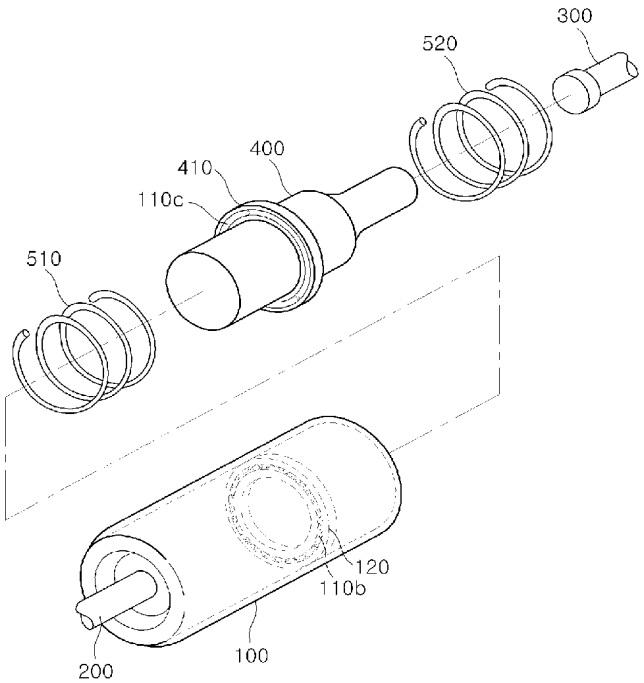
(84) 지정국 (별도의 표시가 없는 한, 가능한 모든 종류의 역내 권리의 보호를 위하여): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), 유라시아 (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), 유럽 (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE,

[다음 쪽 계속]

(54) **Title**: REPEATABLE FUSE

(54) **발명의 명칭** : 반복형 퓨즈

[Fig. 1]



500 : 510, 520
110 : 110b, 110c

(57) **Abstract**: The present invention relates to a repeatable fuse, and more particularly to a repeatable fuse with high reliability which protects against overheating and prevents overcurrent from flowing into a circuit by using an elastic member. The repeatable fuse according to the present invention includes: a housing having an internal space; a first lead terminal disposed at one side of the housing; a second lead terminal insulated from the housing and disposed at the other side of the housing; a spindle electrically disposed inside the housing to be electrically connected to the first lead terminal and disconnected from the second lead terminal; an elastic member installed inside the housing, wherein the elastic member is connected to the spindle and disconnects the spindle from the second lead terminal; and a separation preventing groove disposed inside the housing and preventing the separation of the elastic member by allowing a portion of the elastic member to be seated thereon. According to embodiments of the present invention, it is possible to prevent the elastic member from straying from the original position or being wobbled during stretching or compressing of the elastic member. This can provide a highly reliable fuse which is stably connected or disconnected. Also, the embodiments of the present invention can provide a repeatable fuse maintaining its operating characteristic during repeated use, and decrease contact resistance to allow power consumption to be reduced in a normal operating state, not an overheating or overcurrent state.

(57) 요약서:

[다음 쪽 계속]

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ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

공개:

— 국제조사보고서 없이 공개하며 보고서 접수 후 이를 별도 공개함 (규칙 48.2(g))

본 발명은 반복형 퓨즈에 관한 것으로서, 보다 구체적으로는 탄성부재를 이용하여 과열방호 및 회로에 과전류가 흐르는 것을 방지하는 신뢰성 높은 반복형 퓨즈에 관한 것이다. 발명에 따른 반복형 퓨즈는 내부공간을 갖는 하우징; 하우징 일측에 배치되는 제 1 리드 단자; 하우징과 절연되어 하우징 타측에 배치되는 제 2 리드 단자; 하우징 내부에 배치되어 제 1 리드 단자와 전기적으로 접속되며 제 2 리드 단자와 단속(斷續)되는 스핀들; 하우징 내부에 설치되어 스핀들과 연결되며, 제 2 리드 단자와 스핀들을 단속시키는 탄성부재; 및 하우징 내측에 형성되며, 탄성부재 일부가 안착되어 탄성부재의 유격을 방지하는 이탈방지홈;을 포함한다. 본 발명의 실시예들에 따르면 탄성부재가 인장 또는 압축할 때 원래 위치를 벗어나거나 흔들리는 것을 방지할 수 있다. 이에 따라 안정적으로 접속 또는 단락되는 신뢰도 높은 퓨즈를 제공할 수 있다. 또한 본 발명의 실시예들은 반복사용시에도 동작특성이 유지되는 반복형 퓨즈를 제공할 수 있으며, 접점저항값을 낮추어 과열, 과전류 상태가 아닌 정상동작상태에서 낮은 전력이 소모되게 한다.

명세서

발명의 명칭: 반복형 퓨즈

기술분야

[1] 본 발명은 반복형 퓨즈에 관한 것으로서, 보다 구체적으로는 탄성부재를 이용하여 과열발생시 회로차단 및 회로에 과전류가 흐르는 것을 방지하는 신뢰성 높은 반복형 퓨즈에 관한 것이다.

[2]

배경기술

[3] 일반적으로 전기를 이용하는 모든 전기전자 제품은 항상 회로 내 비정상적인 과전류나 외부 과열원인에 의한 과열에 따른 사고가 내재되어 있다. 종래에는 이를 예방하기 위해 과전류가 흐르면 전류로 발생하는 열에 의해 용융되어 끊어지는 물질로 형성된 일회용 퓨즈를 사용하였다. 하지만 일회용 퓨즈는 값은 저렴하나 재사용이 불가능하여 사용한 후 새 것으로 교체해야 하기 때문에 교체에 따른 비용이 큰 단점이 있었다. 이를 해결하기 위해 열팽창계수가 다른 이종의 금속판을 접합한 바이메탈 써멀 스위치를 일회용 퓨즈대신 사용하였으나, 바이메탈 써멀스위치는 단지 접점의 기능을 수행하며 온도에 따른 작동 편차가 클 뿐만 아니라 리미트 스위치 등과 같은 별도의 장치가 요구되는 문제점이 있다.

[4] 특수 고분자를 이용한 고분자 퓨즈가 개발되었으나, 고분자 퓨즈 역시 화학제품에 따른 물질의 안정성이 떨어지며 급격한 전압 및 전류의 변화 시 폭발 등에 의한 화재 위험 문제가 있다. 더욱이 고분자 퓨즈는 물질의 안정성 및 내구성이 떨어지며 반응시간이 늦어 위급한 상황을 초래할 수도 있다.

[5] 한편, 최근 전자기기는 주로 인쇄 회로 기판의 표면실장화에 따라 퓨즈 역시 표면실장이 가능한 퓨즈가 요구되고 있다. 하지만, 종래 기술에 따른 일회용 퓨즈는 표면실장 과정에서 솔더링을 위해 약 섭씨 270도 이상의 온도가 필요하므로 퓨즈 본래의 특성으로 인해 용융되어 표면실장이 불가능하다. 물론, 바이메탈 써멀스위치는 이러한 문제를 해결할 수 있으나, 과도한 부품크기와 솔더링 온도에 의한 열화가능성으로 인해 표면실장이 어렵다.

[6] 이러한 문제점을 해결하기 위해 연속 사용이 가능하고 표면실장화 할 수 있는 탄성부재, 예컨대 형상기억합금을 이용한 형상기억합금 퓨즈가 개발되었다. 형상기억합금은 온도편차가 적어 신뢰도가 높은 반복형 퓨즈를 제공한다. 그러나 형상기억합금에 의해 탄성적으로 인장 또는 압축을 반복하게 되면 형상기억합금이 원래 위치를 벗어나거나 흔들릴 수 있어 안정감 있는 접속 또는 단락이 어렵다는 단점이 있었다.

[7]

발명의 상세한 설명

기술적 과제

[8] 본 발명은 반복 사용 가능한 반복형 퓨즈를 제공한다.

[9] 본 발명은 탄성부재가 인장 또는 압축할 때 원래 위치를 벗어나거나 흔들리지 않고 안정성 있게 동작하는 반복형 퓨즈를 제공한다.

[10] 또한 본 발명은 동작 신뢰성이 확보되는 반복형 퓨즈를 제공한다.

[11]

과제 해결 수단

[12] 본 발명에 따른 반복형 퓨즈는 내부공간을 갖는 하우징; 하우징 일측에 배치되는 제1 리드 단자; 하우징과 절연되어 하우징 타측에 배치되는 제2 리드 단자; 하우징 내부에 배치되어 제1 리드 단자와 전기적으로 접속되며 제2 리드 단자와 단속(斷續)되는 스핀들; 하우징 내부에 설치되어 스핀들과 연결되며, 제2 리드 단자와 스핀들을 단속시키는 탄성부재; 및 하우징 내측에 형성되며, 탄성부재 일부가 안착되어 탄성부재의 유격을 방지하는 이탈방지홈;을 포함한다.

[13] 본 발명에 따른 반복형 퓨즈에 있어서, 하우징과 제2 리드 단자 사이에 배치되어 하우징과 제2 리드 단자를 절연시키는 절연체를 더 구비하는 것이 바람직하다.

[14] 본 발명에 따른 반복형 퓨즈에 있어서, 하우징 내주면 일측에 돌출형성되는 걸림턱을 포함하는 것이 바람직하다. 이 경우 이탈방지홈은 하우징 내측 밑면부에 형성되는 하우징홈과, 하우징홈과 대향하며 절연체의 일면 또는 걸림턱에 형성되는 걸림홈을 포함하는 것이 바람직하다.

[15] 본 발명에 따른 반복형 퓨즈에 있어서, 스핀들 몸체의 외주면 일측에 돌출형성되며, 탄성부재를 스핀들에 지지시키는 지지부를 더 포함하는 것이 바람직하다.

[16] 이 경우 이탈방지홈은 지지부의 적어도 일측에 형성되는 것이 바람직하다. 또한 이탈방지홈은 상기 하우징의 내면, 하우징의 걸림턱, 상기 절연체, 또는 상기 스핀들의 지지부에 적어도 두 군데 이상 형성되는 것이 바람직하다.

[17] 본 발명에 따른 반복형 퓨즈에 있어서, 이탈방지홈은 만곡된 형상 또는 수직단면부가 다각형 형상으로 함몰되어 형성되는 것이 바람직하다.

[18] 본 발명에 따른 반복형 퓨즈에 있어서, 이탈방지홈은 내부보다 입구가 더 좁은 것이 바람직하다.

[19] 본 발명에 따른 반복형 퓨즈에 있어서, 스핀들의 끝단은 볼록한 만곡부로 형성되는 것이 바람직하다.

[20] 본 발명에 따른 반복형 퓨즈에 있어서, 스핀들 밑면부와 하우징 내측 밑면부를 연결하는 연결 와이어를 더 구비하는 것이 바람직하다.

[21] 본 발명에 따른 반복형 퓨즈에 있어서, 하우징 내측 밑면부에 배치되는 접점판을 더 구비하는 것이 바람직하다.

[22] 본 발명에 따른 반복형 퓨즈에 있어서, 탄성부재는 제1 스프링 및 제2 스프링을 포함하며, 제1 스프링 및 제2 스프링 중 적어도 하나는 형상기억합금을 포함하는 것이 바람직하다.

[23] 본 발명에 따른 반복형 퓨즈에 있어서, 제1 스프링 및 제2 스프링은 스핀들의 지지부를 경계로 분리 배치되어 스핀들을 감싸는 것이 바람직하다.

[24] 이 경우 제1 스프링은 하우징 내측 밑면부와 지지부 사이에 위치하며, 제2 스프링은 절연체의 일면과 지지부 사이 또는 걸림턱과 지지부 사이에 위치하는 하는 것이 바람직하다.

[25] 또한 이탈방지홈은 하우징 내측 밑면부에 형성되는 하우징홈; 하우징홈과 대향하며 절연체의 일면 또는 걸림턱에 형성되는 걸림홈; 하우징홈에 대향하며, 지지부의 일측에 형성되는 제1 지지부홈; 및 걸림홈에 대향하며, 지지부의 일측에 형성되는 제2 지지부홈;을 포함하는 것이 바람직하다.

[26] 본 발명에 따른 반복형 퓨즈에 있어서, 탄성부재는 제1 판스프링 및 제2 판스프링을 포함하는 것이 바람직하다. 이 경우 제1 판스프링 및 제2 판스프링은 스핀들 밑면부와 하우징 내측 밑면부 사이에 나란히 위치하는 것이 바람직하다.

[27] 또한 이탈방지홈은 하우징 내측 밑면부에 형성되는 하우징홈; 하우징홈에 대향하며, 스핀들 밑면부에 형성되는 스핀들홈;을 포함하는 것이 바람직하다.

[28] 이 경우 제1 판스프링의 양단에는 이탈방지부가 구비되어 하우징홈 및 스핀들홈에 각각 장착되는 것이 바람직하다.

[29]

발명의 효과

[30] 본 발명의 실시예들에 따르면 탄성부재가 인장 또는 압축할 때 원래 위치를 벗어나거나 흔들리는 것을 방지할 수 있다. 이에 따라 안정적으로 접속 또는 단락되는 신뢰도 높은 퓨즈를 제공할 수 있다.

[31] 또한 본 발명의 실시예들은 반복사용시에도 동작특성이 유지되는 반복형 퓨즈를 제공할 수 있으며, 접점저항값을 낮추어 정상동작상태에서는 낮은 소비전력을 유지할 수 있다.

[32]

도면의 간단한 설명

[33] 도 1은 본 발명의 일 실시예에 따른 반복형 퓨즈를 나타내는 사시도이다.

[34] 도 2 및 도 3은 본 발명의 일 실시예에 따른 반복형 퓨즈를 나타내는 단면도이다.

[35] 도 4는 본 발명의 일 실시예에 따른 반복형 퓨즈의 일부 확대도이다.

[36] 도 5는 본 발명의 일 실시예에 따른 반복형 퓨즈의 이탈방지홈의 변형예를 나타내는 개념도이다.

[37] 도 6는 본 발명의 일 실시예에 따른 반복형 퓨즈의 작동을 나타내는 작동상태도이다.

[38] 도 7은 본 발명의 다른 실시예에 따른 반복형 퓨즈를 나타내는 단면도이다.

[39] 도 8은 본 발명의 다른 실시예에 따른 반복형 퓨즈의 탄성부재를 나타내는 단면도이다.

[40]

발명의 실시를 위한 최선의 형태

[41] 이하에서는 도면을 참조하면서 본 발명에 따른 반복형 퓨즈에 관하여 구체적으로 설명한다. 그러나 본 발명은 이하에서 개시되는 실시예에 한정되는 것이 아니라 서로 다른 다양한 형태로 구현될 것이며, 단지 본 실시예들은 본 발명의 개시가 완전하도록 하며, 통상의 지식을 가진 자에게 발명의 범주를 완전하게 알려주기 위해 제공되는 것이다. 도면상에서 동일 부호는 동일한 요소를 지칭한다.

[42]

[43] 도 1은 본 발명의 일 실시예에 따른 반복형 퓨즈를 나타내는 사시도이며, 도 2 및 도 3은 본 발명의 일 실시예에 따른 반복형 퓨즈를 나타내는 단면도이다. 또한 도 4는 본 발명에 따른 반복형 퓨즈의 일부 확대도이며, 도 5는 본 발명에 따른 반복형 퓨즈의 이탈방지홈의 변형예를 나타내는 개념도이다. 도 7은 본 발명의 다른 실시예에 따른 반복형 퓨즈를 나타내는 단면도이며, 도 8은 본 발명의 다른 실시예에 따른 반복형 퓨즈의 탄성부재를 나타내는 단면도이다.

[44]

[45] 본 발명에 따른 반복형 퓨즈는 하우징(100), 제1 리드 단자(200), 제2 리드 단자(300), 스핀들(400), 탄성부재(500);를 포함하여 구성된다.

[46] 하우징(100)은 내부공간을 갖고 길이방향으로 연장형성된 박스형상으로서, 후술할 스핀들(400), 탄성부재(400)를 수납하여 보호한다. 하우징(100)은 실시형태에 따라 제1 리드 단자(200)와 접하여 전기적으로 접속될 수 있으므로, 전도성 물질로 형성되는 것이 바람직하다. 하우징(100)은 길이방향과 수직한 단면이 원형, 타원형, 다각형 등으로 형성될 수 있어 원형 박스, 타원형 박스, 다각형 박스 등의 형상을 가질 수 있다. 본 실시예에서는 도 1에 도시된 바와 같이 원형 박스를 예시한다.

[47] 하우징(100)의 내면 일측에는 수납된 탄성부재(500)를 지지하기 위한 이탈방지홈(110 : 110a, 110b)이 형성될 수 있다. 이탈방지홈(110 : 110a, 110b)은 제1 리드 단자(200) 방향에 형성된 하우징홈(110a)과, 제2 리드 단자(300) 방향에 형성된 걸림홈(110b)으로 구성될 수 있으며, 하우징홈(110a)과, 걸림홈(110b)은 서로 대향하고 있다. 본 실시예에서와 같이 원기둥 박스 형태의 하우징(100)의 경우에는 탄성부재(500)가 하우징(100) 내측의 밑면부에 접하는데, 내측 밑면부에는 이와 접하는 탄성부재(500)의 형상을 따라 함몰된 하우징홈(110a)이 형성되어 탄성부재(500)가 인장 또는 압축될 때 탄성부재(500)가 흔들리거나 원래 위치에서 유격되는 것을 방지한다. 예를 들면 탄성부재(500)가 코일 형태의

스프링으로 형성되는 경우에는 코일을 이루선 코일선의 끝단을 따라 링 형태의 홈이 형성된다(도 1 참조).

[48] 이러한 이탈방지홈(110)은 탄성부재(500)의 적어도 일부가 위치 고정될 수 있도록 오목한 홈 형상으로 형성된다. 이탈방지홈(110)은 탄성부재(500)의 형상에 따라 다양한 형상으로 변경할 수 있다. 예를 들면 도 5의 (a), 도 5의 (b) 및 도 5의 (e)에 도시된 바와 같이 소정곡률을 갖는 만곡형으로 형성될 수도 있고, 수직단면부가 다각형 형상(도 5의 (c), 도 5의 (d), 도 5의 (f))으로 형성될 수도 있다. 이탈방지홈(110)의 깊이에 따라 탄성부재(500)의 삽입되는 정도가 다른데, 예컨대 탄성부재(500)가 코일 형태의 스프링으로 형성된 경우에 코일을 이루는 코일선이 절반 이하로 이탈방지홈(110)에 삽입될 수 있고(도 5의 (a), (c) 등 참조), 절반 이상(도 5의 (b)) 또는 코일선 전체(도 5의 (e) 참조)가 삽일될 수도 있다. 또한 도 5의 (e)와 같이 이탈방지홈(110)의 입구가 이탈방지홈(110)의 내부보다 작아짐으로써 탄성부재(500)를 보다 견고하게 고정시킬수 있다. 그리고 이탈방지홈(110)에 안착되는 탄성부재(500)는 보다 단단히 고정되도록 체결부재(미도시)를 이용하여 이탈방지홈(110)에 체결시킬 수도 있다.

[49] 또한 하우징(100)의 내주면 일측에는 내측 수평방향으로 돌출된 걸림턱(120)이 형성되어 탄성부재(500)를 지지할 수 있다. 본 실시예에서는 걸림턱(120)이 하우징(100)의 내측 밑면부와 소정거리 이격되어 형성되며, 내측 밑면부와 걸림턱(120) 사이에 탄성부재가 설치되도록 형성된다. 이 때 걸림턱(120)과 탄성부재(500)가 맞닿는 부분에는 탄성부재(500)의 형상을 따라 함몰된 홈(110b)이 형성되어 탄성부재(500)가 인장 또는 압축될 때 탄성부재(500)가 흔들리거나 원래 위치에서 유격되는 것을 방지한다. 본 실시예에서는 하우징홈(110a)은 하우징(100) 밑면에 형성되며, 걸림홈(110b)은 걸림턱(120)에 형성되어 서로 대향한다. 물론 이탈방지홈의 형성위치는 예시일 뿐 이에 한정되는 것은 아니며, 탄성부재(500)를 고정시킬 수 있는 위치라면 어떠한 위치도 가능하다.

[50] 제1 리드 단자(200)는 외부 전원을 인가 받거나 전원과 연결되는 수단으로서, 전도성 물질을 포함하여 구성되어 있다. 제1 리드 단자(200)은 하우징(100) 일측에 마련되는데, 본 실시예에서는 원형 박스 형상의 하우징(100)의 밑면에 배치되어 있다. 제1 리드 단자(200)는 하우징(100) 또는 별도의 연결부재(미도시)를 통해 탄성부재(500)와 전기적으로 접속되어 있으며, 탄성부재(500)를 통해 다시 스핀들(400)과 전기적으로 접속되어 있다. 예컨대 하우징(100)이 전도성 물질로 구성되고 탄성부재(500)가 하우징(100)의 내면 일측 또는 걸림턱(120)과 접하는 경우에, 제1 리드 단자(200)는 하우징(100)을 통해 스핀들(400)과 전기적으로 접속하게 된다. 그리고 탄성부재(500)가 스핀들(400) 일측과 연결되어 전기적으로 접속할 수 있는데, 이에 대해서는 후술한다. 제1 리드 단자(200)는 본 실시예에서 막대형상으로 구비되어 있으나 이에 한정되지 않고, 탄성부재(500)와 전기적으로 접속할 수 있는 형상이라면

어떠한 형상이라도 가능하다.

[51] 제2 리드 단자(300)는 전기적 연결을 위한 수단으로서, 예컨대 제1 리드 단자(200)로부터 인가받은 전류를 전기전자 소자에 전달하며 전도성 물질을 포함하여 구성되어 있다. 제2 리드 단자(300)는 제1 리드 단자(200)와 소정거리 이격되어 배치되는데, 본 실시예에서는 원형 박스 형상의 하우징(100)에서 제1 리드 단자(200)가 형성된 밑면과 반대방향의 밑면에 형성된다. 이 때 제2 리드 단자(300)는 하우징 밑면을 관통하여 삽입된 형태로 배치될 수 있고(도 2 참조), 밑면에 이격되어 배치될 수도 있다. 즉 스핀들(400)이 이동하여 제2 리드 단자(300)와 접속 또는 단락할 수 있는 위치라면 어떠한 위치도 가능하다. 제2 리드 단자(300)는 스핀들(400)에 의해 제1 리드 단자(200)와 접속 또는 단락하게 된다. 제2 리드 단자(300)는 스핀들(400)을 통해서 제1 리드 단자(200)와 전기적으로 접속되어야 하는데, 따라서 제1 리드 단자(200)와 전기적으로 접속된 하우징(100)과 절연되어 배치되어야 한다. 이를 위해 제2 리드 단자(300)가 배치되는 하우징(100)의 일측은 도 2에 도시된 바와 같이 개구된 형상으로 마련되고 제2 리드 단자(300)가 하우징(100)에서 이격되어 배치될 수 있다. 이 때 제2 리드 단자(300)가 지나가는 하우징(100) 면에 절연물을 코팅할 수 있다. 물론 제2 리드 단자(3000)도 스핀들(400)과 접속하는 부분을 제외하고서 절연물로 코팅할 수 있다. 또한 도 3에 도시된 바와 같이 하우징(100)과 제2 리드 단자(300) 사이에 절연체(130)를 배치하여 절연체(130)에 의해 절연시킬 수도 있다. 예컨대 절연체로 세라믹 애자 등이 사용될 수 있다. 본 실시예에서는 제2 리드 단자(300)의 형상이 막대 형태로 구비되어 있으나 이에 한정되지 않고, 스핀들(400)과 전기적으로 접속할 수 있는 형상이라면 어떠한 형상이라도 가능하다.

[52] 스핀들(400)은 제1 리드 단자(200)와 제2 리드 단자(300)를 접속 또는 단락시키기 위한 수단으로서, 하우징(100)의 내부에 구비된다. 스핀들(400)은 길이방향으로 연장형성된 하우징(100)과 마찬가지로 길이방향으로 연장형성된 축 형태로 구비될 수 있다. 스핀들(400)은 길이방향과 수직한 단면이 원형, 타원형, 다각형 등으로 형성될 수 있는데, 하우징(100)의 단면 형상과 동일하게 형성되는 것이 바람직하다. 본 실시예에서는 도 1에 도시된 바와 같이, 원형 박스 형태의 하우징(100)을 따라 형성된 원통 형상으로 형성되어 원통 형상의 속이 찬 형태로 예시되었으나 속이 비어 있는 형태로 형성되어도 무방하다.
스핀들(400)은 탄성부재(500)를 통해 제1 리드 단자(200)와 전기적으로 접속되어 있으며, 이를 위해 전도성 물질로 형성되는 것이 바람직하다. 스핀들(400)은 탄성부재(500)에 의해 하우징(100) 내부를 길이방향으로 왕복하면서 제2 리드 단자(300)와 단속(斷續), 즉 전기적으로 접속되거나 단락된다. 따라서 스핀들(400)이 제2 리드 단자(300)와 접속 또는 단락되는 것에 따라 제1 리드 단자(200)와 제2 리드 단자(300)가 접속 또는 단락하게 된다. 스핀들(400)은 측면의 적어도 일부에 탄성부재(500)를 지지할 수 있는 지지부(410)가 형성되어

탄성부재(500)와 연결될 수 있다. 지지부(410)는 스핀들(400) 측면에 스핀들(400) 축 방향과 수직방향으로 돌출 형성될 수 있다. 지지부(410)는 스핀들(400) 측면의 둘레를 따라 연속적으로 형성될 수 있고(도 1 참조), 스핀들(400) 측면에 불연속적으로 형성될 수도 있다. 즉 스핀들(400)이 탄성부재(500)와 접속할 수 있는 형태라면 어떠한 형태라도 가능하다. 또한 제2 리드 단자(300)와 접하게 되는 스핀들(400)의 끝단은 도 4에 도시된 바와 같이 소정 곡률반경을 갖는 볼록한 형상인 것이 바람직하다. 스핀들(400) 끝단에 볼록한 만곡부가 형성되는 경우에는 스핀들(400)에 유격이 발생하더라도 스핀들(400) 끝단과 제2 리드 단자(300)의 접하는 면적이 일정하게 유지되어 일정한 접점저항을 유지할 수 있기 때문이다. 예를 들면 도 4의 (a)와 같이 스핀들(400)의 유격이 없을 때에는 접점 M을 중심으로 소정 면적에서 접하고, 도 4의 (b)와 같이 유격이 있을 때에는 접점 N을 중심으로 소정면적에서 접하게 된다. 이 때 스핀들(400) 끝단에 볼록한 만곡부가 형성되는 경우에는 접점이 달라지더라도 접하는 면적이 일정하게 유지될 수 있다.

[53] 탄성부재(500)는 제2 리드 단자(300)와 스핀들(400)을 접속 또는 단락시키기 위한 수단이다. 탄성부재(500)는 하우징(100) 내부에 배치되는데, 하우징(100)의 길이방향으로 인장되거나 압축되도록 배치된다. 탄성부재(500)는 일단이 하우징(100) 내부 일측과 연결되어 제1 리드 단자(200)와 전기적으로 접속되는데, 본 실시예에서는 하우징(100)의 밑면 또는 걸림턱(120)과 연결된다. 그리고 탄성부재(500)의 타단은 스핀들(400) 일측과 연결되어 전기적으로 접속되어 있는데, 본 실시예에서는 스핀들(400)의 지지부에 연결된다. 탄성부재(500)는 전도성 물질로 형성되는 것이 바람직하며, 더 바람직하게는 형상기억합금으로 형성될 수 있다. 탄성부재(500)는 하우징(100) 내부 공간에 복수개 설치될 수 있다. 예컨대, 탄성부재(500)는 코일 형태의 제1 스프링(510) 및 제 2 스프링(520)을 포함하여 구성되어 스핀들(400)을 감싸도록 배치된다. 제1 스프링(510)은 하우징(100) 내부 공간의 하부 즉, 하우징 밑면과 스핀들의 지지부(410) 사이에 위치하며, 제2 스프링(520)은 하우징(100) 내부공간의 상부, 즉 스핀들 지지부(410)와 하우징 걸림턱(120) 사이에 위치할 수 있다. 이 때 제1 스프링(510) 및 제2 스프링(520) 중 적어도 하나는 형상기억합금으로 구성될 수 있다. 예컨대 제2 스프링(520)이 형상기억합금으로 제조될 수 있다.

[54] 또한 탄성부재(500)는 탄성력 있는 재료의 굽힘 탄성을 이용할 수 있도록 플레이트 형상으로 형성된 판스프링으로 구성될 수 있다(도 8 참조). 이 경우 제1 판스프링(530) 및 제2 판스프링(540)을 포함하여 구성되며, 본 실시예에서의 판스프링(530, 540)은 도 7 및 도 8에 도시된 바와 같이 판스프링의 신축방향과 교차하는 방향으로 굽은 형상, 즉 C 자형 또는 누운 M 자형 형상으로 커브를 이루는 플레이트로 이루어진 것을 예시한다. 판스프링은 형상은 이에 한정되는 것은 아니며, 굽힘 탄성을 이용할 수 있는 다양한 형상으로 변경가능하다. 제1 판스프링(530) 및 제2 판스프링(540)은 스핀들(400) 밑면부와 하우징(100) 내측

밑면부 사이에 나란히 위치할 수 있다. 제1 판스프링(530) 및 제2 판스프링(540) 중 적어도 하나는 장력이 우수한 스테인레스 계열 스프링으로 구성될 수 있다. 예컨대 제1 판스프링(530)은 스테인레스 계열 스프링으로 제조되어 온도에 따라 일정장력을 유지할 수 있으며, 제2 판스프링(540)은 전기전도도가 우수한 금속, 예를 들면 구리로 제조되어 하우징(100)과 스핀들(400) 사이의 통전 및 지지 역할도 수행할 수 있다. 또한 판스프링은 전체 저항값을 낮추기 위해 일자로 형성되어 배치될 수도 있다.

[55] 본 실시예에서는 탄성부재(500)를 코일 형태의 스프링 또는 판스프링으로 예시하였으나 이에 한정되는 것은 아니며, 제2 리드 단자(300)를 접속 또는 단락시킬 수 있는 다양한 형상으로 구비될 수 있다.

[56] 지지부(410)와 탄성부재(500)가 맞닿는 부분에는 탄성부재(500)가 잘 고정될 수 있도록 스프링의 형상을 따라 함몰된 이탈방지홈(110)이 형성될 수 있다. 이탈방지홈(110)이 형성되는 경우 제1 스프링(510) 또는 제2 스프링(520)이 흔들리지 않고 안정감 있게 인장 또는 압축하도록 한다. 지지부(410)에 형성되는 이탈방지홈홈은 하우징홈(110a)과 대향하는 방향에 형성되는 제1 지지부홈(110c)과, 걸림홈(110b)과 대향하는 방향에 형성되는 제2 지지부홈(110d)을 포함하여 구성될 수 있다. 지지부(410)에 형성되는 이탈방지홈(110c, 110d)은 전술한 하우징(100)에 형성되는 이탈방지홈(110a, 110b)과 기술적 특징이 동일하므로, 상세한 설명은 생략한다. 또한 이탈방지홈(110)에 보다 단단히 고정시킬 수 있도록 체결부재(미도시)를 이용하여 탄성부재(500)를 체결시킬 수 있다. 본 실시예에서는 예를 들어 형상기억합금으로 이루어진 제2 스프링(520)이 압축된 상태로 스핀들(400)에 삽입배치되고, 은막 도금한 일반 금속으로 이루어진 제1 스프링(510)이 압축된 상태로 스핀들(400)에 삽입배치될 수 있다. 각 스프링에는 일정 수준의 인장력이 요구되는데, 제1 스프링(510)의 인장력이 제2 스프링(520)의 인장력보다 큰 경우 제1 스프링(510)의 인장력에 의해 스핀들(400)이 제2 리드 단자(300)에 맞닿을 수 있다. 일정 수준의 전류에서는 제1 스프링(510)의 인장력에 의해 스핀들(400)이 제2 리드 단자(300)에 전기적으로 접속되어 있다. 과전류가 흐르는 경우에는 스프링에 열이 가해지고, 특히 형상기억합금으로 된 제2 스프링(520)에 열이 가해져서 전이(변태)온도 이상 올라가면, 제2 스프링(520)은 인장된 형태로 변형하게 된다. 제2 스프링(520) 인장에 의해 제1 스프링(510)은 압축되고 결국 지지부(410)를 통해 스프링들에 연결된 스핀들(400)은 제2 리드 단자(300) 반대 방향으로 이동하여 제2 리드 단자(300)와 스핀들(400)이 단락하게 된다.

[57] 탄성부재(500)가 제1 판스프링(530) 및 제2 판스프링(540)으로 구비되어 하우징(100) 내측 밑면부와 스핀들(400) 밑면부 사이에 나란히 위치하는 경우, 판스프링(530, 540)이 흔들리지 않고 안정감 있게 인장 또는 압축할 수 있도록 이탈방지홈(110 : 110a, 110e)이 형성될 수 있다. 이때, 하우징(100) 내측 밑면부에는 하우징홈(110a)이 형성되고, 스핀들(400) 밑면부에는

하우징홈(110a)에 대향하여 스핀들홈(110e)이 더 형성될 수 있다. 스핀들홈(110e)은 전술한 하우징홈(110a)과 기술적 특징이 동일하므로, 상세한 설명은 생략한다. 본 실시예에서는 도 7에서 제1 판스프링(530)의 양단부는 각각 하우징홈(110a)과 스핀들홈(110e)에 안착되고, 제2 판스프링(540)의 양단부는 각각 하우징 내측 밑면부와 스핀들 밑면부에 결합된 것으로 나타내었지만, 제1 판스프링(530) 및 제2 판스프링(540) 모두 하우징홈(110a)과 스핀들홈(110e)에 안착된 형태로 구비될 수 있다. 그리고 이탈방지홈이 형성된 경우에는 판스프링 양단에 이탈방지홈(110a, 110e)에 장착될 수 있는 이탈방지부(531a, 531b)가 형성될 수 있다. 이탈방지부는 도 8의 (a) 도시된 바와 같이 판스프링의 양단에 볼록하게 돌출된 형태로 형성될 수도 있고, 도 8의 (b)에 도시된 바와 같이 이탈방지홈에 끼움결합하도록 형성되어 탈착가능하게 구비될 수도 있다. 탄성부재(500)가 판스프링(530, 540)으로 구비된 경우에도 전술한 코일 형태의 스프링(510, 520)의 경우와 동일한 원리로 인장 또는 압축하므로, 상세한 설명은 생략한다.

[58] 본 실시예에 따른 반복형 퓨즈는 제2 리드 단자(300)가 배치되는 하우징(100) 측에 배치되어 하우징(100)과 제2 리드 단자(300)를 절연시키는 절연체(130)를 더 구비할 수 있다. 본 실시예에서는 도 3에 도시된 바와 같이 절연체(130)가 하우징(100) 내측에 형성되어 제2 리드 단자(300)를 감싸 하우징(100)과 절연시키고, 제2 리드 단자(300)를 단단하게 고정시키는 역할을 한다. 절연체(130)가 구비되는 경우 탄성부재(500)의 일단이 절연체(130)에 고정될 수 있으며, 탄성부재(500)와 맞닿는 절연체(130) 부분에는 하우징(100)과 마찬가지로 이탈방지홈(110b)이 형성될 수 있다(도 3 참조).

[59] 본 실시예에 따른 반복형 퓨즈는 스핀들(400) 밑면부와 하우징(100) 내측 밑면부를 연결하는 연결 와이어(600)를 더 구비할 수 있다. 연결 와이어(600)는 스핀들(400)과 하우징(100)을 연결하여 지지하고 있기 때문에, 스핀들(400)이 탄성부재(500)에 의해 이동하더라도 스핀들(400)의 유격이나 흔들림을 감소시킬 수 있다. 또한 연결 와이어(600)가 금속과 같은 전도성 물질로 이루어진 경우 스핀들(400)과 하우징(100) 사이를 통전하는 역할을 한다.

[60] 하우징(100) 내측 밑면부에 접점판(700)이 더 구비될 수 있다. 접점판은 얇은 금속 플레이트로서, 스핀들(400)과 하우징(100)이 전기전 접촉을 더 용이하게 해준다. 접점판(700)이 구비되는 경우에는 연결 와이어(600)가 하우징 내측 밑면부가 아닌 접점판에 연결될 수 있다.

[61] 상기 예시에서는 탄성부재(제1 및 제2 스프링)의 안정적 설치를 위한 이탈방지홈(110)이 하우징(100), 절연체(130) 등에 형성되어 제1 스프링(510)의 하부측 및 제2 스프링(520)의 상부측에 각각 형성되는 것을 예시하였으나, 이러한 이탈방지홈(110)의 형성위치는 다양하게 변경할 수 있다. 또한 스핀들에 형성된 이탈방지홈(110) 역시 지지부(410)에 형성되는 것을 예시하였으나, 이탈방지홈(110)의 형성위치는 스핀들(400) 표면에서 다양하게 변경될 수 있다.

또한 이탈방지홈(110)의 형상은 도 5에 도시된 바와 같이 다양하게 변경되어 실시될 수 있다.

[62]

발명의 실시를 위한 형태

[63] 이하, 도면을 참조하면서 본 발명의 실시예에 따른 반복형 퓨즈의 작동 상태에 대해 설명한다.

[64] 도 6는 본 발명의 일 실시예에 따른 반복형 퓨즈의 작동을 나타내는 작동상태도이다. 도 6의 (a)는 일정한 전류가 인가되는 경우의 상태를 나타내며, 도 6의 (b)는 과전류가 인가되는 경우의 상태를 나타낸다.

[65] 도 6의 (a)에 도시된 바와 같이 제1 스프링(510) 및 제2 스프링(520)의 인장력의 상호작용에 의해, 스프링에 연결된 스핀들(400)이 제2 리드 단자(300)에 전기적으로 접속되어 있다. 제1 리드 단자(200)를 통해 기준치 이하의 전류가 인가되는 경우에는 제1 리드 단자(200)에 접속된 하우징(100)과 제1 스프링(510) 및 제2 스프링(520)을 통해 스핀들(400)로 전류가 흐른다. 또한 스핀들(400)이 제2 리드 단자(300)에 접속되어 있으므로 회로가 구성되어 전기전자 소자 쪽으로 전류가 흐르게 된다.

[66] 제1 리드 단자(200)에 기준치를 초과하는 과전류가 흐르는 경우에는 이와 접속된 제1 스프링(510) 및 제2 스프링(520)에도 과전류가 흐르고, 스프링들이 갖는 저항값에 의해 스프링들에 열이 생성되어 온도가 상승한다. 특히 형상기억합금으로 된 제2 스프링(520)에 열이 생성되면 원래 형상인 인장된 스프링 형태로 복귀한다. 도 6의 (b)에 도시된 바와 같이 제2 스프링(520)이 인장되면서 그 인장력에 의해 스핀들(400)은 제1 스프링(510)이 위치된 방향으로 이동하며, 이에 따라 제1 스프링(510)이 압축하게 된다.

[67] 이와 같이 제2 스프링(520)의 인장에 의해 스핀들(400)이 제2 리드 단자(300)와 단락이 되며, 제1 리드 단자(200)와 제2 리드 단자(300) 사이에는 전류가 흐르지 않는다. 이 때, 이러한 동작을 위해 제2 스프링(520)이 전이(변태) 온도 이하일 때의 인장력은 제1 스프링(510)의 인장력보다 작으며, 제2 스프링(520)이 전이(변태) 온도 이상일 때의 인장력은 제1 스프링(520)의 인장력보다 큰 것이 바람직하다.

[68] 이후, 스핀들(400)과 제2 리드 단자(300)의 단락에 의해 제2 스프링(520)에 전류가 흐르지 않으므로, 제2 스프링(520)의 온도는 내려가게 된다. 온도가 내려간 제2 스프링(520)은 온도에 의해 발생된 인장력이 소멸하고, 인장력이 소멸되면 제1 스프링(510)의 인장력에 의해 제2 스프링(520)은 다시 압축된다. 이에 따라 스핀들(400)이 이동하여 제2 리드 단자(300)에 다시 전기적으로 접속된다.

[69] 이와 같이 제1 스프링(510)과 제2 스프링(520)은 인장과 압축을 반복하게 되는데, 제1 스프링(510)의 양단은 각각 하우징(100)의 이탈방지홈(110a),

지지부(410)의 안착홈(420)에 의해 지지되어 제1 스프링(510)이 신축을 반복하더라도 제1 스프링(510)이 원래 위치에서 유격되거나 흔들리지 않는다. 제2 스프링(520) 양단 역시 각각 하우징(100)의 이탈방지홈(110b), 지지부(410)의 안착홈(420)에 의해 지지되어 제2 스프링(520)이 신축을 반복하더라도 제2 스프링(520)이 원래 위치에서 유격되거나 흔들리지 않는다.

[70] 본 실시에 및 본 명세서에 첨부된 도면은 본 발명에 포함되는 기술적 사상의 일부를 명확하게 나타내고 있는 것에 불과하며, 본 발명의 명세서 및 도면에 포함된 기술적 사상의 범위 내에서 당업자가 용이하게 유추할 수 있는 변형 예와 구체적인 실시 예는 모두 본 발명의 권리범위에 포함되는 것이 자명하다고 할 것이다.

청구범위

[청구항 1] 내부공간을 갖는 하우징;
상기 하우징 일측에 배치되는 제1 리드 단자;
상기 하우징과 절연되어 하우징 타측에 배치되는 제2 리드 단자;
상기 하우징 내부에 배치되어 상기 제1 리드 단자와 전기적으로 접속되며 상기 제2 리드 단자와 단속(斷續)되는 스핀들;
상기 하우징 내부에 설치되어 상기 스핀들과 연결되며, 상기 제2 리드 단자와 스핀들을 단속시키는 탄성부재; 및
상기 하우징 내측에 형성되며, 상기 탄성부재 일부가 안착되어 탄성부재의 유격을 방지하는 이탈방지홈;을 포함하는 반복형 퓨즈.

[청구항 2] 청구항 1에 있어서,
상기 하우징과 상기 제2 리드 단자 사이에 배치되어 상기 하우징과 상기 제2 리드 단자를 절연시키는 절연체를 더 구비하는 반복형 퓨즈.

[청구항 3] 청구항 1에 있어서,
상기 하우징 내주면 일측에 돌출형성되는 걸림턱을 포함하는 반복형 퓨즈.

[청구항 4] 청구항 2 또는 청구항 3에 있어서,
상기 이탈방지홈은 하우징 내측 밑면부에 형성되는 하우징홈과,
상기 하우징홈과 대향하며 상기 절연체의 일면 또는 걸림턱에 형성되는 걸림홈을 포함하는 반복형 퓨즈.

[청구항 5] 청구항 1 내지 청구항 3 중 어느 한 항에 있어서,
상기 스핀들 몸체의 외주면 일측에 돌출 형성되며, 상기 탄성부재를 스핀들에 지지시키는 지지부를 더 포함하는 반복형 퓨즈.

[청구항 6] 청구항 5에 있어서,
상기 이탈방지홈은 지지부의 적어도 일측에 형성되는 반복형 퓨즈.

[청구항 7] 청구항 5에 있어서,
상기 이탈방지홈은 상기 하우징의 내면, 하우징의 걸림턱, 상기 절연체, 또는 상기 스핀들의 지지부에 적어도 두 군데 이상 형성되는 반복형 퓨즈.

[청구항 8] 청구항 1에 있어서,
상기 이탈방지홈은 만곡된 형상 또는 수직단면부가 다각형 형상으로 함몰되어 형성되는 반복형 퓨즈.

[청구항 9] 청구항 1에 있어서,

상기 이탈방지홈은 내부보다 입구가 더 좁은 반복형 퓨즈.

[청구항 10] 청구항 1에 있어서,
상기 스핀들의 끝단은 볼록한 만곡부로 형성되는 반복형 퓨즈.

[청구항 11] 청구항 1에 있어서,
상기 스핀들 밑면부와 상기 하우징 내측 밑면부를 연결하는 연결 와이어를 더 구비하는 반복형 퓨즈.

[청구항 12] 청구항 1에 있어서,
하우징 내측 밑면부에 배치되는 접점판을 더 구비하는 반복형 퓨즈.

[청구항 13] 청구항 5에 있어서,
상기 탄성부재는 제1 스프링 및 제2 스프링을 포함하며,
제1 스프링 및 제2 스프링 중 적어도 하나는 형상기억합금을 포함하는 반복형 퓨즈.

[청구항 14] 청구항 13에 있어서,
상기 제1 스프링 및 제2 스프링은 상기 스핀들의 지지부를 경계로 분리 배치되어 스핀들을 감싸는 반복형 퓨즈.

[청구항 15] 청구항 14에 있어서,
상기 제1 스프링은 하우징 내측 밑면부와 지지부 사이에 위치하며,
상기 제2 스프링은 절연체의 일면과 지지부 사이 또는 걸림턱과 지지부 사이에 위치하는 반복형 퓨즈.

[청구항 16] 청구항 15에 있어서,
상기 이탈방지홈은
상기 하우징 내측 밑면부에 형성되는 하우징홈;
상기 하우징홈에 대향하며, 상기 절연체의 일면 또는 걸림턱에 형성되는 걸림홈;
상기 하우징홈에 대향하며, 상기 지지부의 일측에 형성되는 제1 지지부홈; 및
상기 걸림홈에 대향하며, 상기 지지부의 일측에 형성되는 제2 지지부홈;을 포함하는 반복형 퓨즈.

[청구항 17] 청구항 5에 있어서,
상기 탄성부재는 제1 판스프링 및 제2 판스프링을 포함하는 반복형 퓨즈.

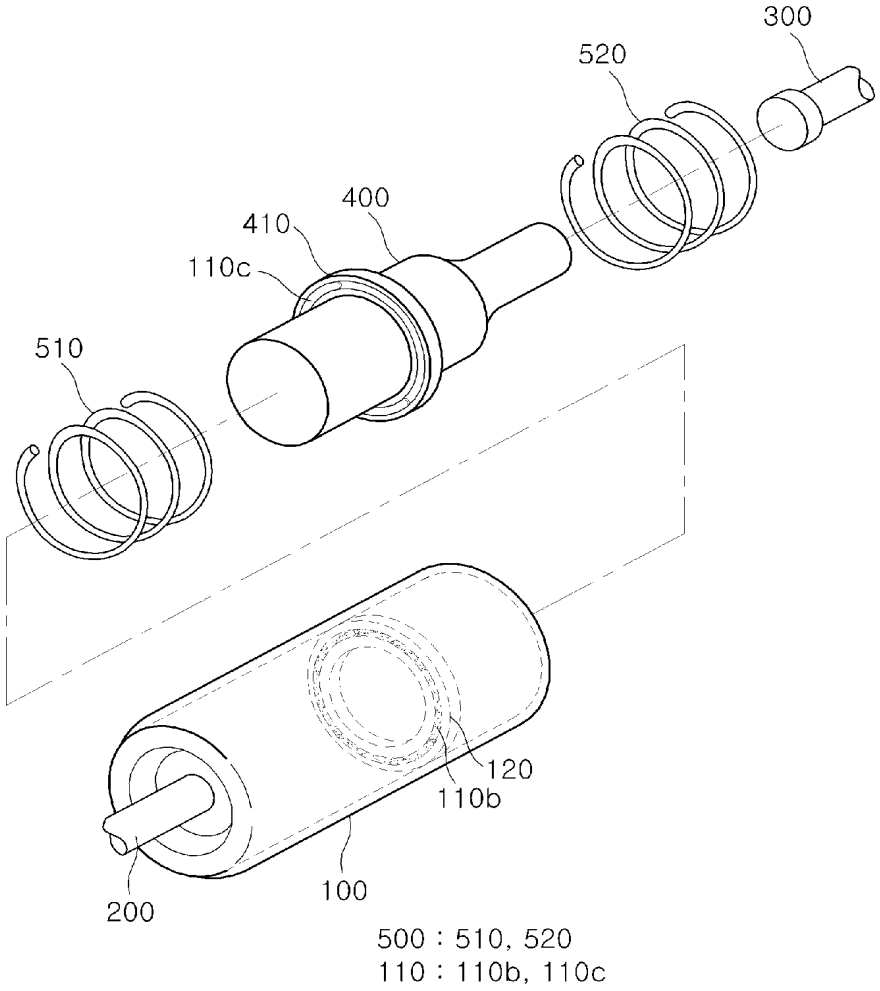
[청구항 18] 청구항 17에 있어서,
제1 판스프링 및 제2 판스프링은 상기 스핀들 밑면부와 하우징 내측 밑면부 사이에 나란히 위치하는 반복형 퓨즈.

[청구항 19] 청구항 18에 있어서,
상기 이탈방지홈은
상기 하우징 내측 밑면부에 형성되는 하우징홈;

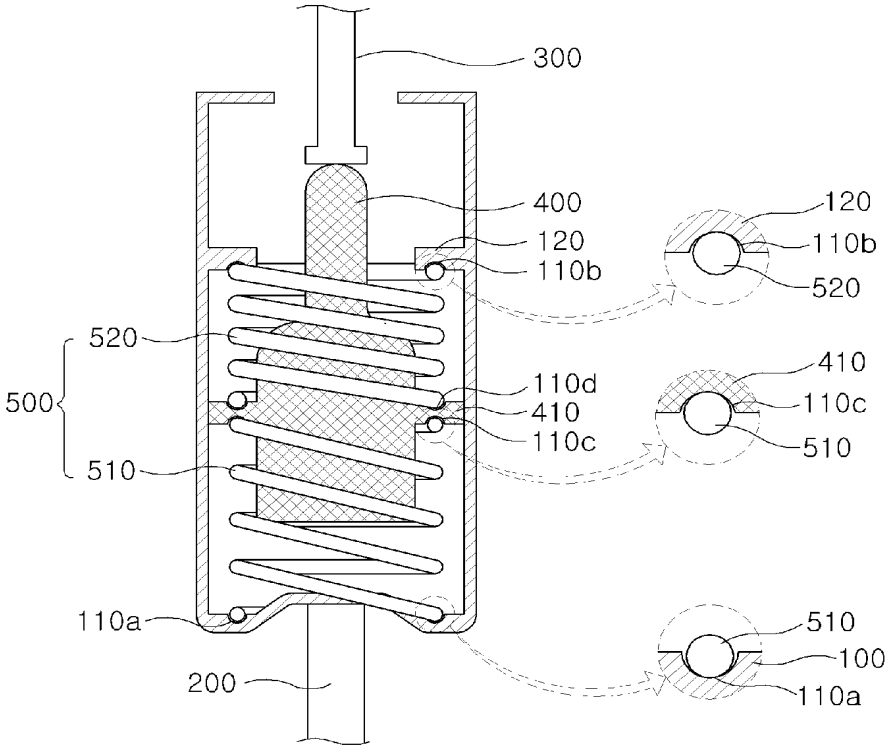
상기 하우징홈에 대향하며, 상기 스핀들 밑면부에 형성되는 스핀들홈;을 포함하는 반복형 퓨즈.

[청구항 20] 청구항 19에 있어서,
상기 제1 판스프링 및 제2 판스프링의 양단에는 이탈방지부가 구비되어 상기 하우징홈 및 스핀들홈에 각각 장착되는 반복형 퓨즈.

[Fig. 1]

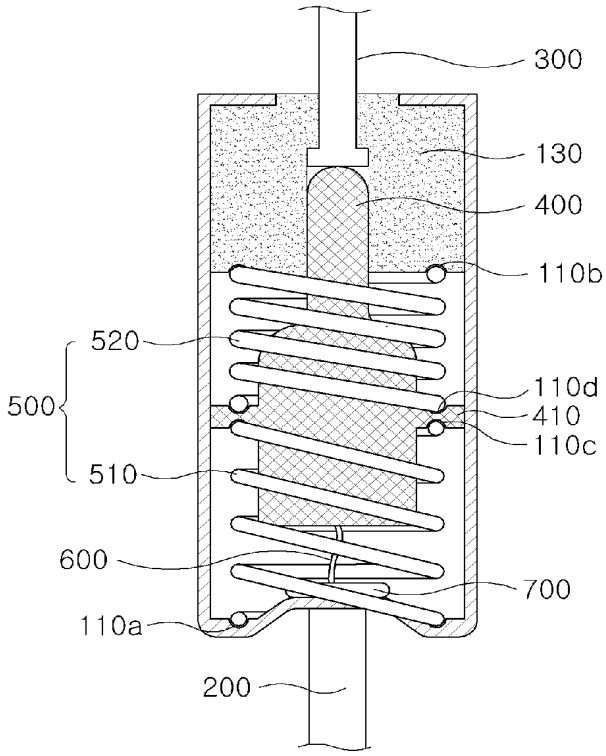

300
520
400
410
110c
510
120
110b
100
200
500 : 510, 520
110 : 110b, 110c

[Fig. 2]



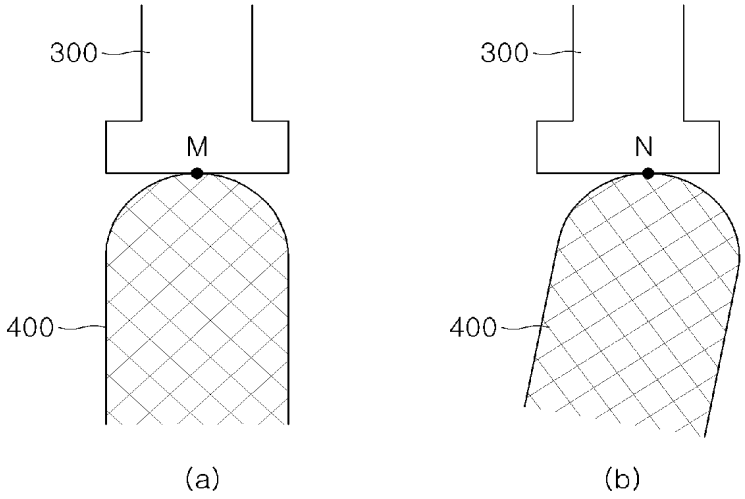
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420 : 420a,420b

[Fig. 3]

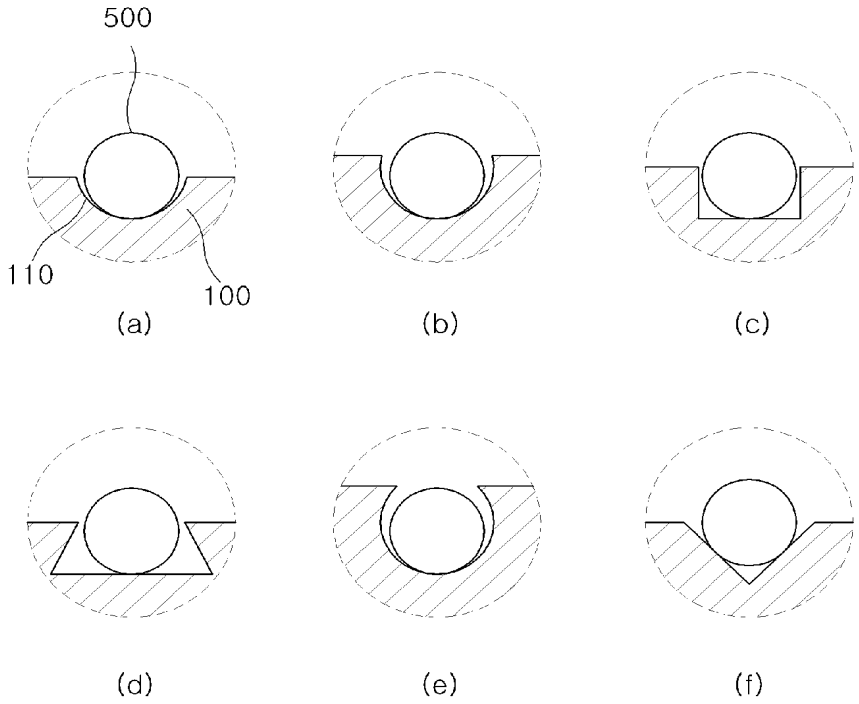


110 : 110a, 110b,110c, 110d
420 : 420a,420b

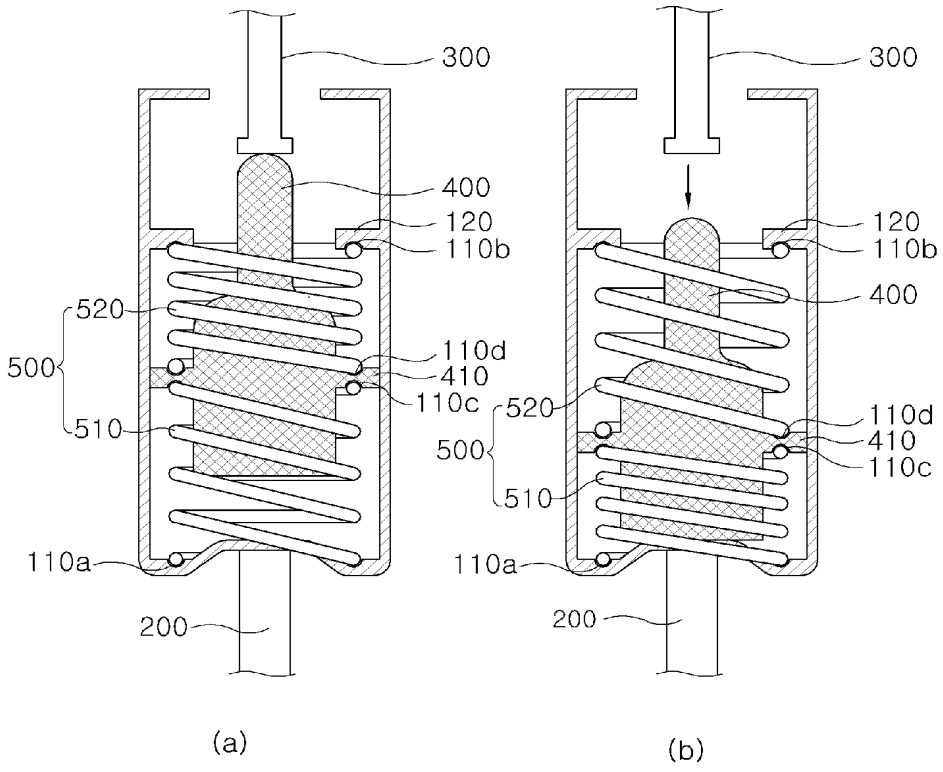
[Fig. 4]



[Fig. 5]

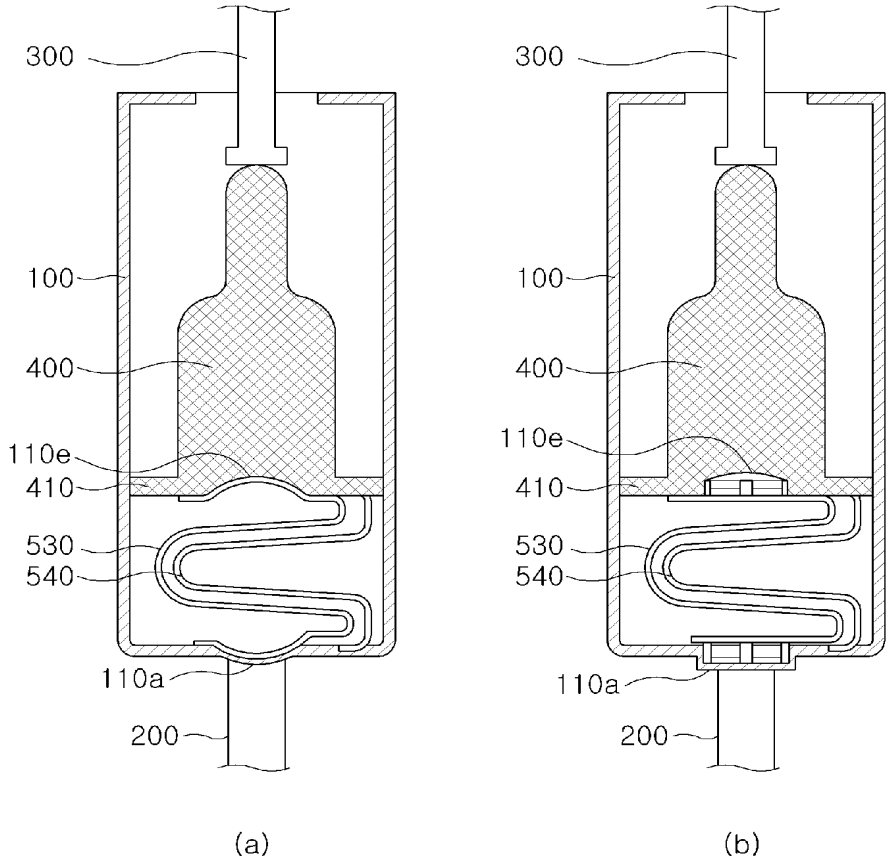


[Fig. 6]

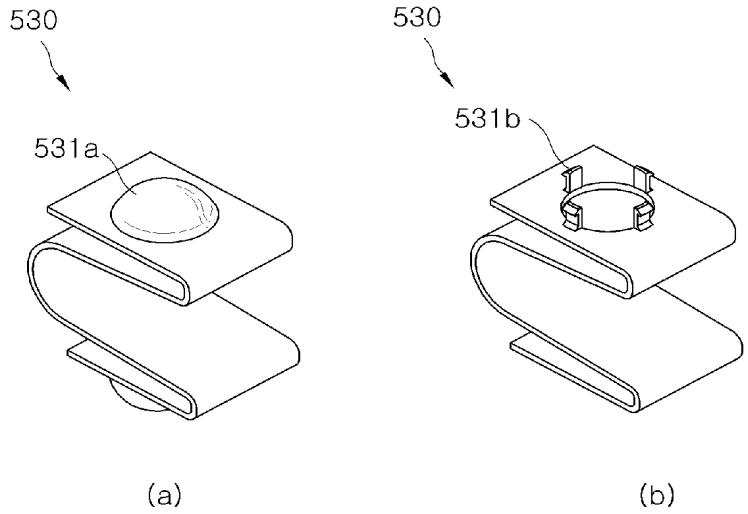


110 : 110a, 110b,110c, 110d
420 : 420a,420b

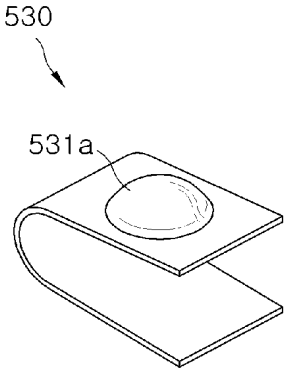
[Fig. 7]


300
100
400
110e
410
530
540
110a
200
(a)
300
100
400
110e
410
530
540
110a
200
(b)

[Fig. 8]



(a) (b)



(c)

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/301,609	**12/22/2022 07:54:51 PM ET**	**S4079.10001US03**

Title of Invention

LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	3509	FILED BY	Brian Gonzalez
PATENT CENTER #	61346111	FILING DATE	04/08/2021
CUSTOMER #	97149	FIRST NAMED INVENTOR	Dean Solon
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Eric Maschoff

Documents

TOTAL DOCUMENTS: 12

DOCUMENT		PAGES	DESCRIPTION	SIZE (KB)
2022.12.22 OA Response_S4079.10001US03.pdf		9	-	294 KB
2022.12.22 OA Response_S4079.10001US03-A....pdf	(1-1)	1	Amendment/Request for Reconsideration-After Non-Final Rejection	133 KB
2022.12.22 OA Response_S4079.10001US03-CLM.pdf	(2-5)	4	Claims	151 KB
2022.12.22 OA Response_S4079.10001US03-REM.pdf	(6-9)	4	Applicant Arguments/Remarks Made in an Amendment	218 KB

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WO1990011608.pdf	16	Foreign Reference	648 KB
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(81) Bestimmungsstaaten: AT (europäisches Patent), AU, BE (europäisches Patent), BG, BR, CA, CH (europäisches Patent), DE (europäisches Patent), DK (europäisches Patent), ES (europäisches Patent), FI, FR (europäisches Patent), GB (europäisches Patent), HU, IT (europäisches Patent), JP, KR, LK, LU (europäisches Patent), NL (europäisches Patent), NO, RO, SE (europäisches Patent), SU, US.

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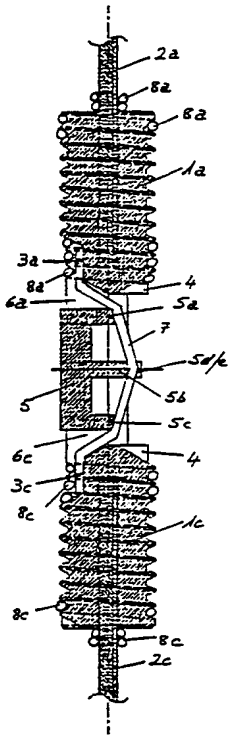
(54) Bezeichnung: SCHMELZSICHERUNG

(57) Abstract

In order to protect in particular electronic circuits from overheating, current or voltage surges, and transients, a fuse is proposed which includes a fuse wire (7) between two connecting wires (8a, 8c), conveniently in the form of resistance wires, on a fuse body (1). The fuse wire (7) is routed over several partitions (5a, 5b, 5c), advantageously three of different heights, and through two openings (6a, 6c) in the central zone (1b) of the fuse body, to connector points (3a, 3c) where it is connected to the resistance wires (8a, 8c). The fuse provides protection simultaneously against voltage and current overloads, transients and thermal overloads, and can readily be incorporated in any circuit since it is about the size of a resistor.

(57) Zusammenfassung

Um insbesondere empfindliche elektronische Schaltungen vor thermischer Überhitzung und Strom- oder Spannungsstössen sowie Transienten zu sichern, wird eine Schmelzsicherung vorgeschlagen, die auf einem Sicherungskörper (1) zwischen zwei Verbindungsdrähten (8a, 8c), vorteilhafterweise in Form von Widerstandsdrähten, einen Schmelzdraht (7) umfasst, der über mehrere, vorteilhafterweise drei unterschiedliche Höhen aufweisende Querwandungen (5a, 5b, 5c) und durch zwei Öffnungen (6a, 6c) im mittleren Bereich (1b) des Sicherungskörpers zu Anschlussstellen (3a, 3c) für die Verbindung mit den Widerstandsdrähten (8a, 8c) geführt ist. Diese Schmelzsicherung dient gleichzeitig als Überspannungs-, Überstrom-, Transienten und Thermosicherung und ist problemlos in jede Schaltung einsetzbar, da sie lediglich ungefähr die Grösse eines Widerstandes aufweist.



SECTION A-A
SCHNITT A-A

+ Siehe Rückseite

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BENENNUNGEN VON "DE"

Bis auf weiteres hat jede Benennung von "DE" in einer internationalen Anmeldung, deren internationaler Anmeldetag vor dem 3. Oktober 1990 liegt, Wirkung im Gebiet der Bundesrepublik Deutschland mit Ausnahme des Gebietes der früheren DDR.

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SCHMELZSICHERUNG

Die vorliegende Erfindung betrifft eine Schmelzsicherung gemäss dem Oberbegriff des Patentanspruchs 1.

Insbesondere empfindliche elektronische Schaltungen, wie sie beispielsweise in aufwendigen Steuerungen, Computern, etc. zur Anwendung gelangen, werden in der Regel mittels Schmelzsicherungen vor überhöhten Spannungen oder Strömen gesichert, um deren Zerstörung zu verhindern. Dies ist speziell überall dort von Vorteil, wo relativ einfache und billige Netzteile verwendet werden, die die über die öffentliche Stromversorgung, resp. das Stromnetz zur Verfügung gestellte Spannung mit ihren Variationen und Stromstössen nicht zu glätten, kompensieren oder auszufiltern vermögen.

Herkömmliche Schmelzsicherungen, die üblicherweise aus einem Widerstands- oder Schmelzdraht bestehen, der in einem Glasröhrchen zwischen zwei Kontaktschuhe eingespannt ist, oder die ähnlich aufgebaut sind, sind nicht in der Lage, in der Stromversorgung kurzfristig auftretende Transienten zu unterdrücken und schnell genug auf Ueberhitzungen der Schaltung zu reagieren, um diese vor hitzebedingten Schäden zu bewahren. Unerwünschte Transienten werden daher in den herkömmlichen elektronischen Schaltungen, mittels diskreten Vorwiderständen eliminiert und separate Thermosicherungen werden für die Schicherung der Schaltungen und/oder Geräte gegen Ueberhitzung eingesetzt.

Der vorliegenden Erfindung liegt die Aufgabe zugrunde, eine Schmelzsicherung zu schaffen, die einen nachgeschalteten

Verbraucher, beispielsweise in Form einer elektronischen Schaltung, gleichzeitig gegen Ueberspannungen, Ueberströme und Transienten spwoe Ueberhitzung sichert und in ihren Abmessungen möglichst klein ist und auf jeden der erwähnten Störfaktoren einzeln so schnell reagiert, dass der Verbraucher mit Sicherheit vor Schäden bewahrt bleibt. Die neue Schmelzsicherung soll ferner mechanisch so konstruiert sein, dass mit Sicherheit vermieden wird, dass beim sogenannten Durchbrennen der Sicherung verflüssigter Schmelzdraht nach dem Abtropfen und Wiedererstarren eine neue elektrisch leitende Verbindung zwischen den beiden Sicherungskontakten herstellen kann.

Erfindungsgemäss wird diese Aufgabe durch eine Schmelzsicherung gelöst, wie sie im Patentanspruch 1 definiert ist.

Der Aufbau und die Funktion einer vorteilhaften Ausführungsvariante einer solchen erfindungsgemässen Schmelzsicherung wird hiernach anhand der Zeichnung erläutert. In Letzterer zeigt

Fig. 1 den Körper einer solchen erfindungsgemässen Schmelzsicherung von oben gesehen, ohne eingelegte Schmelz- und Widerstandsdrähte,

Fig. 2 den Schmelzsicherungskörper nach Fig. 1 im Längsschnitt entlang der Linie A-A, wobei der Schmelzdraht eingelegt und Widerstandsdrähte angedeutet sind.

Man erkennt in den Fig. 1 und 2 einen Körper 1 einer erfindungsgemässen Schmelzsicherung, welcher Körper im wesentlichen drei Körperbereiche 1a, 1b, und 1c umfasst und vorteilhafterweise aus Kunststoff oder Keramik besteht. Die Körperbereiche 1a und 1c können einander identisch und spiegelbildlich bezüglich einer Symmetrieachse B-B mit dem mittleren Körperbereich 1b verbunden sein. Sie sind

vorteilhafterweise mit je einem Anschlussdraht 2a, resp. 2c bestückt, die dem Einlöten der erfindungsgemässen Schmelzsicherung z.B. in eine gedruckte Schaltung dienen können. Es ist günstig, wenn die beiden seitlichen Körperbereiche 1a und 1c im wesentlichen einen kreisrunden Querschnitt aufweisen und schraubenähnlich geformt sind. Da, wo sie in den mittleren Körperbereich 1b übergehen, weisen die beiden äusseren Körperbereiche 1a und 1c vorteilhafterweise je eine Abflachung 3a und 3c auf, deren Funktion weiter unten beschrieben wird.

Der mittlere Körperbereich 1b ist in Draufsicht vorteilhafterweise im wesentlichen rechteckig gestaltet und weist eine Umrandung 4 auf, innerhalb von welcher ein zentraler Block 5 mit drei Querwandungen 5a, 5b und 5c angeordnet ist. Die mittlere Querwandung 5b ist dabei höher als die beiden anderen Querwandungen 5a und 5c, an welche sich je eine Oeffnung 6a resp. 6c anschliesst. Die äusseren Bereiche 5d und 5e der mittleren Querwandung 5b sind vorteilhafterweise bis auf die Höhe der Umrandung 4 hochgezogen und dienen dem Schmelzdraht 7 als seitliche Begrenzungen, resp. Anschläge.

Wie aus Fig. 2 ersichtlich ist, wird der Schmelzdraht 7, bei dem es sich vorteilhafterweise um einen Flachdraht aus einer eutektischen Blei-Wismuth-Legierung mit einem Schmelzpunkt von ca. 125° C handelt, von der Abflachung 3a am seitlichen Körperbereich 1a durch die Oeffnung 6a im mittleren Körperbereich 1b über die drei Querwandungen 5a, 5b und 5c und durch die Oeffnung 6c zur Abflachung 3c am seitlichen Körperbereich 1c geführt. An beiden Abflachungen 3a und 3c steht er in elektrischem Kontakt mit in den schraubenförmigen Rillen der seitlichen Körperbereiche 1a und 1c eingelegten Widerstandsdrähten 8a und 8c, die ihrerseits auch mit den jeweiligen Kontaktdrähten 2a, resp. 2c derart verbunden sind, dass sie um diese herumgewickelt werden. Dadurch entsteht eine elektrische Verbindung zwischen dem Anschlussdraht 2a und dem

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Anschlussdraht 2c, die über den Widerstandsdraht 8a, den Schmelzdraht 7 und den Widerstandsdraht 8c führt. Zwecks Erhöhung der Kontaktsicherheit können die Kontaktzonen Anschlussdraht 2a / Widerstandsdraht 8a, Widerstandsdraht 8a / Schmelzdraht 7 sowie Schmelzdraht 7 / Widerstandsdraht 8c und Widerstandsdraht 8c / Anschlussdraht 2c mit einem elektrisch leitenden Kleber, beispielsweise einem kupfer- oder silberhaltigen Zweikomponentenkleber, bedeckt werden. Aufgrund der tiefen Schmelztemperatur des Schmelzdrahtes 7 ist ein Verlöten des Schmelzdrahtes 7 mit den Widerstandsdrähten 8a und 8c sehr schwierig und kaum rationell möglich, aber bei entsprechender Wahl des Lotes nicht ausgeschlossen. Die drei Körperbereiche 1a, 1b und 1c der beschriebenen Ausführungsvariante einer erfindungsgemässen Schmelzsicherung werden zwecks Vermeidung mechanischer Beschädigungen des Schmelzdrahtes und der Widerstandsdrähte vorteilhafterweise in ein Kunststoffröhrlein, möglichst in Form eines Schrumpfschlauches, gelegt, derart, dass ein Bauteil entsteht, das sowohl dem Aussehen nach wie auch in punkto Dimensionen im wesentlichen einem Widerstand entspricht.

Der Fachmann erkennt leicht, dass das Einlegen eines Schmelzdrahtes zwischen zwei Widerstandsdraht-Wicklungen, von denen jede als Vorwiderstand dient, vorteilhaft ist und die Schmelzsicherung in beiden Einbaurichtungen gegen Transienten unempfindlich macht, da diese durch den jeweiligen Vorwiderstand weitgehend eliminiert werden. Die Verwendung eines flachen, im wesentlichen einen rechteckigen Querschnitt aufweisenden Schmelzdrahtes unterstützt dabei die Wirkung des Vorwiderstandes.

Die Verwendung eines Schmelzdrahtes mit einer Schmelztemperatur von nur ca. 125° C ist ebenfalls sehr vorteilhaft und kann praktisch nur dank der erfindungsgemässen Verbindung eines Schmelzdrahtes mit Widerstandsdraht-Vorwiderständen auf einem Sicherungskörper realisiert werden. Dabei ist zu berücksichtigen, dass bei Bedarf auf die

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Widerstandsdraht-Wicklungen verzichtet werden kann und an deren Stelle niederohmige Verbindungsdrähte die elektrische Verbindung zwischen Schmelzdraht und Anschlussdrähten herstellen können. Durch diese oder die Widerstandsdrähte ist der Schmelzdraht 7 thermisch genügend von den Anschlussdrähten isoliert, derart, dass diese problemlos z.B. in eine gedruckte Schaltung eingelötet werden können, ohne dass das Risiko besteht, dass der Schmelzdraht dadurch zum Schmelzen gebracht wird. Andererseits gestattet es der tiefe Schmelzpunkt der eutektischen Blei-Wismuth-Legierung aber, die Schmelzsicherung auch als Thermosicherung einzusetzen, die abschmilzt, bevor eine Ueberhitzung im Bereich der die Schmelzsicherung tragenden Schaltung dieser Schaden zufügen kann.

Der Fachmann erkennt weiter, dass die Formgebung des zentralen Blockes 5 mit seinen drei Querwandungen 5a, 5b und 5c grosse Vorteile gegenüber herkömmlichen Schmelzsicherungen bietet, denn in keiner Lage der Schmelzsicherung kann durchgebrannter und abgeschmolzener Schmelzdraht eine die beiden verbleibenden Schmelzdrahtenden verbindende Schmelzspur bilden.

Der Fachmann erkennt, dass es durchaus möglich ist, die erfindungsgemässe Schmelzsicherung im Detail anders aufzubauen als dies beim beschriebenen vorteilhaften Ausführungsbeispiel der Fall ist. Derartige konstruktive Aenderungen liegen im Bereiche dessen, was der Fachmann ohne erfinderisches Dazutun schaffen kann und werden daher hier nicht näher umschrieben.

Die hiervor beschriebene und in der Zeichnung dargestellte Ausführungsvariante einer erfindungsgemässen Schmelzsicherung lässt sich automatisch und in grossen Serien kostengünstig herstellen. Die Höhe des Schaltstromes kann durch eine adäquate Dimensionierung des Querschnittes des Schmelzdrahtes bestimmt werden. Der Wert der beiden Vorwiderstände ist durch eine entsprechende Wahl eines Widerstandsdrahtes ebenfalls problemlos einstellbar.

Es ist selbstverständlich, dass je nach Einsatzart der erfindungsgemässen Schmelzsicherung die Anschlussdrähte 2a und 2c beispielsweise durch Kontaktschuhe ersetzt werden können, die in bekannter Art und Weise auf die beiden Enden der seitlichen Körperbereiche 1a und 1c aufsetzbar sind.

Die erfindungsgemässe Schmelzsicherung bietet gegenüber den bekannten Elementen dieser Art wesentliche Vorteile, die insbesonder darin liegen, dass ein einziges klein dimensioniertes diskretes Element mehrere Funktionen erfüllen kann.

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PATENTANSPRUECHE

1. Schmelzsicherung mit einem Sicherungskörper (1) und einem zwischen zwei Anschlüssen (2) angeordnetem Schmelzdraht (7), dadurch gekennzeichnet, dass zwischen dem Schmelzdraht (7) und den Anschlüssen (2a, 2c) je ein auf je einem seitlichen Bereich (1a, 1c) des Sicherungskörpers (1) aufgewickelter Verbindungsdraht (8a, 8c) angeordnet ist und dass der Schmelzdraht (7) in einem mittleren Bereich (1b) des Sicherungskörpers (1) angeordnet ist, der mehrere Querwandungen (5a, 5b, 5c) unterschiedlicher Höhe sowie Oeffnungen (6a, 6c) für das Durchführen des Schmelzdrahtes (7) aufweist.

2. Schmelzsicherung nach Anspruch 1, dadurch gekennzeichnet, dass die seitlichen Bereiche (1a, 1c) des Sicherungskörpers (1) je eine Abflachung (3a, 3c) aufweisen, die der elektrischen Verbindung zwischen Schmelzdraht (7) und Verbindungsdraht (8a, 8c) dienen.

3. Schmelzsicherung nach Anspruch 1, dadurch gekennzeichnet, dass die Verbindungsdrähte (8a, 8c) Widerstandsdrähte sind.

4. Schmelzsicherung nach Anspruch 1, dadurch gekennzeichnet, dass der mittlere Bereich (1b) des Sicherungskörpers (1) eine rundum gehende Umrandung (4) aufweist, innerhalb von welcher die drei Querwandungen (5a, 5b, 5c) angeordnet sind, von denen die mittlere (5b) die grösste Höhe aufweist.

5. Schmelzsicherung nach Anspruch 1, dadurch gekennzeichnet, dass die seitlichen Bereiche (1a, 1c) des Sicherungskörpers (1) schraubenförmig ausgebildet sind.

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6. Schmelzsicherung nach Anspruch 4, dadurch gekennzeichnet, dass die mittlere Querwandung (5b) an ihren seitlichen Randbereichen (5d, 5e) erhöht ist.

7. Schmelzsicherung nach Anspruch 1, dadurch gekennzeichnet, dass der Sicherungskörper (1) mit eingelegtem Schmelzdraht (7) und aufgewickelten Verbindungsdrähten (8a, 8c) in einem rohrförmigen Mantel untergebracht ist.

8. Schmelzsicherung nach Anspruch 1, dadurch gekennzeichnet, dass die Anschlüsse (2a, 2c) im Sicherungskörper (1) eingegossene Anschlussdrähte oder auf die seitlichen Bereiche (1a, 1c) des Sicherungskörpers (1) aufgesetzte Kontaktschuhe sind.

9. Schmelzsicherung nach Anspruch 1, dadurch gekennzeichnet, dass der Schmelzdraht (7) aus einer eutektischen Blei-Wismuth-Legierung mit einem Schmelzpunkt bei ungefähr 125° C besteht.

10. Schmelzsicherung nach Anspruch 9, dadurch gekennzeichnet, dass der Schmelzdraht (7) einen im wesentlichen rechteckigen Querschnitt aufweist.

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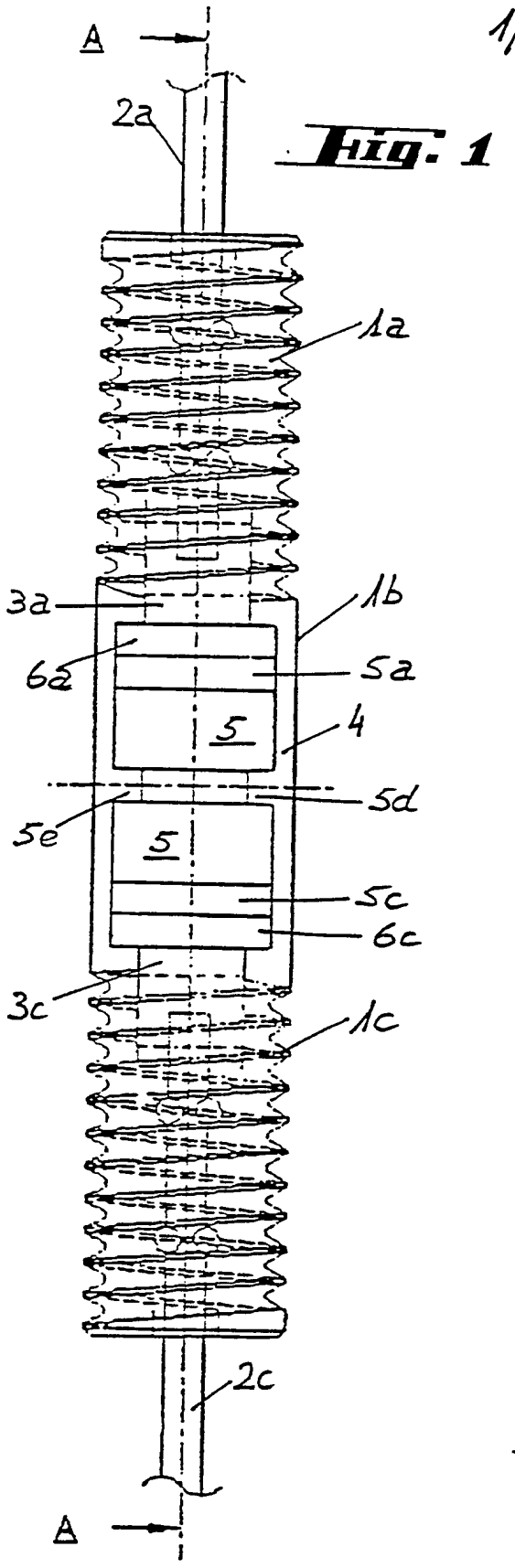


Fig. 1

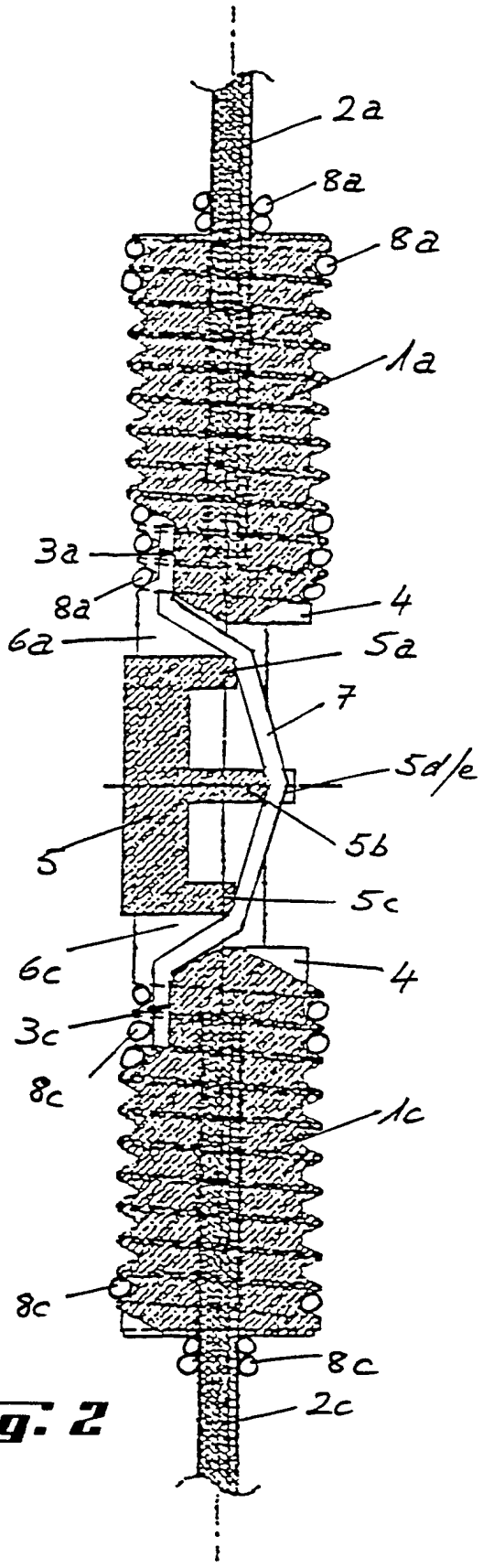


Fig. 2

Schnitt A-A

INTERNATIONAL SEARCH REPORT

International Application No PCT/CH 90/00071

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl.[5] H01H85/04

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
Int.Cl.[5]	H01H

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	GB, A, 2182811 (COOPER) 20 May 1987 see page 2, lines 65 - 115; figures 1-3	1, 3, 7
Y	US, A, 2017492 (GLOWACKI) 15 October 1935 see page 3, lines 11 - 67; figures 9-13	1, 3, 7
A		4, 6
A	GB. A. 2096844 (BESWICK) 20 October 1982 see claim 1	1
A	GB, A, 002301 A.D. 1914 (BERRY) 03 December 1914 see claim 1; figures 1, 2	1, 5
A	US, a, 1501018 (LIPPENCOT) 08 July 1924 see claim 1; figure 13	1, 3
A	US, A, 3793560 (SCHULTHEIS) 19 February 1974 see claim 1	1, 9
A	DE, C, 312052 (KNUDSEN) 07 May 1919	

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"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

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
18 May 1990 (18.05.90)	14 June 1990 (14.06.90)
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	

Form PCT/ISA/210 (second sheet) (January 1985)

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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

PCT/CH 90/00071
SA 34977

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 18/05/90
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
GB-A-2182811	20-05-87	CA-A-	1253543	02-05-89
		DE-A-	3638042	14-05-87
		JP-A-	62113332	25-05-87
US-A-2017492		None		
GB-A-2096844	20-10-82	EP-A-	0076284	13-04-83
		WO-A-	8203724	28-10-82
US-A-1501018		None		
US-A-3793560	19-02-74	None		
DE-C-312052		None		

EPO FORM P0479

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

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen PCT/CH 90/00071

I. KLASSIFIKATION DES ANMELDUNGSGEGENSTANDS (bei mehreren Klassifikationssymbolen sind alle anzugeben)[6]

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

Int.Kl. 5 H01H85/04

II. RECHERCHIERTE SACHGEBIETE

Recherchierter Mindestprüfstoff [7]

Klassifikationssytem	Klassifikationssymbole
Int.Kl. 5	H01H

Recherchierte nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Sachgebiete fallen [8]

III. EINSCHLAGIGE VEROFFENTLICHUNGEN [9]

Art.°	Kennzeichnung der Veröffentlichung [11], soweit erforderlich unter Angabe der maßgeblichen Teile [12]	Betr. Anspruch Nr.[13]
Y	GB,A,2182811 (COOPER) 20 Mai 1987 siehe Seite 2, Zeilen 65 - 115; Figuren 1-3	1, 3, 7
Y A	US,A,2017492 (GLOWACKI) 15 Oktober 1935 siehe Seite 3, Zeilen 11 - 67; Figuren 9-13	1, 3, 7 4, 6
A	GB,A,2096844 (BESWICK) 20 Oktober 1982 siehe Anspruch 1	1
A	GB,A,002301 A.D.1914 (BERRY) 03 Dezember 1914 siehe Anspruch 1; Figuren 1, 2	1, 5
A	US,A,1501018 (LIPPENCOT) 08 Juli 1924 siehe Anspruch 1; Figur 13	1, 3
A	US,A,3793560 (SCHULTHEIS) 19 Februar 1974 siehe Anspruch 1	1, 9

° Besondere Kategorien von angegebenen Veröffentlichungen [10] :

"A" Veröffentlichung, die den allgemeinen Stand der Technik definiert, aber nicht als besonders bedeutsam anzusehen ist

"E" älteres Dokument, das jedoch erst am oder nach dem internationalen Anmeldedatum veröffentlicht worden ist

"L" Veröffentlichung, die geeignet ist, einen Prioritätsanspruch zweifelhaft erscheinen zu lassen, oder durch die das Veröffentlichungsdatum einer anderen im Recherchenbericht genannten Veröffentlichung belegt werden soll oder die aus einem anderen besonderen Grund angegeben ist (wie ausgefuhrt)

"O" Veröffentlichung, die sich auf eine mündliche Offenbarung, eine Benutzung, eine Ausstellung oder andere Maßnahmen bezieht

"P" Veröffentlichung, die vor dem internationalen Anmeldedatum, aber nach dem beanspruchten Prioritätsdatum veröffentlicht worden ist

-/--

"T" Spätere Veröffentlichung, die nach dem internationalen Anmeldedatum oder dem Prioritätsdatum veröffentlicht worden ist und mit der Anmeldung nicht kollidiert, sondern nur zum Verständnis des der Erfindung zugrundeliegenden Prinzips oder der ihr zugrundeliegenden Theorie angegeben ist

"X" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als neu oder auf erfinderischer Tätigkeit beruhend betrachtet werden

"Y" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als auf erfinderischer Tätigkeit beruhend betrachtet werden, wenn die Veröffentlichung mit einer oder menreren anderen Veröffentlichungen dieser Kategorie in Verbindung gebracht wird und diese Verbindung für einen Fachmann naheliegend ist

"&" Veröffentlichung, die Mitglied derselben Patentfamilie ist

IV. BESCHEINIGUNG

Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
18.MAI 1990	14. 06. 90
Internationale Recherchenbehörde	**Unterschrift des bevollmächtigten Bediensteten**
EUROPAISCHES PATENTAMT	DESMET W.H.G. Desmet Willy

Formblatt PCT/ISA/210 (Blatt 2) (Januar 1985)

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III. EINSCHLAGIGE VEROFFENTLICHUNGEN (Fortsetzung von Blatt 2)

Art °	Kennzeichnung der Veröffentlichung, soweit erforderlich unter Angabe der maßgeblichen Teile	Betr. Anspruch Nr.
A	DE,C,312052 (KNUDSEN) 07 Mai 1919	

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ANHANG ZUM INTERNATIONALEN RECHERCHENBERICHT ÜBER DIE INTERNATIONALE PATENTANMELDUNG NR.

PCT/CH 90/00071
SA 34977

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben.
Die Angaben über die Familienmitglieder entsprechen dem Stand der Datei des Europäischen Patentamts am 18/05/90
Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie		Datum der Veröffentlichung
GB-A-2182811	20-05-87	CA-A-	1253543	02-05-89
		DE-A-	3638042	14-05-87
		JP-A-	62113332	25-05-87
US-A-2017492		Keine		
GB-A-2096844	20-10-82	EP-A-	0076284	13-04-83
		WO-A-	8203724	28-10-82
US-A-1501018		Keine		
US-A-3793560	19-02-74	Keine		
DE-C-312052		Keine		

EPO FORM P0473

Für nähere Einzelheiten zu diesem Anhang : siehe Amtsblatt des Europäischen Patentamts, Nr.12/82

Espacenet

Bibliographic data: CN202797033 (U) — 2013-03-13

Photovoltaic counter current protector

Inventor(s): LV JIKUN; BAO CHENG; ZHOU ZHENGSHUANG; WU HAO ± (LV JIKUN, ; BAO CHENG, ; ZHOU ZHENGSHUANG, ; WU HAO)

Applicant(s): JIANGSU JIUDING SOLAR ENERGY SYSTEM CO LTD ± (JIANGSU JIUDING SOLAR ENERGY SYSTEM CO., LTD)

Classification: - international: ***H01L23/367; H01L31/048; H05K7/20***
- cooperative: H01L2924/0002 (EP); Y02E10/50 (EP) more

Application number: CN201220413313U 20120821

Priority number(s): CN201220413313U 20120821

Abstract of CN202797033 (U)

The utility model discloses a photovoltaic count current protector comprising an aluminum pedestal and a top cover, the top cover covers the pedestal to form a cavity, two terminal blocks respectively connected with an anode and a cathode of a cable connector are arranged in the cavity, the two terminal blocks are electrically connected through a current blocking diode, an inner surface of the pedestal is clamped with a ceramic seat, the two terminal blocks are fixed on the ceramic seat, an inner concave arc surface is arranged between the two terminal blocks on the ceramic seat, a pipe body outer circular surface of the current blocking diode fits with the inner concave arc surface, a top cover inner surface right above the current blocking diode is provided with a heat isolating plate, and a bottom of the pedestal is attached with a heat conductive silica gel pad. The photovoltaic counter current protector can enable the heat generated in work of the current blocking diode to be fast radiated through the terminal blocks, the ceramic seat, the pedestal, the heat conductive silica gel pad, and finally through an aluminium alloy frame of the photovoltaic assembly, heat radiation property of the counter current protector is greatly improved, and service life of the photovoltaic counter current protector is prolonged.

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(19)中华人民共和国国家知识产权局

(12)实用新型专利

(10)授权公告号 CN 202797033 U
(45)授权公告日 2013.03.13

(21)申请号 201220413313.6

(22)申请日 2012.08.21

(73)专利权人 江苏九鼎光伏系统有限公司
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代理人 王凌霄

(51)Int.Cl.
H01L 31/048(2006.01)
H01L 23/367(2006.01)
H05K 7/20(2006.01)

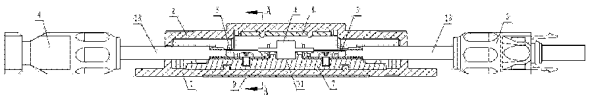
权利要求书 1 页 说明书 2 页 附图 1 页

(54)实用新型名称

光伏逆流保护器

(57)摘要

本实用新型公开了一种光伏逆流保护器，包括铝制的底座、上盖，在上盖盖在底座上后形成的腔体内，设有两个分别与电缆连接器的正极和负极相连的接线端子，两个接线端子通过阻流二极管电性连接，底座内表面卡设有陶瓷座，两个接线端子固定在陶瓷座上，陶瓷座上位于两个接线端子之间具有内凹弧面，阻流二极管的管体外圆面与所述内凹弧面相贴合，上盖内表面位于阻流二极管正上方设有隔热板，底座底面贴附有导热硅胶垫。本实用新型可使阻流二极管工作时产生的热量通过接线端子、陶瓷座、底座及导热硅胶垫，最终通过光伏组件的铝合金框快速散发出去，从而极大地提高了逆流保护器的散热性能，有利于延长光伏逆流保护器的使用寿命。



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1. 一种光伏逆流保护器，包括铝制的底座（1）、上盖（2），在上盖（2）盖在底座（1）上后形成的腔体内，设有两个分别与正极连接器（3）和负极连接器（4）相连的接线端子（5），两个接线端子（5）之间通过阻流二极管（6）电性连接，其特征是：所述底座（1）内表面卡设有陶瓷座（7），两个接线端子（5）固定在陶瓷座（7）上，陶瓷座（7）上位于两个接线端子（5）之间具有内凹弧面（71），阻流二极管（6）的管体外圆面与所述内凹弧面（71）相贴合，上盖（2）内表面位于阻流二极管（6）正上方设有隔热板（8），底座（1）底面贴附有导热硅胶垫（9）。

2. 根据权利要求 1 所述的光伏逆流保护器，其特征是：所述上盖（2）内绕陶瓷座（7）四周具有八个压住陶瓷座（7）边缘的支撑脚（10）。

3. 根据权利要求 1 所述的光伏逆流保护器，其特征是：所述底座（1）背面开设有可注入密封硅胶对所述腔体进行密封、增强导热效果的灌胶孔（11）和灌胶时用于排除内部空气的排气孔（12）。

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光伏逆流保护器

技术领域

[0001] 本实用新型涉及太阳能电池组件技术领域，尤其是一种光伏逆流保护器。

背景技术

[0002] 在光伏系统中，串联的各支路输出电压总有高低之差，如某一支路产生故障、阴影遮蔽等，都会使该支路的输出电压降低，高电压支路的电流就会流向低电压支路。对于离网系统当方阵不发电时，蓄电池的电流反过来流向组件或方阵，因此避免此类问题，在各支路中均串联接入有逆流保护器。目前，市场上太阳能发电系统所用的逆流保护器的壳体材料普遍使用工程塑料制作，这种结构的逆流保护器，普遍存在以下缺陷：首先，逆流保护器处于长期工作状态下，壳体内部的二极管会产生大量的热能，热量通过壳体内空气传导和对流传给壳体，壳体再通过传导将热量释放，但由于空气和塑料的导热性能差，壳体内的热量不能及时释放出来，造成了壳体内的温度不断升高，使得阻流二极管长期处在高温下工作而降低了使用寿命，同时过高的温度也加速了壳体的变形和老化，缩短了产品的使用寿命。

实用新型内容

[0003] 本实用新型要解决的技术问题是：克服现有技术中之不足，提供一种散热性能好、工作可靠稳定的光伏逆流保护器，延长光伏逆流保护器的使用寿命。

[0004] 本实用新型解决其技术问题所采用的技术方案是：一种光伏逆流保护器，包括铝制的底座、上盖，在上盖盖在底座上后形成的腔体内，设有两个分别与正极连接器和负极连接器相连的接线端子，两个接线端子之间通过阻流二极管电性连接，所述底座内表面卡设有陶瓷座，两个接线端子固定在陶瓷座上，陶瓷座上位于两个接线端子之间具有内凹弧面，阻流二极管的管体外圆面与所述内凹弧面相贴合，上盖内表面位于阻流二极管正上方设有隔热板，底座底面贴附有导热硅胶垫。

[0005] 进一步地，所述上盖内绕陶瓷座四周具有八个压住陶瓷座边缘的支撑脚。

[0006] 为方便灌注光伏密封硅胶，所述底座背面开设有可注入密封硅胶对所述腔体进行密封、增强导热效果的灌胶孔和灌胶时用于排除内部空气的排气孔。

[0007] 本实用新型的有益效果是：本实用新型将阻流二极管的管体外圆面与陶瓷座的内凹弧面相互贴合，使得阻流二极管工作时产生的热量最大面积地传递给陶瓷座并通过底座散发，上盖内表面设置的隔热板可将热量与上盖隔开，不至于造成上盖过热而损坏，底座底面贴附的导热硅胶垫在安装时与光伏组件的铝合金框紧密贴合，使得阻流二极管工作时产生的热量最终通过铝合金框快速散发出去，从而极大地提高了逆流保护器的散热性能，有利于延长光伏逆流保护器的使用寿命。

附图说明

[0008] 下面结合附图和实施方式对本实用新型进一步说明。

[0009] 图 1 是本实用新型的结构示意图。

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[0010] 图 2 是图 1 的仰视结构示意图。

[0011] 图 3 是图 1 中 A-A 的剖视结构示意图。

[0012] 图中 1. 底座 2. 上盖 3. 正极连接器 4. 负极连接器 5. 接线端子 6. 阻流二极管 7. 陶瓷座 71. 内凹弧面 8. 隔热板 9. 导热硅胶垫 10. 支撑脚 11. 灌胶孔 12. 透气孔 13. 线缆

具体实施方式

[0013] 现在结合附图对本实用新型作进一步的说明。这些附图均为简化的示意图仅以示意方式说明本实用新型的基本结构，因此其仅显示与本实用新型有关的构成。

[0014] 如图 1、图 2 所示的一种光伏逆流保护器，包括采用铝合金制作的底座 1、扣合盖于底座 1 上的上盖 2，上盖 2 与底座 1 通过位于四个边角的四个沉头自攻螺丝实现连接固定。

[0015] 在上盖 2 盖在底座 1 上后所形成的腔体内，底座 1 内表面设有一块陶瓷座 7，陶瓷座 7 背面有两个圆形孔，通过两个圆形孔与底座 1 上的两个圆柱凸点之间的配合实现陶瓷座 7 和底座 1 之间的定位安装，同时，上盖 2 内绕陶瓷座 7 四周具有八个压住陶瓷座 7 边缘的支撑脚 10，以实现陶瓷座 7 与底座 1 的紧密贴合。在陶瓷座 7 上通过圆头螺丝固定有两个相对于底座 1 中心对称设置的接线端子 5，两个接线端子 5，其中之一通过线缆 13 连接有正极连接器 3，另一个通过线缆 13 连接有负极连接器 4。在两个接线端子 5 之间设有阻流二极管 6，阻流二极管 6 的两个引脚与接线端子 5 上的折弯脚以焊锡的方式实现电性连接。陶瓷座 7 上位于两个接线端子 5 之间具有内凹弧面 71，阻流二极管 6 的管体外圆面与所述内凹弧面 71 相贴合，当阻流二极管 6 工作时，产生的热量绝大部分可由阻流二极管 6 的管体传递给陶瓷座 7，同时另外部分热量又通过阻流二极管 6 引脚传递到接线端子 5，进而由接线端子 5 传递到陶瓷座 7 上。

[0016] 上盖 2 内表面位于阻流二极管 6 正上方设有隔热板 8，上盖 2 内表面上有两个紧配柱，隔热板 8 上有两个通孔，通过挤压紧配柱变形，实现隔热板 8 与上盖 2 的紧配合，当阻流二极管 6 工作时，隔热板 8 能将热量与上盖 2 内表面隔开，不至于上盖 2 过热而变形。底座 1 底面有一个长方形凹形面，长方形凹形面内贴附有导热硅胶垫 9，在安装时，导热硅胶垫 9 可与太阳能组件铝合金边框紧密贴合。

[0017] 在底座 1 背面有一个灌胶孔 11 和两个排气孔 12，灌光伏密封硅胶时，胶由灌胶孔 11 进入，内部的空气由两个排气孔 12 排出，通过灌胶实现光伏逆流保护器腔体内部的密封绝缘。

[0018] 安装时，光伏逆流保护器通过四个 M4 螺丝穿过底座 1 四个边角处的通孔安装在太阳能组件铝合金边框上，具有高导热性的导热硅胶垫 9 保证了底座 1 与太阳能组件铝合金边框的紧密贴合，当阻流二极管 6 工作时，产生的大部分热量会通过接线端子 5、陶瓷座 7、底座 1、导热硅胶垫 9 之间的层层传递，最终通过太阳能组件的铝合金边框散发出去，从而大大提高了光伏逆流保护器的散热性能，确保了光伏逆流保护器的正常工作，达到延长光伏逆流保护器使用寿命的目的。

[0019] 上述实施方式只为说明本实用新型的技术构思及特点，其目的在于让熟悉此项技术的人士能够了解本实用新型的内容并加以实施，并不能以此限制本实用新型的保护范围，凡根据本实用新型精神实质所作的等效变化或修饰，都应涵盖在本实用新型的保护范围内。

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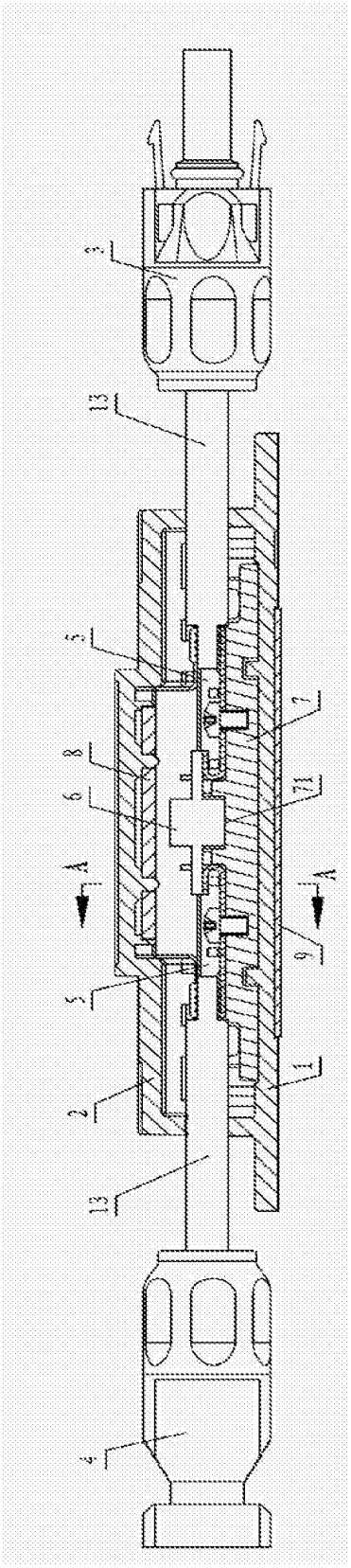


图 1

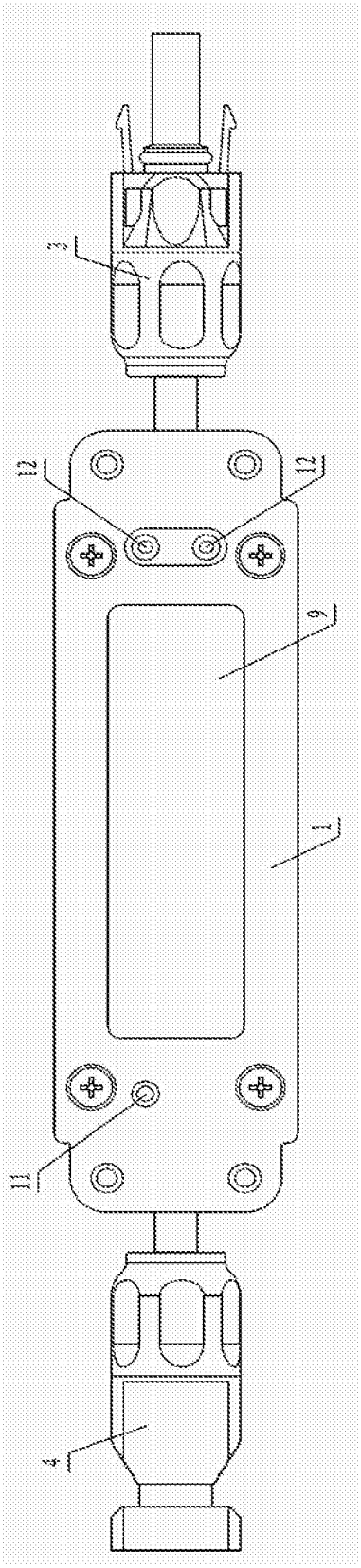


图 2

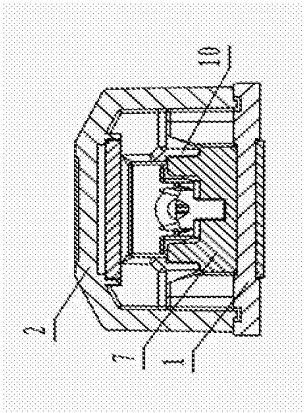


图 3

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Espacenet

Bibliographic data: DE202006007613 (U1) — 2006-08-17

Photovoltaic system for production of electrical energy, has thermal fuse provided in connecting lines between photovoltaic unit and hand-over point, where fuse has preset marginal temperature corresponding to fire temperature

Inventor(s):

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Classification:
- **international:** ***H02N6/00***
- **cooperative:** **H01H37/76 (EP)**; **H01L31/02021 (EP)**; Y02B10/10 (EP); Y02E10/50 (EP)

Application number: DE20062007613U 20060511

Priority number(s): DE20062007613U 20060511

Abstract of DE202006007613 (U1)

The system has a photovoltaic unit (12) for roofage or open space assembling. Electrical connecting lines (16) transfer direct current voltage to an electrical hand-over point (18) and/or to an inverter (19). A thermal fuse (20) is provided in the electrical connecting lines between the photovoltaic unit and the electrical hand-over point. The thermal fuse has a preset marginal temperature that corresponds to the temperature of fire.

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(51) Int Cl.[8]: ***H02N 6/00*** (2006.01)

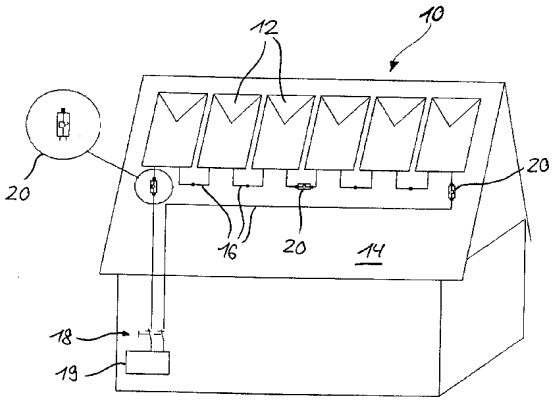
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Benninger und Partner, 93047 Regensburg

Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

(54) Bezeichnung: **Fotovoltaikanlage und Brandschutzsicherung hierfür**

(57) Hauptanspruch: Fotovoltaikanlage (10) mit wenigstens einem Fotovoltaikelement (12) zur Dach- oder Freiflächenmontage und mit elektrischen Verbindungsleitungen (16) zur Übertragung von Gleichspannung zu einer elektrischen Übergabestelle (18) bzw. zu einem Wechselrichter (19), gekennzeichnet durch eine thermische Sicherung in der elektrischen Verbindungsleitung (16) zwischen dem wenigstens einen Fotovoltaikelement (12) und der elektrischen Übergabestelle (18).



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Beschreibung

[0001] Die vorliegende Erfindung betrifft eine Fotovoltaikanlage mit den Merkmalen des Oberbegriffs des unabhängigen Anspruchs 1 sowie eine Brandschutzsicherung für eine Fotovoltaikanlage.

[0002] Fotovoltaikanlagen werden zur Erzeugung von elektrischer Energie durch Umwandlung von solarer Strahlungsenergie in vielfältigen Varianten eingesetzt. Bekannte Anordnungen sehen eine Vielzahl von einzelnen Fotovoltaikelementen vor, die bspw. auf Gebäudedächern oder auf Freiflächen aufgestellt und gruppiert sein können. Die einzelnen Elemente sind in der Regel in Gruppen in Serie geschaltet, so dass die bereitgestellte elektrische Gleichspannung zu einem Wechselrichter geleitet und in ein öffentliches Stromnetz eingespeist oder zu eigenen Verwendung bereitgestellt werden kann.

[0003] Im Schadens- oder Störfall, insbesondere bei Bränden, können die von der Anlage bereitgestellten elektrischen Spannungswerte jedoch zu Problemen führen, da bei den typischerweise auftretenden Brandtemperaturen die Leitungsisolierungen rasch verschmoren, so dass Kurzschlüsse entstehen können. Auftreffendes Löschwasser kann zusätzliche Probleme verursachen, da nicht isolierte Leitungsabschnitte in Verbindung mit dem Löschwasser zu Funkenüberschlägen führen können. Die Brandbekämpfung ist deshalb schwierig und für die Feuerwehrleute gefährlich. Zudem ist für die Brandbekämpfer nicht erkennbar, ob eine potenzielle Gefährdung durch stromführende offene Leitungen vorliegt oder nicht.

[0004] Ein Ziel der vorliegenden Erfindung besteht darin, eine Sicherung für Fotovoltaikanlagen zur Verfügung zu stellen, die im Störfall, insbesondere bei auftretenden Bränden, eine Gefährdung der Brandbekämpfer zuverlässig verhindern kann.

[0005] Dieses Ziel der Erfindung wird mit dem Gegenstand des unabhängigen Anspruchs erreicht. Merkmale vorteilhafter Weiterbildungen der Erfindung ergeben sich aus den abhängigen Ansprüchen.

[0006] Eine erfindungsgemäße Fotovoltaikanlage umfasst wenigstens ein Fotovoltaikelement zur Dach- oder Freiflächenmontage und eine elektrische Verbindungsleitung zur Übertragung von Gleichspannung zu einer elektrischen Übergabestelle. Die Erfindung sieht eine thermische Sicherung in der elektrischen Verbindungsleitung zwischen dem wenigsten einen Fotovoltaikelement und der elektrischen Übergabestelle vor. Die thermische Sicherung sorgt für eine Unterbrechung der Leitungsverbindung und damit der elektrischen Leitung bei einer definierbaren Grenztemperatur, typischerweise bei einer Temperatur, wie sie bei Bränden auftritt. Die erfindungsgemäße thermische Sicherung ermöglicht somit eine effektive Brandsicherung und verhindert dadurch, dass bei einem Gebäude- oder Anlagebrand das Verschmoren von elektrischen Leitungsisolierungen zur Spannungsüberschlägen, Funkenflug oder Kurzschlüssen führen kann, wodurch Brandbekämpfer wie Feuerwehrleute erheblich gefährdet werden können.

[0007] Als Thermosicherung kann insbesondere eine Schmelzsicherung zum Einsatz kommen, die bei einer von außen aufgebrachten Grenztemperatur von bspw. 180° C bis 220° C zu einer Unterbrechung einer elektrischen Verbindung führen kann. Die Grenztemperatur ist vorzugsweise so zu wählen, dass einerseits die hohen Temperaturen, die bei intensiver Sonneneinstrahlung auf die Kollektorflächen einwirken, nicht zu einer Unterbrechung der Leitungsverbindung führen, andererseits jedoch bei einem Brand eine Unterbrechung gewährleistet ist.

[0008] Vorzugsweise ist innerhalb einer Serienschaltung von mehreren Fotovoltaikelementen wenigstens eine Thermosicherung vorgesehen. Von Vorteil ist es, wenn innerhalb einer Gruppe von Fotovoltaikelementen, die mittels einer Thermosicherung von einer weiteren Gruppe von Fotovoltaikelementen getrennt ist, eine Teilspannung von maximal 120 Volt abfällt. Bis zu einer solchen Teilspannung ist die Gefahr von Funkenüberschlägen noch relativ gering, während oberhalb dieser Grenzspannung eine Gefährdung von Personen droht, die zur Brandbekämpfung eingesetzt sind.

[0009] Eine weitere Ausführungsvariante sieht vor, dass jeweils Gruppen von in Serie geschalteten Fotovoltaikelementen endseitig mit wenigstens einer Thermosicherung versehen sind. Insbesondere kann an jedem Leitungsanschluss einer Gruppe von in Serie geschalteten Fotovoltaikelementen jeweils eine Thermosicherung angeordnet sein. Mit mehreren solcher Thermosicherungen ist somit eine ausreichende Brandsicherung ermöglicht.

[0010] Eine erfindungsgemäße Ausführungsform sieht vor, dass die Thermosicherung als Unterbrechungskontakt oder -schalter ausgebildet ist, der bei einer definierbaren Grenztemperatur einen Leitungskontakt dauerhaft trennt. Die Thermosicherung kann insbesondere als Schmelzsicherung o. dgl. ausgebildet sein. Diese Schmelzsicherung kann insbesondere ein zylindrisches Gehäuse mit einer darin angeordneten vorgespannten Spiralfeder umfassen, deren vorgespanntes Ende mit einer Weichlotverbindung in einer der Stirnseiten des Gehäuses verankert ist, so dass bei Schmelzen des Weichlots die Spiralfeder entspannt und die elektrische Verbindung getrennt wird.

[0011] Die Schutzhülse kann bspw. aus Kunststoff

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oder Keramik bestehen, die Spiralfeder vorzugsweise aus einem elektrisch gut leitfähigen Material wie eine Kupferlegierung. Mit der Legierung des Weichlots kann die Schmelztemperatur definiert und auf einen sinnvollen Schmelzpunkt von ca. 180° C bis ca. 220 ° C eingestellt werden, die bei auftretenden Bränden für eine zuverlässige Trennung der elektrischen Verbindung sorgen kann. Wahlweise kann auch eine geeignete Schmelzpille zum Einsatz kommen, mittels derer die vorgespannte Spiralfeder unter Herstellung eines elektrischen Leitungskontakts verankert ist, so dass sie bei einer definierten Grenztemperatur gelöst und entspannt wird, wobei der elektrische Kontakt dauerhaft getrennt wird.

[0012] Eine besonders vorteilhafte Variante der Brandschutzsicherung sieht vor, dass die thermische Sicherung in eine Steckverbindung integriert sein kann, die in eine vorhandene Steckverbindungsleitung eingefügt werden kann. Die thermische Sicherung kann bspw. in einem kurzen Steckerabschnitt angeordnet sein, der zwischen eine Steckverbindung eingefügt und somit in jede Verbindungsleitung nachträglich integriert werden kann. Damit ist grundsätzlich ein Einbau in jeder Steckverbindung möglich, wodurch auch die Nachrüstung von Altanlagen problemlos sichergestellt ist. Wahlweise kann die Thermosicherung auch in einem Fotovoltaikelement, in einem Schaltkasten und/oder innerhalb der Leitungsverbindung angeordnet bzw. dort integriert sein.

[0013] Auf die beschriebene Weise ist ein vollständiger Schutz durch eine sichere Stringabschaltung im Brandfall ermöglicht. Durch mehrere Brandschutzsicherung im String, bspw. nach jedem dritten Modul, kann die Generatorspannung unter ein gefahrdrohendes Maß reduziert werden. Grundsätzlich ist die Konstruktion auf alle gängigen Fotovoltaik-Steckverbinder übertragbar.

[0014] Die thermische Sicherung ist vorzugsweise so auszulegen, dass sie mit Strömen von wenigstens zehn Ampere belastet werden kann und eine Spannungsfestigkeit von mehr als 1000 Volt aufweist. Auf diese Weise wird ein Spannungsüberschlag auch bei Spannungen von bis zu 1000 Volt zuverlässig verhindert. Die Auslösetemperatur kann in gewünschten Grenzen eingestellt werden, indem bspw. eine geeignete Lotverbindung oder Schmelzverankerung der Feder ausgewählt wird.

[0015] Die vorliegende Erfindung umfasst neben der Fotovoltaikanlage auch das thermische Sicherungselement, das die zuvor beschriebenen Merkmale aufweisen kann. Insbesondere kann das Sicherungselement eine vorgespannte Feder in einem Gehäuse aufweisen, wobei die Feder an einem Ende mittels einer Weichlotverbindung an einem der beiden Gehäusekontakte verankert ist, so dass bei Schmelzen des Weichlots die Feder entspannt wird und für eine Trennung der Kontaktverbindung zwischen den beiden herausgeführten elektrischen Kontakten sorgt. Die Gehäusewandung bzw. Schutzhülse kann bspw. aus Keramik oder einem anderen geeigneten Material gefertigt sein.

[0016] Die Erfindung wird nachfolgend anhand bevorzugter Ausführungsbeispiele unter Bezugnahme auf die beiliegenden Zeichnungen näher erläutert.

[0017] Fig. 1 zeigt in einer schematischen Darstellung den grundsätzlichen Aufbau einer erfindungsgemäßen Fotovoltaikanlage.

[0018] Fig. 2 zeigt in einer schematischen Schnittdarstellung den Aufbau einer Thermosicherung, die insbesondere zur Brandschutzsicherung einer Fotovoltaikanlage dient.

[0019] Fig. 3 zeigt eine mögliche Anordnung einer Thermosicherung in einem Steckermodul.

[0020] Die schematische Darstellung der Fig. 1 verdeutlicht eine Fotovoltaik-Anlage **10**, die mehrere flächige Fotovoltaikelemente **12** aufweist, die im gezeigten Ausführungsbeispiel auf einem geneigten Gebäudedach **14** montiert sind. Die Fotovoltaikelemente **12** können selbstverständlich auch in Freiflächenmontage angeordnet sein, bspw. auf einem Feld oder auf einer Wiese o. dgl. Die Fotovoltaikelemente **12** sind in der Regel gruppenweise in Serie (sog. „String", vgl. Fig. 1) und mehrere Gruppen ggf. parallel (nicht dargestellt) geschaltet. Die elektrische Verbindung zwischen den einzelnen Fotovoltaikelementen **12** erfolgt über elektrische Verbindungsleitungen **16**. Weiterhin ist eine elektrische Übergabestelle **18** erkennbar, die bspw. ein Schaltkasten, ein sog. Gleichspannungs-Freischalter (DC-Freischalter) o. dgl. sein kann, an dem die von den Fotovoltaikelementen **12** insgesamt gelieferte Gleichspannung zur Verfügung gestellt wird.

[0021] Die von der Anlage **10** gelieferte Gleichspannung wird normalerweise zu einem Wechselrichter **19** geleitet, der für eine Einspeisung in ein öffentliches Stromnetz erforderlich ist, damit die Spannung auf netzkonforme Werte – typischer 230 Volt und 50 Hertz – gebracht werden kann.

[0022] Innerhalb der elektrischen Verbindungsleitungen **16** ist wenigstens eine Thermosicherung **20** vorgesehen, die bei einer definierbaren Grenztemperatur die elektrische Verbindung unterbricht. Die Grenztemperatur kann insbesondere auf Werte von ca. 200° eingestellt sein, damit die Thermosicherung **20** bei einem Brand zuverlässig auslöst und die elektrische Verbindung trennt, um die Unfallgefahr für die Brandbekämpfer zu reduzieren.

[0023] Im gezeigten Ausführungsbeispiel sind ins-

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gesamt drei Thermosicherungen **20** vorhanden, wobei jeweils eine Thermosicherung an den elektrischen Zu- und Ableitungen der in Serie geschalteten Gruppe von insgesamt sechs Fotovoltaikelementen **12** (sog. Stringenden) angeordnet ist. Eine weitere Thermosicherung **20** ist in der Mitte des Strings, zwischen jeweils drei Fotovoltaikelementen **12**, angeordnet. Im Brandfall wird somit der Stromkreis durch die Temperatureinwirkung zuverlässig unterbrochen, so dass eine gefährliche Spannung nicht mehr entstehen kann. Grundsätzlich ist es sinnvoll, die Brandschutzsicherungen in der Modulfläche so anzuordnen, dass zum einen eine gleichmäßige Überwachung und Absicherung der Modulfläche gebildet ist und zum anderen eine Teilspannung der verbleibenden Stringabschnitte von ca. 120 Volt nicht überschritten wird.

[0024] Die schematische Darstellung der Fig. 2 verdeutlicht einen möglichen konstruktiven Aufbau einer erfindungsgemäßen Thermosicherung **20**, die ein Gehäuse bzw. eine Schutzhülse **22** aus Keramik oder einem anderen geeigneten Material aufweisen kann, an dessen stirnseitigen Enden jeweils Leitungsanschlüsse **24** herausgeführt sind. Die Leitungsanschlüsse **24** sind im Gehäuseinneren mit einer vorgespannten Spiralfeder **26** verbunden, wobei ein Ende der Spiralfeder **26** als Leitungsanschluss **24** aus dem Gehäuse **22** geführt ist, während das andere Ende der Spiralfeder **26** über eine Quetschhülse **28** aus Stahl mit einem Kupferdrahtabschnitt **30** verbunden ist. Dieser Kupferdrahtabschnitt **30** steckt in einer Lotverbindung **32**, die mit dem anderen Leitungsanschluss **24** elektrisch leitend verbunden ist.

[0025] Bei einer legierungsabhängigen Schmelztemperatur der Lotverbindung **32** von ca. 180° C bis 220 ° C löst sich der Kupferdrahtabschnitt **30** aus der Lötstelle **32**, wodurch die vorgespannte Spiralfeder **26** entspannt und die elektrische Verbindung zwischen den beiden Leitungsanschlüssen **24** aufgetrennt wird. Der Abstand der entspannten Spiralfeder von der Lotverbindung **32** ist vorzugsweise so zu bemessen, dass die gewünschte Spannungsfestigkeit von mindestens 1000 Volt sichergestellt ist. Die Dimensionierungen der Spiralfeder **26**, der Leitungsanschlüsse **24** sowie der Lotverbindung **32** hängen von der gewünschten Strombelastbarkeit ab. Die Dimensionierung ist vom Fachmann weiterhin so zu wählen, dass ein möglichst geringer Übergangswiderstand der Thermosicherung **20** gewährleistet ist.

[0026] Anstelle der erwähnten Lotverbindung kann die Kontaktierung der Feder auch auf andere Weise sichergestellt werden, bspw. mittels einer sog. „chemischen Pille" oder einer „Schmelzpille", mit deren Hilfe die vorgespannte Feder bei einer bestimmten Grenztemperatur freigegeben wird. Mit Hilfe derartiger „Pillen" sind nahezu beliebige Auslösetemperaturen einstellbar, was unter Umständen notwendig und sinnvoll sein kann.

[0027] Die schematische Darstellung der Fig. 3 verdeutlicht der Einbau einer erfindungsgemäßen Thermosicherung **20** in einem Steckerelement **34**, so dass die Brandschutzsicherung nahezu beliebig in vorhandene Steckverbindungen eingefügt werden kann. Das Steckerelement **34** umfasst einen Steckerabschnitt **36** und einen Buchsenabschnitt **38**, zwischen denen ein Schutzrohr **40** oder eine Hülle angeordnet ist, innerhalb derer die Temperatursicherung aufgenommen ist. Das Schutzrohr **40** ist vorzugsweise so bemessen, dass es bei einem auftretenden Brand keine thermische Isolierung für die darunter angeordnete Thermosicherung **20** darstellt.

[0028] Die in der vorstehenden Beschreibung, den Zeichnungen und den Ansprüchen offenbarten Merkmale der Erfindung können sowohl einzeln als auch in beliebiger Kombination für die Verwirklichung der Erfindung in ihren verschiedenen Ausgestaltungen von Bedeutung sein. Die Erfindung ist nicht auf die vorstehenden Ausführungsbeispiele beschränkt. Vielmehr ist eine Vielzahl von Varianten und Abwandlungen denkbar, die von dem erfindungsgemäßen Gedanken Gebrauch machen und deshalb ebenfalls in den Schutzbereich fallen.

Bezugszeichenliste

10	Fotovoltaikanlage
12	Fotovoltaikelement
14	Gebäudedach
16	Verbindungsleitung
18	Übergabestelle
19	Wechselrichter
20	Thermosicherung
22	Schutzhülse
24	Leitungsanschluss
26	Spiralfeder
28	Quetschhülse
30	Kupferdrahtabschnitt
32	Lotverbindung
34	Steckerelement
36	Steckerabschnitt
38	Buchsenabschnitt
40	Schutzrohr

Schutzansprüche

1. Fotovoltaikanlage (**10**) mit wenigstens einem Fotovoltaikelement (**12**) zur Dach- oder Freiflächenmontage und mit elektrischen Verbindungsleitungen (**16**) zur Übertragung von Gleichspannung zu einer elektrischen Übergabestelle (**18**) bzw. zu einem Wechselrichter (**19**), gekennzeichnet durch eine thermische Sicherung in der elektrischen Verbindungsleitung (**16**) zwischen dem wenigstens einen Fotovoltaikelement (**12**) und der elektrischen Übergabestelle (**18**).

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2. Fotovoltaikanlage nach Anspruch 1, gekennzeichnet durch wenigstens eine Thermosicherung (**20**) innerhalb der elektrischen Verbindungsleitungen (**16**).

3. Fotovoltaikanlage nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass die Thermosicherung (**20**) eine Grenztemperatur von insbesondere ca. 180 ... 220 °C aufweist, die einer Brandtemperatur entspricht.

4. Fotovoltaikanlage nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, dass innerhalb einer Serienschaltung von mehreren Fotovoltaikelementen (**12**) wenigstens eine Thermosicherung (**20**) vorgesehen ist.

5. Fotovoltaikanlage nach Anspruch 4, dadurch gekennzeichnet, dass innerhalb einer Gruppe von Fotovoltaikelementen (**12**), die mittels einer Thermosicherung (**20**) von einer weiteren Gruppe von Fotovoltaikelementen (**12**) getrennt ist, eine Teilspannung von maximal 120 Volt abfällt.

6. Fotovoltaikanlage nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, dass jeweils Gruppen von in Serie geschalteten Fotovoltaikelementen (**12**) endseitig mit wenigstens einer Thermosicherung (**20**) versehen sind.

7. Fotovoltaikanlage nach Anspruch 6, dadurch gekennzeichnet, dass an jedem Leitungsanschluss einer Gruppe von in Serie geschalteten Fotovoltaikelementen (**12**) jeweils eine Thermosicherung (**20**) angeordnet ist.

8. Fotovoltaikanlage nach einem der voranstehenden Ansprüche, dadurch gekennzeichnet, dass die Thermosicherung (**20**) als Unterbrechungskontakt oder -schalter ausgebildet ist, der bei einer Grenztemperatur einen Leitungskontakt dauerhaft trennt.

9. Fotovoltaikanlage nach Anspruch 8, dadurch gekennzeichnet, dass die Thermosicherung (**20**) als Schmelzsicherung ausgebildet ist.

10. Fotovoltaikanlage nach einem der voranstehenden Ansprüche, dadurch gekennzeichnet, dass die Thermosicherung (**20**) eine in einer Schutzhülse (**22**) befindliche und vorgespannte Spiralfeder (**26**) aufweist, deren eines Ende mittels einer unter erhöhter Temperatur lösbaren Kontaktierung an einem nach außen geführten Leitungsanschluss (**24**) verankert ist.

11. Fotovoltaikanlage nach Anspruch 10, dadurch gekennzeichnet, dass die Thermosicherung (**20**) eine in einer Schutzhülse (**22**) befindliche und vorgespannte Spiralfeder (**26**) aufweist, deren eines Ende mittels einer Weichlotkontaktierung an einem nach außen geführten Leitungsanschluss (**24**) verankert ist.

12. Fotovoltaikanlage nach Anspruch 10 oder 11, dadurch gekennzeichnet, dass die Thermosicherung (**20**) in einem Steckerelement (**34**) integriert ist, das mittels eines Steckerabschnittes (**36**) und eines Buchsenabschnittes (**38**) in eine vorhandene, steckbare Leitungsverbindung (**16**) einsetzbar ist.

13. Fotovoltaikanlage nach einem der voranstehenden Ansprüche, dadurch gekennzeichnet, dass die Thermosicherung (**20**) in einem Fotovoltaikelement (**12**), in einem Schaltkasten und/oder innerhalb der Leitungsverbindung (**16**) angeordnet bzw. dort integriert ist.

14. Thermosicherung (**20**) entsprechend einem der voranstehenden Ansprüche, insbesondere zur Verwendung innerhalb der elektrischen Leitungsverbindungen (**16**) einer Fotovoltaikanlage (**10**).

Es folgen 2 Blatt Zeichnungen

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Anhängende Zeichnungen

Fig. 1

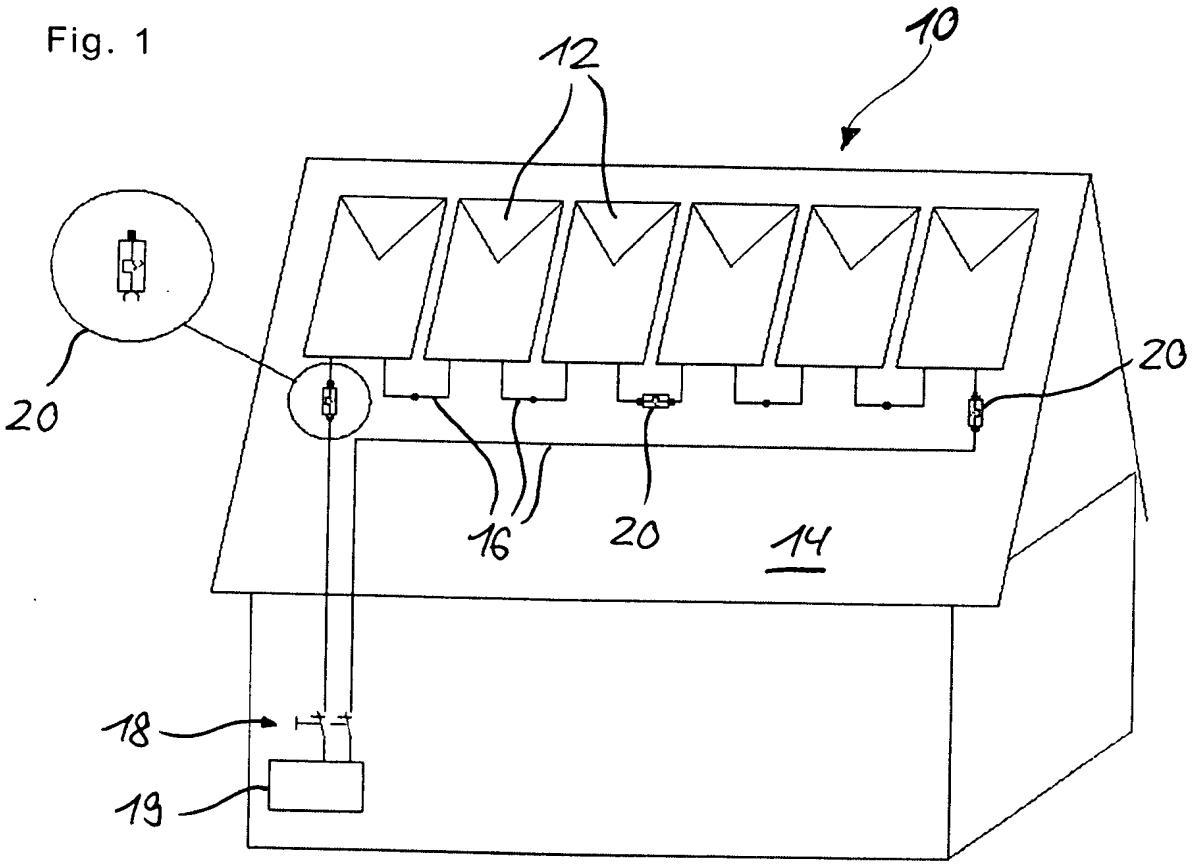
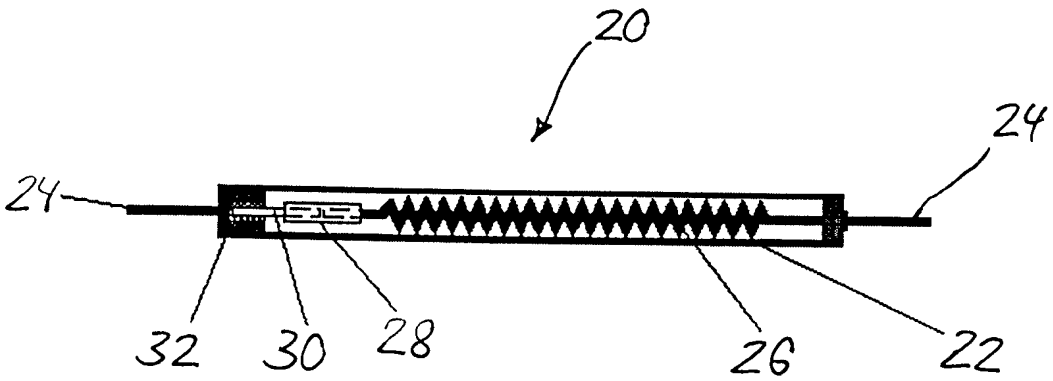
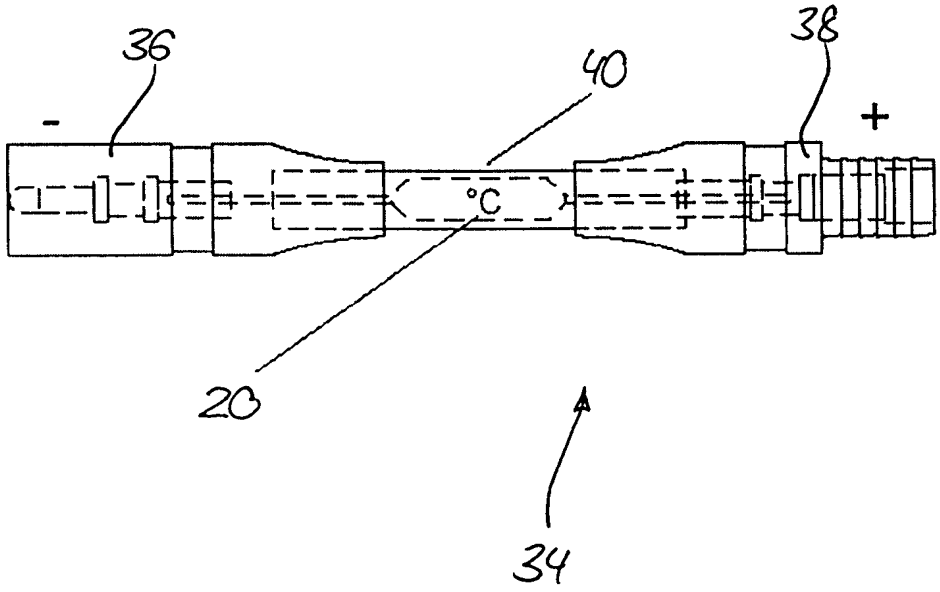


Fig. 2



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Fig. 3



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(54) **Title**: SOLAR CELL CONNECTING CABLE AND MANUFACTURING METHOD THEREFOR

(54) **发明名称** : 太阳能电池连接线及其制造方法

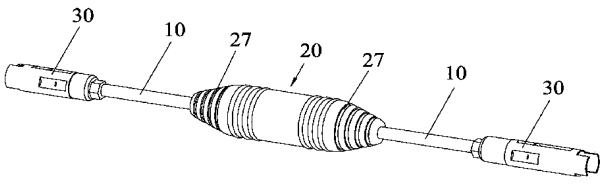


图1 / FIG. 1

(57) **Abstract**: A solar cell connecting cable and a manufacturing method therefor. The solar cell connecting cable comprises a fuse holder (20), two electric wires (10), and two plug terminals (30). One end of the electric wires is connected to one plug terminal, and the other end forms a wiring end (11). The fuse holder comprises a fuse component (22), a holder body (24), and a one-piece insulating housing sleeve (26). The wiring ends of the two electric wires are each fixedly connected to the holder body. Arranged within the holder body is the fuse component, and the two ends thereof are respectively connected to the wiring ends of the electric wires. The insulating housing sleeve covers the exterior of the holder body and is in a sealed connection to the electric wires. In an instance of overcurrent, the fuse holder allows effective protection by interrupting power. The fuse component, the fuse holder, and the wiring ends of the electric wires are sealed and covered by the one-piece insulating housing sleeve. This allows the solar cell connecting cable to be water-resistant, corrosion-resistant, and highly airtight, and to meet the requirements of harsh outdoor environmental conditions, thus ensuring the operational stability and reliability of solar cells.

[见续页]

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(57) 摘要:

一种太阳能电池连接线及其制造方法。该太阳能电池连接线包括保险丝座（20）、两电缆（10）及两插头端子（30），电缆一端与插头端子连接，另一端形成接线端（11）。该保险丝座包括保险丝组件（22）、座体（24）及一体成型的绝缘壳套（26），两电缆的接线端分别与座体固定连接，保险丝组件安装在座体内并且两端分别与电缆的接线端电连接，绝缘壳套包覆于座体外并与电缆密封连接。当电流过大时，保险丝座能有效起到断电保护作用。一体成型的绝缘壳套将保险丝组件、座体以及电缆的接线端密封包覆起来，从而使太阳能电池连接线防水、耐腐蚀、密封性好，且符合于室外恶劣环境条件下的使用要求，保障太阳能电池工作的稳定可靠性。

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太阳能电池连接线及其制造方法

技术领域

本发明涉及一种连接线，尤其涉及一种太阳能电池连接线及其制造方法。

背景技术

取之不尽，用之不竭的太阳能，因为其安全、干净、环保而越来越受到人们的青睐。太阳能产业成为全球竞相追逐的朝阳产业，在中国，越来越多的企业加入到这个“逐日产业”当中来，中国已经成为全球第三大太阳能制造基地，太阳能电池是将太阳辐射直接转换成电能的器件，通过电池板把太阳能转化为电能，然后通过接线盒、线缆组件、控制器和逆变器把太阳能电池板转化的电能输送给交流负载、直流负载和蓄电池，从而有效的将太阳能转化为可供人们日常生活或工作的能源。随着太阳能发电的广泛推广使用，太阳能电池专用连接线也运营而生，并且发展迅速，在建造太阳能发电系统时，需要将成百上千的太阳能电池板通过连接线串并联起来，从而获取较大的输出功率，如通过行的串联及列的并联方式，列两端的输出电压较大时，会使行的电流增大，有可能造成输出电流过大，电流的过载容易损坏电池板及其他零部件，因此需要引进保护装置来实现电流过载时的断电保护，但由于太阳能电池通常应用并设置在气候恶劣多变的室外环境中，其连接线及保护装置一般均处于露天状态，日晒雨淋，工作环境恶劣，要求所述保护装置必须具有防水，防腐蚀，防紫外线的性能，因此需要一种具有过载保护功能、防水、耐腐蚀、密封性好并符合于室外恶劣环境条件下的使用要求的连接线来实现太阳能电池的输出连接。

发明内容

本发明的目的在于提供一种具有过载保护功能且防水、耐腐蚀、密封性好并符合于室外恶劣环境条件下的使用要求的太阳能电池连接线。

本发明的另一目的在于提供一种具有过载保护功能且防水、耐腐蚀、密封性好并符合于室外恶劣环境条件下的使用要求的太阳能电池连接线的制造方法。

为了实现上述目的，本发明提供了一种太阳能电池连接线，包括保险丝座、两电缆及两插头端子，所述电缆一端与所述插头端子连接，另一端形成接线端，所述保险丝座包括保险丝组件、座体及一体成型的绝缘壳套，两所述电缆的接线端分别与所述座体固定连接，所述保险丝组件安装在所述座体内并两端分别与所述电缆的接线端电连接，所述绝缘壳套包覆于所述座体外并与所述电缆密封连接。

较佳地，所述绝缘壳套为辐照交联聚乙烯壳套，所述辐照交联聚乙烯壳套两端呈尖头状并形成有若干环形的凹纹。聚乙烯在射线作用下可以发生辐照交联反应，交联后形成体型高分子，提高了聚乙烯的耐热防腐蚀等级，采用辐照交联聚乙烯壳套能加强所述太阳能电池连接线的抗老化、防辐射及耐高温性能，保护保险丝组件不受外界恶劣环境损害，提高太阳能电池工作的稳定性。所述凹纹结构能使绝缘壳套结构更加紧密，加强密封性，且有利于排水，防止积留在绝缘壳套上。

较佳地，所述电缆外还包覆有辐照交联聚乙烯层，由于所述电缆同样需要暴露在恶劣环境中，包覆有辐照交联聚乙烯层的电缆耐热及抗老化性能强。

较佳地，所述太阳能电池连接线还包括两密封圈，所述密封圈设置在所述绝缘壳套与所述电缆之间，所述密封圈能有效加强电缆接线端与绝缘壳套之间的密封性。

本发明同时提供了一种太阳能电池连接线的制造方法，包括如下步骤：（1）提供两电缆及两插头端子，所述电缆一端与所述插头端子连接，另一端形成接线端；（2）提供一保险丝组件及用于安装所述保险丝组件的座体，将两所述电缆的接线端分别固定在所述座体上并分别与所述电缆的接线端电连接；（3）在所述座体外用聚乙烯浇注成型一绝缘壳套，所述绝缘壳套包覆所述座体并与所述电缆密封连接。

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较佳地，所述电缆外还包覆有聚乙烯层，且所述聚乙烯层为辐照交联聚乙烯层，所述绝缘壳套为辐照交联聚乙烯壳套，聚乙烯材料通过电子加速器辐照处理成为的辐照交联聚乙烯壳套。

与现有技术相比，本发明的太阳能电池连接线可通过插头端子分别实现与太阳能电池及其他零部件连接，当输出电流过大时，保险丝座的设置能有效切断通路起到保护作用，两电缆的接线端与保险丝座的座体固定连接并与保险丝组件的两端分别电连接，所述绝缘壳套一体成型于所述座体外，将保险丝组件、座体、以及电缆的接线端密封包覆起来，结构紧凑小巧，机械性能稳定，不仅防水、防腐蚀、防紫外线且密封性好，符合于室外恶劣环境条件下的使用要求，使太阳能电池的工作性能更稳定可靠。同样地，本发明的太阳能电池连接线的制造方法所制造出来的太阳能电池连接线同样具有上述效果。

附图说明

图 1 是本发明实施例的太阳能电池连接线的结构示意图。

图 2 是本发明实施例太阳能电池连接线的保险丝座的结构示意图。

图 3 是本发明太阳能电池连接线的制造方法的流程图。

具体实施方式

现在参考附图描述本发明的实施例，附图中类似的元件标号代表类似的元件。

参考图 1 及图 2，本发明实施例的太阳能电池连接线包括两电缆 10、保险丝座 20 及两插头端子 30，所述电缆 10 一端与所述插头端子 30 连接，另一端形成接线端 11，所述插头端子 30 与太阳能电池板及其他零部件如接线盒或逆变器的接线端对接匹配，可以根据实际需要选择合适的插头端子 30。所述保险丝座 20 包括保险丝组件 22、座体 24 及一体成型的绝缘壳套 26，两所述电缆 10 的接线端 11 分别与所述座体 24 固定连接，所述保险丝组件 22 安装在所述座体 24 内并两端与所述电缆 10 的接线端 11 电连接，所述保险丝组件 22 与现有的组件类似，均利用熔融体在电流过大时熔融从而使两端的通路切断的原理，

可通过引线实现与电缆 10 的电连接。具体地，所述座体 24 两端对应开设有供电缆 10 插入从而实现与保险丝组件 22 电连接的插孔 25，所述电缆 10 的接线端 11 穿过所述插孔 25 伸入所述座体 24 内并与保险丝组件 22 的电连接，所述绝缘壳套 26 包覆于所述座体 24 外并与所述电缆 10 密封连接。

较佳地，所述绝缘壳套 26 为辐照交联聚乙烯壳套，所述绝缘壳套 26 两端呈尖头状并形成有若干环形的凹纹 27。聚乙烯在射线作用下可以发生辐照交联反应，交联后形成体型高分子，提高了聚乙烯的耐热防腐蚀等级，采用辐照交联聚乙烯壳套能加强所述太阳能电池连接线的抗老化、防辐射及耐高温性能，保护保险丝组件 22 不受外界恶劣环境损害，提高太阳能电池工作的稳定性。所述座体 24 的轮廓与所述绝缘壳套 26 匹配，所述绝缘壳套 26 罩设在座体 24 上并与电缆 10 的接线端 11 通过浇注后连结在一起，具有优良的密封性，结构小巧，实用性强，所述凹纹 27 也可以呈螺旋状，所述绝缘壳套 26 上可印制标志，方便识别且美观。同样较佳地，所述电缆 10 外还包覆有辐照交联聚乙烯层，由于所述电缆 10 同样需要暴露在恶劣环境中，包覆有辐照交联聚乙烯层的电缆 10 耐热及抗老化性能强。

较佳地，所述太阳能电池连接线还包括两密封圈 40，所述密封圈 40 设置在所述绝缘壳套 26 与所述电缆 10 之间，所述密封圈 40 能有效加强电缆 10 的接线端 11 与绝缘壳套 26 之间的密封性。

参考图 3，本发明同时提供了一种太阳能电池连接线的制造方法，包括如下步骤：

S1：提供两电缆及两插头端子，所述电缆一端与所述插头端子连接，另一端形成接线端；

S2：提供一保险丝组件及用于安装所述保险丝组件的座体，将两所述电缆的接线端分别固定在所述座体上并分别与所述电缆的接线端电连接；

S3：在所述座体外用聚乙烯浇注成型一绝缘壳套，所述绝缘壳套包覆所述座体并与所述电缆密封连接。

详细地，制造生产本发明的太阳能电池连接线时，先将保险丝组件 22 安装在座体 24 内，将两电缆 10 各自的接线端 11 穿过座体 24 的插孔 25 并通过焊接

或其他方式实现与保险丝组件 22 的电连接，然后将所述座体 24 与电缆 10 一起在所述座体 24 的部位上浇注成型一聚乙烯材料的绝缘壳套 26，所述绝缘壳套 26 在两端的尖头状处可热压形成若干环形的凹纹 27，一方面使结构更紧密，有利于排水，另一方面有利于增强密封性能。一体成型所述绝缘壳套 26 后再将所述聚乙烯材料的绝缘壳套 26 通过电子加速器辐照处理成为辐照交联聚乙烯壳套。较佳地，所述电缆 10 外还包覆有聚乙烯层，所述电缆 10 一起通过电子加速器辐照处理形成辐照交联聚乙烯层。

与现有技术相比，本发明的太阳能电池连接线可通过插头端子 30 分别实现与太阳能电池及其他零部件连接，当输出电流过大时，保险丝座 20 的设置能有效切断通路起保护作用，两电缆 10 的接线端 11 与保险丝座 20 的座体 24 固定连接并与保险丝组件 22 的两端分别电连接，所述绝缘壳套 26 一体成型于所述座体 24 外，将保险丝组件 22、座体 24、以及电缆 10 的接线端 11 密封包覆起来，结构紧凑小巧，不仅防水、耐腐蚀且密封性好，符合于室外恶劣环境条件下的使用要求，使太阳能电池的工作性能更稳定可靠。同样地，本发明的太阳能电池连接线的制造方法所制造出来的太阳能电池连接线同样具有上述效果。

以上所揭露的仅为本发明的优选实施例而已，当然不能以此来限定本发明之权利范围，因此依本发明申请专利范围所作的等同变化，仍属本发明所涵盖的范围。

权 利 要 求

1.一种太阳能电池连接线，其特征在于：包括保险丝座、两电缆及两插头端子，所述电缆一端与所述插头端子连接，另一端形成接线端，所述保险丝座包括保险丝组件、座体及一体成型的绝缘壳套，两所述电缆的接线端分别与所述座体固定连接，所述保险丝组件安装在所述座体内并两端分别与所述电缆的接线端电连接，所述绝缘壳套包覆于所述座体外并与所述电缆密封连接。

2.如权利要求 1 所述的太阳能电池连接线，其特征在于：所述绝缘壳套为辐照交联聚乙烯壳套。

3.如权利要求 2 所述的太阳能电池连接线，其特征在于：所述辐照交联聚乙烯壳套两端呈尖头状并形成有若干环形的凹纹。

4.如权利要求 1 所述的太阳能电池连接线，其特征在于：所述电缆外还包覆有辐照交联聚乙烯层。

5.如权利要求 1 所述的太阳能电池连接线，其特征在于：所述太阳能电池连接线还包括两密封圈，所述密封圈设置在所述绝缘壳套与所述电缆之间。

6.一种太阳能电池连接线的制造方法，其特征在于：包括如下步骤：

（1）提供两电缆及两插头端子，所述电缆一端与所述插头端子连接，另一端形成接线端；

（2）提供一保险丝组件及用于安装所述保险丝组件的座体，将两所述电缆的接线端分别固定在所述座体上并分别与所述电缆的接线端电连接；

（3）在所述座体外用聚乙烯浇注成型一绝缘壳套，所述绝缘壳套包覆所述座体并与所述电缆密封连接。

7. 如权利要求 6 所述的太阳能电池连接线的制造方法，其特征在于：所述电缆外还包覆有聚乙烯层。

8. 如权利要求 7 所述的太阳能电池连接线的制造方法，其特征在于：所述聚乙烯层为辐照交联聚乙烯层。

9. 如权利要求 6 所述的太阳能电池连接线的制造方法，其特征在于：所述绝缘壳套为辐照交联聚乙烯壳套。

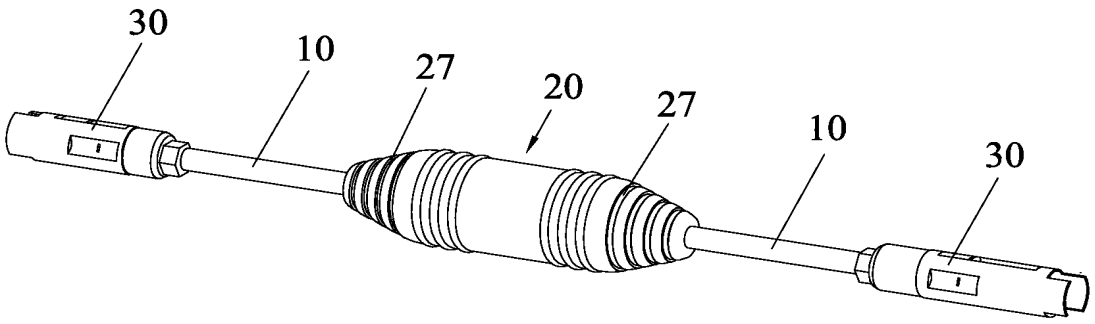


图1

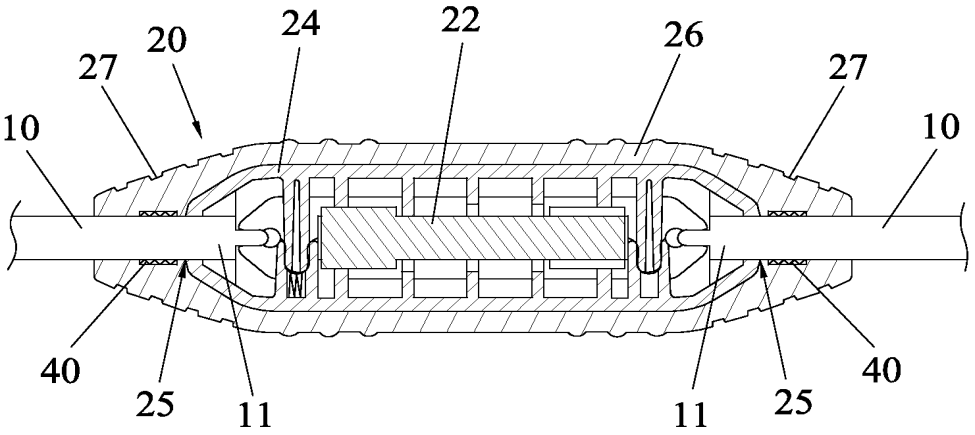


图2

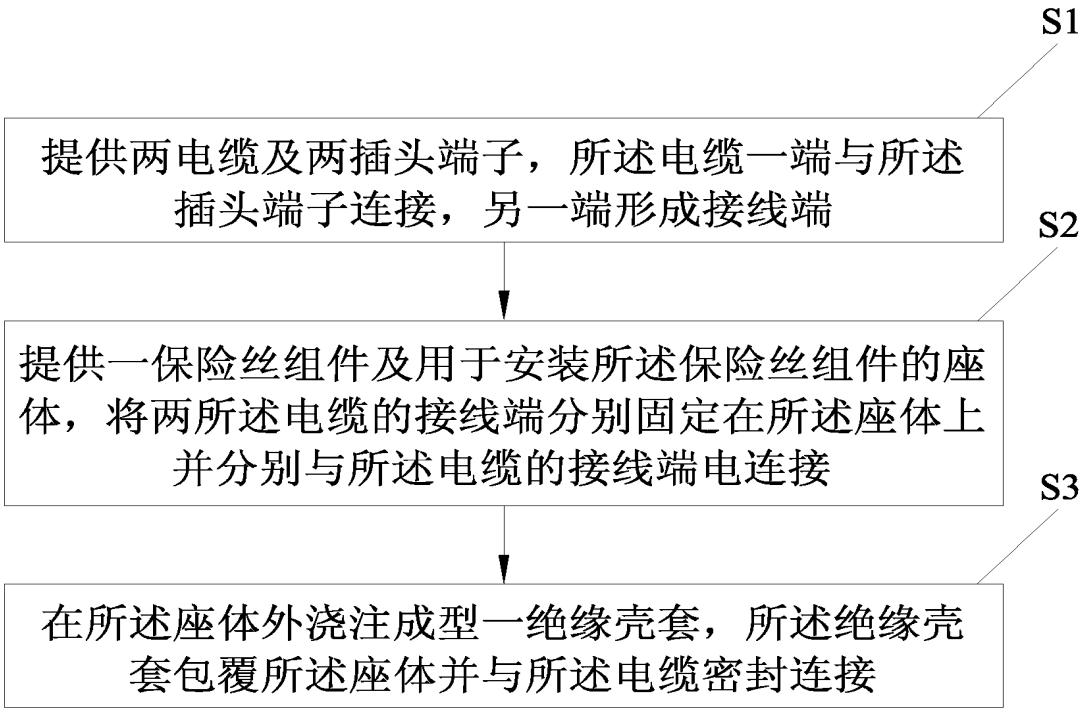

S1
提供两电缆及两插头端子，所述电缆一端与所述插头端子连接，另一端形成接线端
S2
提供一保险丝组件及用于安装所述保险丝组件的座体，将两所述电缆的接线端分别固定在所述座体上并分别与所述电缆的接线端电连接
S3
在所述座体外浇注成型一绝缘壳套，所述绝缘壳套包覆所述座体并与所述电缆密封连接

图3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2011/083209

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC:H01R, H01H, H02G, H02N, H01B, H02H, H01L;

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

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

WPI ; EPODOC ; CNPAT ; CNKI:

solar, photovoltaic, wire, cable, cord, terminal, insulat+, casing, housing, case, sheath, seal, polyethylene, polythene, PE;

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 平 11-40838A (SHARP KK) 12 Feb.1999(12.02.1999) description, paragraphs【0025】-【0057】, figures1-16	1-9
Y	DE202006007613U1 (BECK M) 21 Sep. 2006(21.09.2006) description, paragraphs【0020】-【0027】, figures1-2	1-9
A	DE102008027189A1 (PFEFFER R et al.) 15 Jan.2009(15.01.2009) the whole document	1-9
PX	CN102117976A (DONGGUAN ANWELL DIGITAL MACHINERY CO LTD) 06 Jul.2011(06.07.2011) claims 1-9, figures 1-3	1-9
PX	CN201994507U (DONGGUAN ANWELL DIGITAL MACHINERY CO LTD) 28 Sep.2011(28.09.2011) description, paragraphs【0012】-【0020】, figures1-2	1-9

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 Feb. 2012(15.02.2012)	08 Mar. 2012(08.03.2012)
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer RAN, Chunyan Telephone No. (86-10) 62411745

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2011/083209

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
JP 平 11-40838A	12.02.1999	None	
DE202006007613U1	21.09.2006	None	
DE102008027189A1	15.01.2009	None	
CN102117976A	06.07.2011	None	
CN201994507U	28.09.2011	None	

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2011/083209

A. CLASSIFICATION OF SUBJECT MATTER
H01R 13/68 (2006.01) i
H01R 13/52 (2006.01) i

Voltage, LLC
EX1021-214

国际检索报告

国际申请号
PCT/CN2011/083209

A. 主题的分类

见附加页

按照国际专利分类(IPC)或者同时按照国家分类和 IPC 两种分类

B. 检索领域

检索的最低限度文献(标明分类系统和分类号)

IPC:H01R, H01H, H02G, H02N, H01B, H02H, H01L;

包含在检索领域中的除最低限度文献以外的检索文献

在国际检索时查阅的电子数据库(数据库的名称，和使用的检索词（如使用）

WPI ; EPODOC ; CNPAT ; CNKI：

太阳能，光伏，线，缆，端子，绝缘，壳，套，密封，聚乙烯，PE;

solar, photovoltaic, wire, cable, cord, terminal, insulat+, casing, housing, case, sheath, seal, polyethylene, polythene, PE;

C. 相关文件

类　型*	引用文件，必要时，指明相关段落	相关的权利要求
Y	JP 平 11-40838A (SHARP KK) 12.2 月 1999(12.02.1999) 说明书第【0025】—【0057】段、附图 1—16	1—9
Y	DE202006007613U1 (BECK M) 21.9 月 2006(21.09.2006) 说明书第【0020】—【0027】段、附图 1—2	1—9
A	DE102008027189A1 (PFEFFER R 等) 15.1 月 2009(15.01.2009) 全文	1—9
PX	CN102117976A (东莞宏威数码机械有限公司) 06.7 月 2011(06.07.2011) 权利要求 1—9，附图 1—3	1—9
PX	CN201994507U (东莞宏威数码机械有限公司) 28.9 月 2011(28.09.2011) 说明书第【0012】—【0020】段、附图 1—2	1—9

☐ 其余文件在 C 栏的续页中列出。　　☒ 见同族专利附件。

* 引用文件的具体类型：

"A" 认为不特别相关的表示了现有技术一般状态的文件

"E" 在国际申请日的当天或之后公布的在先申请或专利

"L" 可能对优先权要求构成怀疑的文件，或为确定另一篇引用文件的公布日而引用的或者因其他特殊理由而引用的文件（如具体说明的）

"O" 涉及口头公开、使用、展览或其他方式公开的文件

"P" 公布日先于国际申请日但迟于所要求的优先权日的文件

"T" 在申请日或优先权日之后公布，与申请不相抵触，但为了理解发明之理论或原理的在后文件

"X" 特别相关的文件，单独考虑该文件，认定要求保护的发明不是新颖的或不具有创造性

"Y" 特别相关的文件，当该文件与另一篇或者多篇该类文件结合并且这种结合对于本领域技术人员为显而易见时，要求保护的发明不具有创造性

"&" 同族专利的文件

国际检索实际完成的日期	国际检索报告邮寄日期
15.2 月 2012(15.02.2012)	**08.3 月 2012 (08.03.2012)**
ISA/CN 的名称和邮寄地址： 中华人民共和国国家知识产权局 中国北京市海淀区蓟门桥西土城路 6 号 100088 传真号：　(86-10)62019451	受权官员 冉春艳 电话号码：(86-10) **62411745**

Voltage, LLC
EX1021-215

国际检索报告
关于同族专利的信息

国际申请号
PCT/CN2011/083209

检索报告中引用的专利文件	公布日期	同族专利	公布日期
JP 平 11-40838A	12.02.1999	无	
DE202006007613U1	21.09.2006	无	
DE102008027189A1	15.01.2009	无	
CN102117976A	06.07.2011	无	
CN201994507U	28.09.2011	无	

Voltage, LLC
EX1021-216

A. 主题的分类

H01R 13/68 (2006.01) i

H01R 13/52 (2006.01) i

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/301,609	12/22/2022 07:54:51 PM ET	S4079.10001US03

Title of Invention

LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	3509	FILED BY	Brian Gonzalez
PATENT CENTER #	61346111	AUTHORIZED BY	Eric Maschoff
CUSTOMER #	97149	FILING DATE	04/08/2021
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Dean Solon

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 5003	E2022BLJ55404926	Brian Gonzalez

PRE-AUTHORIZED ACCOUNT	PRE-AUTHORIZED CATEGORY
505394	37 CFR 1.16 (National application filing, search, and examination fees); 37 CFR 1.17 (Patent application and reexamination processing fees); 37 CFR 1.19 (Document supply fees); 37 CFR 1.21 (Miscellaneous fees and charges)

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
2253	EXTENSION FOR RESPONSE WITHIN THIRD MONTH -	740.00	1	740.00
2806	SUBMISSION OF AN INFORMATION DISCLOSURE STATEMENT	130.00	1	130.00
			TOTAL AMOUNT:	$870.00

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

described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) 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
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 17/301,609	Filing Date 04/08/2021	☐ 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	12/22/2022	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 18	Minus	** 20	= 0		x $50 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0		x $240 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

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

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/PAMELA V THERATT/
*** 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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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/301,609	04/08/2021	Dean Solon	S4079.10001US03	3509

97149 7590 06/22/2022

Maschoff Brennan
1389 Center Drive, Suite 300
Park City, UT 84098

EXAMINER
CANNON, RYAN SMITH

ART UNIT	PAPER NUMBER
1726	

NOTIFICATION DATE	DELIVERY MODE
06/22/2022	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):

d@mabr.com

Voltage, LLC
EX1021-221

Office Action Summary	Application No. 17/301,609	Applicant(s) Solon, Dean	
	Examiner ERIC R SMITH	Art Unit 1726	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 4/8/2021.

☐ 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) 1-19 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) 1-16 and 18-19 is/are rejected.

8) ☑ Claim(s) 17 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 4/8/2021 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

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

4) ☐ Other: _____.

Voltage, LLC
EX1021-222

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Claim Rejections - 35 USC § 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.

Claim(s) 1-3, 8, and 9 is/are rejected under 35 U.S.C. 102(a)(1) as being anticipated by US Patent 3,852,516 to Vander Ploog.

Regarding claims 1-3, 8, and 9, the preamble for claim 1 recites a lead assembly for use in a solar energy installation. If the body of a claim fully and intrinsically sets forth all of the limitations of the claimed invention, and the preamble merely states, for example, the purpose or intended use of the invention, rather than any distinct definition of any of the claimed invention's limitations, then the preamble is not considered a limitation and is of no significance to claim construction. Pitney Bowes, Inc. v. Hewlett-Packard Co., 182 F.3d 1298, 1305, 51 USPQ2d 1161, 1165 (Fed. Cir. 1999). MPEP §2111.02.II. As the body of the claim recites a structurally complete invention, the limitation that the lead assembly is for use in a solar energy installation is not given patentable weight.

Vander Ploog teaches a lead assembly including

- a drop line 16 (Fig. 1, C2/L48-56)
- a feeder cable 11/12 electrically coupled to the drop line 16 at a nexus (coincident with 15)
- an undermold 18/20 that fully encases the nexus, the undermold further comprising

- a first aperture (portion of 20 displaced by cable 11/12) extending completely through the undermold 18/20 and having a first diameter, wherein the feeder cable 11/12 extends through the first aperture along a first longitudinal axis (C2/L56-64, C3/L9-14)
- a second aperture (portion of 20 displaced by line 16) extending partially through the undermold 18/20 and having a second diameter different than the first diameter, wherein the drop line 16 extends from the second aperture along along a second longitudinal axis.

Per **claim 2**, Vander Ploog teaches the limitations of claim 1. The drop line 16 includes a section of exposed wire 17 at the nexus.

Per **claim 3**, Vander Ploog teaches the limitations of claim 2. The feeder cable 11/12 includes a section of exposed wire 13/14 at the nexus.

Per **claim 8**, Vander Ploog teaches the limitations of claim 1. The first longitudinal axis and the second longitudinal axis are substantially parallel in a region before the nexus (Fig. 1).

Per **claim 9**, Vander Ploog teaches the limitations of claim 1. The second diameter is smaller than the first diameter (Fig. 1).

Claim(s) 1, 4, 8, and 9 is/are rejected under 35 U.S.C. 102(a)(1) as being anticipated by US Patent 6,265,665 to Zahnen.

Regarding claims 1, 4, 8, and 9, the preamble for claim 1 recites a lead assembly for use in a solar energy installation. If the body of a claim fully and intrinsically sets forth all of the limitations of the claimed invention, and the preamble merely states, for example, the purpose or intended use of the invention, rather than any distinct definition of any of the claimed invention's limitations, then the preamble is not considered a limitation and is of no significance to claim construction. Pitney Bowes, Inc. v. Hewlett-Packard Co., 182 F.3d 1298, 1305, 51 USPQ2d 1161, 1165 (Fed. Cir. 1999). MPEP §2111.02.II.

As the body of the claim recites a structurally complete invention, the limitation that the lead assembly is for use in a solar energy installation is not given patentable weight.

Zahnen teaches a lead assembly including

- a drop line 24 (Figs. 2-5, C3/L67-C4/L4)
- a feeder cable 26 electrically coupled to the drop line at a nexus 11
- an undermold that fully encases the nexus (gel 18/20 fills the volume of 10 so that a mold of gel forms around 11/24/26; Figs. 10, 11 C3/L63-C3/L67, C7/L15-19), the undermold further comprising
    - a first aperture extending completely through the undermold (the gel fills the volume except for where a cable/line/nexus exists; the gel would therefore have an aperture having the shape of cable 26 that through the mold as seen in Fig. 1) and having a first diameter, wherein the feeder cable 26 extends through the first aperture along a first longitudinal axis
    - a second aperture extending partially through the undermold (the sealant would have an aperture the size of line 24 that extends partially from left to right through the mold as seen in Fig. 1) and having a second diameter different than the first diameter, wherein the drop line extends from the second aperture along a second longitudinal axis
- an overmold 10 surrounding the undermold and forming an undermold-overmold interface at an outer surface of the undermold (the undermold forms to the shape of the volume, which is bounded by the inner surface of 10 seen in Figs. 5, 7).

Per **claim 4**, Zahnen teaches the limitations of claim 1. Zahnen teaches that the overmold 10 defines at least one aperture 42 for attaching the halves of the mold together (Figs. 1, 7, C4/L41-49).

Per **claim 8**, Zahnen teaches the limitations of claim 1. The first longitudinal axis and the second longitudinal axis are substantially parallel (Fig. 1).

Per **claim 9**, Zahnen teaches the limitations of claim 1. The second diameter is smaller than the first diameter (Fig. 1).

Claim Rejections - 35 USC § 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.

The factual inquiries for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claim(s) 1-3, 5-9, 13-16, 18, and 19 is/are rejected under 35 U.S.C. 103 as being unpatentable over US Patent 6,268,559 to Yamawaki, and further in view of US Patent 3,852,516 to Vander Ploog.

Regarding claims 1-3, 5-9 and 13-15, the preamble for claim 1 recites a lead assembly for use in a solar energy installation. If the body of a claim fully and intrinsically sets forth all of the limitations of the claimed invention, and the preamble merely states, for example, the purpose or intended use of the invention, rather than any distinct definition of any of the claimed invention's limitations, then the preamble is not considered a limitation and is of no significance to claim construction. Pitney Bowes, Inc. v. Hewlett-Packard Co., 182 F.3d 1298, 1305, 51 USPQ2d 1161, 1165 (Fed. Cir. 1999). MPEP §2111.02.II.

As the body of the claim recites a structurally complete invention, the limitation that the lead assembly is for use in a solar energy installation is not given patentable weight.

Yamawaki teaches a lead assembly 16 including

- a drop line 31 (Figs. 8, 9) (C9/L64-C10/L16)
- a feeder cable 32, the feeder cable electrically coupled to the drop line 31 at a nexus (illustrated as a node between phantom lines in Figs. 8A, 8B, 9A, C10/L17-32)
- an undermold 33e that fully encases the nexus (33e is illustrated in Fig. 9B as being fully encased by 33f, and therefore necessarily fully encases the nexus)
- an overmold 33f surrounding the undermold 33e and forming an undermold-overmold interface at an outer surface of the undermold (Fig. 9B illustrates a cutout of the relationship between 33e, 33f; only the thickness of 33f intercedes between the undermold 33e surface and the exterior, therefore the interface is present).

Per **claims 1 and 9**, the drop line has a first diameter (shown in the perspective view of Fig. 9B) and extends along a first longitudinal axis and the feeder cable has a second diameter and extends along a second longitudinal axis. While the second diameter is not specifically described as different or smaller than the first diameter, a skilled artisan would understand that the first and second diameter could have three relative configurations: both diameters are equal, the first diameter is smaller than the second diameter, and the second diameter is smaller than the first diameter. Therefore it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to form the second diameter different than or smaller than the first diameter because it would have been obvious to try.

The Supreme Court decided that a claim can be proved obvious merely by showing that the combination of known elements was obvious to try. In this regard, the Supreme Court explained that, "[w]hen there is a design need or market pressure to solve a problem and there are a finite number of

identified, predictable solutions, a person of ordinary skill in the art has a good reason to pursue the known options within his or her technical grasp." An obviousness determination is not the result of a rigid formula disassociated from the consideration of the facts of the case. Indeed, the common sense of those skilled in the art demonstrates why some combinations would have been obvious where others would not. Therefore, choosing from a finite number of identified, predictable solutions, with a reasonable expectation for success, is likely to be obvious to a person if ordinary skill in the art. See *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421, USPQ2d 1385, 1395 – 97 (2007) (see MPEP § 2143, E.).

The undermold 33e is described as having rigidity (C10/L67-C11/L2), but is not specifically shown to have a first aperture and second aperture. Vander Ploog teaches a similar lead assembly having a similar undermold (18/20) having rigidity, also comprising an analogous feeder cable (12) and drop line (16) (C2/L56-65, C3/L9-11), wherein the mold comprises a first aperture extending completely through the undermold (the material of 20 displaced by the cable 12 is in the form of an aperture), such that the feeder cable extends through the first aperture along its analogous first longitudinal axis, and a second aperture extending partially through the undermold (the material of 20 displaced by line 16 is in the form of an aperture), such that the drop line extends into the second aperture along a second longitudinal axis. Vander Ploog teaches that it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to employ this undermold in order to provide electrical and mechanical protection to the nexus (C1/L53-56, C1/L61-C2/L6). The undermold of modified-Yamawaki would therefore possess the claimed first aperture and second aperture with the claimed properties.

Per **claims 2 and 3**, modified-Yamawaki teaches the limitations of claim 1. Yamawaki does not specifically teach that the drop line and the feeder cable each include a respective section of exposed wire at the nexus. However, it would have been obvious as of the effective filing date of the claimed

invention for a person having ordinary skill in the art to form sections of exposed wire, as Vander Ploog shows that such exposure is necessary for electrical connection at a nexus (coincident with 15 of Fig. 1, C2/47-55).

Per **claims 5-7**, modified-Yamawaki teaches the limitations of claim 1. The feeder cable 31 of Yamawaki terminates at a feeder cable connector 34 (Figs. 4-7, 8A, 8B, C11/L3-13). The limitation that the feeder cable connector is configured to attach directly to an inverter, or to attach directly to a jumper cable, which in turn connects directly to an inverter is an intended use limitation. Intended use limitations are given weight to the extent that the prior art structure is capable of performing the intended use. See MPEP § 2111.02, 2112.01 and 2114-2115. The cited passages of Yamawaki teach that the feeder cable connector is capable of electrically connecting a lead assembly and inverter (for instance, see Fig. 2, C7/L54-C8/L11).

Per **claim 8,** modified-Yamawaki teaches the limitations of claim 1. In the schematic view of Fig. 9, the first longitudinal axis and the second longitudinal axis are substantially parallel for a portion (Fig. 9A). Further, Vander Ploog teaches that the analogous first longitudinal axis and second longitudinal axis are substantially parallel in a region before the nexus in that invention (Fig. 1). Therefore it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to form the first longitudinal axis and second longitudinal axis to be substantially parallel because they are illustrated as such. The prior art can be modified or combined to reject claims as *prima facie* obvious as long as there is a reasonable expectation of success. See *In re Merck & Co., Inc.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986) (see MPEP § 2143.02).

Per **claims 13-15**, modified-Yamawaki teaches the limitations of claim 1. The drop line terminates in a drop line connector 34 (Figs. 4-7, 8A, 8B, C11/L3-13). The drop line connector connects to a wiring harness (one of elements 25 in Fig. 5, 26 in Fig. 6, 27 in Fig. 7) connecting to a plurality of solar panels M.

The limitation that the lead assembly combines power received from the plurality of solar panels and conducts that power directly to an inverter electrically connected to the feeder capable is at least in part a statement of intended use. Regardless, in an embodiment, the lead assembly 16 combines power received from a plurality of solar panels (MN in Fig. 2) and conducts that power to an inverter 13 electrically connected to the feeder cable (C7/L54-C8/L11). While a wire 18 intervenes between the lead assembly 16 and the inverter 13 in that embodiment, a skilled artisan would understand that the wire provides no function other than conduction of electricity, which is also provided by the wire assembly, and it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to omit that wire to establish a direct connection, as it would merely require the omission of an element while the function is retained. MPEP §2144.04.II.B.

Regarding claim 16, 18, and 19, Yamawaki teaches a solar power system comprising

- a plurality of solar panels M electrically coupled by a wire harness (one of elements 25 in Fig. 5, 26 in Fig. 6, 27 in Fig. 7) to form a first solar array MN (C8/L12-32)
- lead assembly 16 comprising
    - a drop line 31 (Figs. 8, 9) electrically connected to the wire harness (at 28b/34 in Figs. 5-7) and configured to receive power from the plurality of solar panels M (C9/L64-C10/L16)
    - a feeder cable 32, the feeder cable electrically connected to the drop line 31 at a nexus (illustrated as a node between phantom lines in Figs. 8A, 8B, 9A, C10/L17-32)
    - a primary mold 33e that fully encases the nexus (33e is illustrated in Fig. 9B as being fully encased by 33f, and therefore necessarily fully encases the nexus) so as to substantially seal the nexus from external environmental conditions (C13/L6-18).

The drop line has a first diameter (shown in the perspective view of Fig. 9B) and extends along a first longitudinal axis and the feeder cable has a second diameter and extends along a second

longitudinal axis. While the second diameter is not specifically described as smaller than the first diameter, a skilled artisan would understand that the first and second diameter could have three relative configurations: both diameters are equal, the first diameter is smaller than the second diameter, and the second diameter is smaller than the first diameter. Therefore it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to form the second diameter smaller than the first diameter because it would have been obvious to try.

The Supreme Court decided that a claim can be proved obvious merely by showing that the combination of known elements was obvious to try. In this regard, the Supreme Court explained that, "[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has a good reason to pursue the known options within his or her technical grasp." An obviousness determination is not the result of a rigid formula disassociated from the consideration of the facts of the case. Indeed, the common sense of those skilled in the art demonstrates why some combinations would have been obvious where others would not. Therefore, choosing from a finite number of identified, predictable solutions, with a reasonable expectation for success, is likely to be obvious to a person if ordinary skill in the art. See *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421, USPQ2d 1385, 1395 – 97 (2007) (see MPEP § 2143, E.).

The primary mold 33e is described as having rigidity (C10/L67-C11/L2), but is not specifically shown to have a first aperture and second aperture. Vander Ploog teaches a similar lead assembly having a similar primary mold (18/20) having rigidity and providing an environmental seal, also comprising an analogous feeder cable (12) and drop line (16) (C2/L56-65, C3/L9-11), wherein the mold comprises a first aperture extending completely through the primary mold (the material of 20 displaced by the cable 12 is in the form of an aperture), such that the feeder cable extends through the first aperture along its analogous first longitudinal axis, and a second aperture extending partially through

the primary mold (the material of 20 displaced by line 16 is in the form of an aperture), such that the drop line extends into the second aperture along a second longitudinal axis. Vander Ploog teaches that it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to employ this primary mold in order to provide electrical and mechanical protection to the nexus (C1/L53-56, C1/L61-C2/L6). The primary mold of modified-Yamawaki would therefore possess the claimed first aperture and second aperture with the claimed properties.

Per **claim 18**, modified-Yamawaki teaches the limitations of claim 16. The feeder cable is directly electrically connected to a connection unit 18 (Fig. 2, C7/L54-59).

Per **claim 19**, modified-Yamawaki teaches the limitations of claim 16. The system further comprises a secondary mold 33f surrounding the primary mold 33e and forming an undermold-overmold interface at an outer surface of the primary mold (Fig. 9B illustrates a cutout of the relationship between 33e, 33f; only the thickness of 33f intercedes between the primary mold 33e surface and the exterior, therefore the interface is present).

Claim(s) 4 is/are rejected under 35 U.S.C. 103 as being unpatentable over Yamawaki and Vander Ploog as applied to claim 1 above, and further in view of US PGPub 2011/0011642 to Solon.

Regarding claim 4, modified-Yamakawi teaches the limitations of claim 1. The references do not teach that the overmold defines at least one attachment aperture. Solon, however, teaches that it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to form an overmold (56) with an attachment aperture 52 so that zip ties or fasteners may secure an assembly (¶0026, 0029).

Claim(s) 12 is/are rejected under 35 U.S.C. 103 as being unpatentable over Yamawaki and Vander Ploog as applied to claim 1 above, and further in view of US PGPub 2010/0139733 to Jonczyk.

Regarding claim 12, modified-Yamakawi teaches the limitations of claim 1. The references do no teach that the drop line includes a fuse. However, it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to include a fuse in the drop line because Jonczyk teaches such a fuse (e.g. 112 of Fig. 9) in a similar drop line in order to protect the circuits the assembly may be connected to (¶0002, 0037, 0038).

Claim(s) 10 is/are rejected under 35 U.S.C. 103 as being unpatentable over Zahnen as applied to claim 1 above, and further in view of US PGPub 2009/0088032 to Keeven.

Regarding claim 10, Zahnen teaches the limitations of claim 1. Zahnen does not teach that the lead assembly of that invention comprises a third aperture. Keeven teaches that such a lead assembly can be formed to accommodate a second drop line, such as for additional parallel lines shown for the embodiment of Figs. 1B (¶0042). Therefore it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to modify Zahnen's assembly to comprise a third aperture partially through the undermold and having a third diameter, wherein a second drop line extends from the third aperture along a third longitudinal axis because those limitations would arise from the obvious inclusion of a second drop line. The mere duplication of parts, without any new or unexpected results, is within the ambit of one of ordinary skill in the art. See *In re Harza*, 124 USPQ 378 (CCPA 1960) (see MPEP § 2144.04).

A skilled artisan would understand that the first and third diameter could have three relative configurations: both diameters are equal, the first diameter is smaller than the third diameter, and the third diameter is smaller than the first diameter (as is shown for the first and second diameters in Zahnen). Therefore it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to form the third diameter smaller than the first diameter because it would have been obvious to try.

The Supreme Court decided that a claim can be proved obvious merely by showing that the combination of known elements was obvious to try. In this regard, the Supreme Court explained that, "[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has a good reason to pursue the known options within his or her technical grasp." An obviousness determination is not the result of a rigid formula disassociated from the consideration of the facts of the case. Indeed, the common sense of those skilled in the art demonstrates why some combinations would have been obvious where others would not. Therefore, choosing from a finite number of identified, predictable solutions, with a reasonable expectation for success, is likely to be obvious to a person if ordinary skill in the art. See *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421, USPQ2d 1385, 1395 – 97 (2007) (see MPEP § 2143, E.).

Claim(s) 1-3, 5-8, 10, and 11 is/are rejected under 35 U.S.C. 103 as being unpatentable over JP2003-293536A to Umeoka (machine translation relied upon herein), and further in view of US PGPub 2012/0125395 to Bellacicco.

Regarding claims 1-3, 5-8, 10, and 11, the preamble for claim 1 recites a lead assembly for use in a solar energy installation. If the body of a claim fully and intrinsically sets forth all of the limitations of the claimed invention, and the preamble merely states, for example, the purpose or intended use of the invention, rather than any distinct definition of any of the claimed invention's limitations, then the preamble is not considered a limitation and is of no significance to claim construction. Pitney Bowes, Inc. v. Hewlett-Packard Co., 182 F.3d 1298, 1305, 51 USPQ2d 1161, 1165 (Fed. Cir. 1999). MPEP §2111.02.II. As the body of the claim recites a structurally complete invention, the limitation that the lead assembly is for use in a solar energy installation is not given patentable weight.

Umeoka teaches a lead assembly including

- a drop line 8a extending along a first longitudinal axis (Figs. 2, 12, middle p. 6 of the translation, middle p. 8) and having a first diameter (a skilled artisan would understand from the depiction of the wires throughout the Figs. of the disclosure that the drop line 8a has a conventional round cross-section, and therefore necessarily has a first diameter)
- a feeder cable 40a electrically coupled to the drop line 8a at a nexus extending along a second longitudinal axis and having a second diameter (illustrated as a filled dot in Fig. 12(a))
- *Per* **claims 10 and 11**, a second drop line 8b extending along a third longitudinal axis and having a third diameter, wherein the third longitudinal axis is substantially concentric with the second longitudinal axis and substantially parallel with the first longitudinal axis (left element 8a and right element 8b extend left-right for a portion and are aligned in the up-down direction).

Umeoka does not teach an undermold fully encasing the nexus and an overmold surrounding the undermold and forming an undermold-overmold interface at an outer surface of the undermold. Bellacicco teaches that it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to form a lead assembly with lines, cables, and nexuses of the assembly encased by an undermold (material 166 of Figs. 14, 24C encases the wires and electrical connections therein by molding around the elements of the assembly; ¶0048, 0052, 0055, 0059) which is surrounded by an overmold (170/180, ¶0053, 0056), such that an undermold-overmold interface is formed, so that the lead assembly can be constructed efficiency (¶0044).

As such, the feeder cable 40a, which extends completely and continuously through the region of the lead assembly, would displace the material of the undermold in the form of a first aperture extending completely through the undermold and having the first diameter, the feeder cable extending through the first aperture along the first longitudinal axis in the assembly of modified-Umeoka. Similarly, the drop line 8a would displace the material of the undermold in the form of a second aperture extending partially through the undermold and having the second diameter, where the dropline extends

from the second aperture along the second longitudinal axis. Finally, the second drop line 8b would displace the material of the undermold in the form of a third aperture extending partially through the undermold and having the third diameter, where the second drop line extends from the third aperture along the third longitudinal axis.

Umeoka does not describe the first diameter, second diameter, and third diameter of the feeder cable, drop line, and second drop line, respectively, or their relative comparison. Notably, the feeder cable 40a is distinguished from the first and second drop lines 8a, 8b by its different function in the text. Regardless, a skilled artisan would understand that five possibilities regarding the first, second, and third diameters are possible: all three are different, all three are the same, the first diameter is different than the same second and third diameters, the second diameter is different than the same first and third diameters, the third diameter is different than the same first and second diameter. Therefore it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to try a configuration in which the first diameter is different than the second diameter and the third diameter is different than the first diameter.

The Supreme Court decided that a claim can be proved obvious merely by showing that the combination of known elements was obvious to try. In this regard, the Supreme Court explained that, "[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has a good reason to pursue the known options within his or her technical grasp." An obviousness determination is not the result of a rigid formula disassociated from the consideration of the facts of the case. Indeed, the common sense of those skilled in the art demonstrates why some combinations would have been obvious where others would not. Therefore, choosing from a finite number of identified, predictable solutions, with a reasonable expectation for success, is likely to be obvious to a person if ordinary skill in the art. See *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421, USPQ2d 1385, 1395 – 97 (2007) (see MPEP §

2143, E.).

Per **claims 2 and 3**, modified-Umeoka teaches the limitations of claim 1. While Umeoka does not teach exposed wire, Belaccico teaches that it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to include a section of exposed wire in the drop line and the feeder cable at the nexus in order to establish an electrical connection (¶0038, 0040-0042, 0044, 0055).

Per **claim 5**, modified-Umeoka teaches the limitations of claim 1. The feeder cable 40a terminates at a feeder cable connector 41 or 42 (Figs. 1, 2, 5, 8, bottom of p. 5 of translation).

Per **claims 6 and 7**, modified-Umeoka teaches the limitations of claim 5. The feeder cable 31 of Yamawaki terminates at a feeder cable connector 34 (Figs. 4-7, 8A, 8B, C11/L3-13). The limitation that the feeder cable connector is configured to attach directly to an inverter, or to attach directly to a jumper cable, which in turn connects directly to an inverter is an intended use limitation. Intended use limitations are given weight to the extent that the prior art structure is capable of performing the intended use. See MPEP § 2111.02, 2112.01 and 2114-2115. The cited passages of Yamawaki teach that the feeder cable connector is capable of electrically connecting a lead assembly to another electrical element.

Per **claim 8**, modified-Umeoka teaches the limitations of claim 1. The first longitudinal axis and the second longitudinal axis are substantially parallel (see cited Figs. and passages above).

Allowable Subject Matter

Claim 17 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ERIC R SMITH whose telephone number is (571)270-7186. The examiner can normally be reached M-F, 8:30am-5:30pm MST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jeffrey Barton can be reached on (571) 272-1307. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ERIC R. SMITH
Primary Examiner
Art Unit 1726

/ERIC R SMITH/
Primary Examiner, Art Unit 1726

Notice of References Cited	Application/Control No. 17/301,609	Applicant(s)/Patent Under Reexamination Solon, Dean	
	Examiner ERIC R SMITH	Art Unit 1726	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-6268559-B1	07-2001	Yamawaki; Takeharu	G05F1/62	307/77
*	B	US-3852516-A	12-1974	Vander Ploog; Cornelius J.	H02G15/003	174/76
*	C	US-20110011642-A1	01-2011	Solon; Dean	H01R11/28	174/72A
*	D	US-20100139733-A1	06-2010	Jonczyk; Ralf	H01H85/201	174/72A
*	E	US-20090088032-A1	04-2009	Keeven; James	H01R4/36	439/797
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*	G	US-20120125395-A1	05-2012	Bellacicco; John	H01L31/02008	136/244
	H					
	I					
	J					
	K					
	L					
	M					

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N	JP-2003293536-A	10-2003	JP	UMEOKA T	H02S20/23
	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.

Voltage, LLC
EX1021-239

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/301,609	Solon, Dean
	Examiner	Art Unit
	ERIC R SMITH	1726

CPC - Searched*		
Symbol	**Date**	**Examiner**
H01L31/0422,0424,0482,0484,05	1/16/2014	ERS
E04D3/40	1/17/2014	ERS
H01L31/02013,02008,02021	7/1/2014	ERS
H02S40/00-38	5/23/2014	ERS
H01R4/187,18,70	11/30/2017	ERS
H01R3-13/All	4/17/2020	ERS
H01R11/11	4/17/2020	ERS
H01R4/021,023,5205	4/17/2020	ERS
H01R13/5205	4/17/2020	ers
H01R4/027,10	4/17/2020	ERS
H01R9/0509	4/17/2020	ERS
H02S40/30,36	6/16/2022	RS
H01R4/All	6/16/2022	RS
H01R9/All	6/16/2022	RS
H01R13/All	06/16/2022	RS
H01R24/All	06/16/2022	RS
H01R25/All	6/16/2022	RS

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

Voltage LLC
EX1021-240

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/301,609	Solon, Dean
	Examiner	Art Unit
	ERIC R SMITH	1726

US Classification - Searched*			
Class	Subclass	Date	Examiner
52	173.3	7/16/2013	ERS
136	243-265	7/16/2013	ERS

* 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
Keyword search in USPC subclasses, CPC subgroups, IPC subgroups (see EAST history for search strategy)	5/23/2017	ERS
Inventor search in DAV	5/24/2017	ERS
Keyword search in CPC subgroups (see EAST history for search strategy)	11/30/2017	ERS
Update inventor search in DAV	11/30/2017	ERS
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Keyword search in EAST databases (see EAST history for search strategy)	9/14/2018	ERS
Updated inventor search in DAV	9/18/2018	ERS
Updated inventor search in DAV	6/6/2019	ERS
Keyword search in EAST databases (see EAST history for search strategy)	6/6/2019	ERS
Search consult with Examiner James Harvey in AU 2833	4/16/2020	ERS
Keyword search in EAST databases (see EAST history for search strategy)	5/8/2020	ERS
Updated inventor search in DAV	5/8/2020	ERS
Updated inventor search in DAV	2/1/2021	ERS
Keyword search in CPC subgroups	6/16/2022	RS
Inventor search in DAV	6/16/2022	RS

Voltage 1166
EX1021-241

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/301,609	Solon, Dean
	Examiner	Art Unit
	ERIC R SMITH	1726

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
H02S40	30	2/1/2021	ERS
H01R9	03,0509	2/1/2021	ERS
H01R4	70,187,18,70,021,023,5205	2/1/2021	ERS
H01R11	11	2/1/2021	ERS
H01R3	All	2/1/2021	ERS

Voltage 116
EX1021-242

ROOF MEMBER WITH SOLAR BATTERY

DOCUMENT ID	DATE PUBLISHED
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INVENTOR INFORMATION

NAME	CITY	STATE	ZIP CODE	COUNTRY
UMEOKA TAKASHI	N/A	N/A	N/A	N/A

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2002-04-01

CPC CURRENT

TYPE	CPC	DATE
CPCI	H02S20/23	2014-12-01
CPCA	Y02B10/10	2013-01-01
CPCA	Y02E10/50	2013-01-01

Abstract

<P>PROBLEM TO BE SOLVED: To provide a roof member with a solar battery having high water-proof performance and eliminating damage on a cable when fixed to a roof foundation. <P>SOLUTION: The roof member is provided with a roof substratum 2 having a solar battery panel 5 fixed to its obverse side, and a recess portion 39 for housing a cable 40 on its reverse side. A lead wire 8 pulled out from the solar battery panel 5 is led from the obverse side through an outer periphery of the roof substratum 2 to the recess portion 39 on the reverse side to be connected to the cable 40, and the cable 40 is pulled to the roof substratum 2 from the recess portion 39. Connectors 41, 42 are fixed to end parts of the cable 40, respectively. Cut parts 10a, 10b, 10c are formed in the roof substratum 2 to communicate with the recess portion 39. The lead wire 8 is led to be pulled in through the cut parts, and the end parts of the cable 40 are pulled out. The cable 40 is fixed to the recess portion 39 by a bundling band 45. <P>COPYRIGHT: (C)2004,JPO

Description

Detailed Description of the Invention
[0001]
BACKGROUND OF THE INVENTION 1. Field of the Invention The present invention relates to a roof material with a solar cell, and in particular, it has a high waterproof performance, and when the nail or the like is hammered in and fixed to the roof substrate, there is a problem that the nail damages the lead wire or the cable. A roof material with a solar cell that can be prevented.
[0002]
2. Description of the Related Art Conventionally, as a roof material with a solar cell of this type, there is a solar cell module described in JP-A-2000-114578. This solar cell module is provided with a housing recess for housing a terminal box in a metal roofing material. Then, a pair of lead wires protruding from the terminal

box of the solar cell is drawn out from the through hole of the storage recess to the lower surface side of the metal roof material.
In the solar cell module constructed as described above, usually, a large number of solar cell modules are arranged on the roof, and lead wires drawn out from the respective solar cell modules are connected by a connector to connect the solar cell module to the outer periphery thereof. It has to be routed along, and the generated power is obtained from the output line to which many lead wires are connected. When fixing the solar cell module on the roof substrate, a plurality of places around the solar cell module are fixed by nailing or nailing.
[0004]
In the solar cell module having the above structure, since the metal roof member is provided with the through holes through which the pair of lead wires protruding from the terminal box are drawn out, it is difficult to perform waterproof sealing. In addition, when a fire or the like occurs in the adjacent house, the flame may reach the roof plate of the roof and cause a fire. Further, as described above, in the solar module to which the solar cell is fixed, the lead wires are located along the outer periphery of the solar module, and when fixing them to the roof base with nails, etc., these lead wires and output wires are damaged. It is necessary to carry out the work so as not to do so, and if the work is done carelessly, there is a risk that the cables and the like routed around the outside of the solar cell module may be punched out with a nail.
The present invention has been made in view of the above problems, and an object thereof is to provide a waterproof performance because a lead wire for taking out electric power from a solar cell panel does not penetrate the roof base material. High, most of the cables and leads connecting multiple solar panels are housed in the recesses on the back side of the roof substrate, which damages the cables and leads when fixing the roof substrate to the roof substrate. The purpose is to provide a roof material with a solar cell that is rare. Also,
An object of the present invention is to provide a roof material with a solar cell, which can be easily installed, because it is easy to connect with a connector when connecting a plurality of roof materials with a solar cell.
[0006]
[Means for Solving the Problems] To achieve the above object,
The roof material with a solar cell according to the present invention comprises a roof base material having a solar cell panel fixed on the front surface side and a concave portion for storing a cable formed on the back surface side, and a lead wire drawn from the solar cell panel is a roof. While being connected to the cable by being guided from the front surface side to the recessed portion on the back surface side through the outer periphery of the base material, the cable is drawn out from the recessed portion to the outside of the roof base material,
A connector or a connection terminal is preferably fixed to the end of the cable.
The solar cell panel is fixed to a concave portion formed on the front surface side of the roof material with a fastener or the like, and a lead wire for taking out the generated electric power from the solar cell panel is drawn out from the upper portion of the solar cell panel to the front surface side. There is. The cable is to connect each solar cell panel to each other and to be connected to the lead wire of the solar cell panel when a large number of roofing materials with solar cells are arranged side by side on the roof substrate, and the recess for storing the cable is It is preferable that the roof substrate is formed horizontally above the back surface side of the roof substrate.
According to this structure, the lead wire pulled out from the solar cell panel is led from the front surface side of the roof base material through the outer periphery to the recessed portion on the rear surface side of the roof base material, and the cable is also terminated. Most of the parts except the parts or the vicinity of the connector are housed in the recesses, and the exposed part on the front surface side of the roof substrate can be reduced. Therefore, it is possible to prevent the lead wire and the cable from being damaged when the roof material with the solar cell is fixed to the roof substrate with nails or the like. Further, since the lead wire and the cable can be connected in the recess, the relay connector and the like are not exposed to the outside, and the installation work on the roof substrate is facilitated.
In the above roof material with solar cells, a notch portion communicating with the recess is formed on the outer periphery of the roof substrate, and the lead wire is drawn into the recess through the notch and the end of the cable is pulled out. Is suitable. The notch is formed by notching the wall surface forming the recess, and communicates the outer space of the roof substrate with the inner space of the recess. Thus,

the lead wire can be easily pulled into the recess and the cable end or the connector fixed to the cable end can be easily pulled out from the recess. It should be noted that the lead wire lead-in and the cable end lead-out may be shared by one notch. Further, the cutout portion may be a through hole that penetrates the wall surface forming the recess.
As a preferred specific embodiment of the roof material with a solar cell according to the present invention, in the above-mentioned roof material with a solar cell, fixing means such as a binding band is provided in the recess to fix the cable and / or the lead wire. It is characterized in that it is fixed to the recess by means. Since nail holes used when fixing roof materials with solar cells to the roof substrate with nails etc. are often drilled along the upper side, the recess for storing the cable and the nail hole often overlap, According to this configuration, the cable connecting the plurality of roof materials with solar cells is fixed to the recess on the back surface side of the roof base material and is prevented from moving. It is possible to prevent the cables and lead wires from being damaged by nails. Again 1
When a plurality of solar cell panels are fixed to one roofing material with solar cells, the plurality of solar cell panels can be connected in series or in parallel with this cable.
Further, as another preferable specific embodiment of the roof material with a solar cell according to the present invention, in the roof material with a solar cell, both ends of the cable are drawn out from both ends of the roof base material. It is characterized by that. It is preferable that the positions where the cables are pulled out are closer to both ends because the exposed portions of the cable are reduced. According to this configuration, most of the cables that connect a large number of roof materials with solar cells are housed in the recesses except for the connector portions at both ends or the tip, so that the roof substrate of the roof materials with solar cells can be used. It will be easy to install. In addition, since the lead wire has few exposed portions and the connection between the lead wire and the cable can be made in the concave portion, the relay connector and the like are not exposed and the appearance can be improved.
Furthermore, it is possible to efficiently connect the solar cell panel and the cable, and connect the solar cell-equipped roof members together.
It is preferable to provide a fixing tool insertion hole such as a nail on the roof base material while avoiding the cable and / or the lead wire fixed to the concave portion by the fixing means. With this structure, when fixing the roof material with the solar cell to the roof substrate by inserting nails or screws into the fixing tool insertion holes provided in the roof base material, the fixing tool should not damage the cables or lead wires. Is prevented.
[0013]
BEST MODE FOR CARRYING OUT THE INVENTION An embodiment of a roof member with a solar cell according to the present invention will be described in detail below with reference to the drawings. 1 is a front view of a roof material with a solar cell according to the present embodiment, FIG. 2 is a rear view of FIG. 1, FIG. 3 is a front view of a surface material of a roof material with a solar cell, and FIG. 4 is a roof material with a solar cell. A front view of the backup material, FIG. 5 (a) is a plan view of the roof material with a solar cell of FIG. 1, (b) is a plan view of the backup material of FIG. 4, and (c).
FIG. 5 is a bottom view of the backup material of FIG.
1 to 5, a roof material 1 with a solar cell (hereinafter referred to as a roof material) 1 includes a roof base material 2, and the roof base material 2 has two solar cell panels 5 and 5 installed therein. A surface material 10 having two concave portions (described later) formed on the front side and a backup material 30 fixed to the back surface of the surface material 10 are provided. The surface material 10 is formed of a metal plate material or the like, and in the present embodiment, it is formed by press forming a 0.8 mm thick galvanium steel plate. The size and shape of the surface material 10 is a general roof material attached to the roof surface,
For example, it is preferable that the roof tile and the like have substantially the same shape. Further, it may have a shape in which a plurality of general roofing materials are provided in parallel with the eaves or in the flow direction, that is, a shape in which a plurality of them are integrated.
In the surface material 10, a back surface side overlapping portion 11 is projected from the rectangular portion of the front surface to the right side, and the back surface side overlapping portion 11 is formed as a step portion which is depressed from the surface of the surface material 10, and the roof material. It is formed with a thickness of about one half of the thickness of. A drainage groove 11a for draining invading rainwater is formed on the front surface of the back-side overlapping portion 11. The draining groove 11a is

formed by two grooves in the upper half, and merges in the middle to form one groove in the lower half, and the rainwater that has entered the back of the overlapping portion is drained to the front side. It can be configured.
On the left side of the rectangular portion, there is formed a front surface side overlapping portion 12 into which the adjacent back surface side overlapping portions 11 are inserted when the roofing materials 1 are arranged in the horizontal direction.
The front surface side overlapping portion 12 is formed as a step portion from the back surface of the roofing material 1 and is formed with a thickness of about ½ of the thickness of the roofing material 1, and the back surface side overlapping portion 11 and the front surface side overlapping portion are formed. The two roofing materials 1 are configured to be flat when the portion 12 is overlapped. On the back surface of the front surface side overlapping portion 12, a projection 12a into which the drainage groove 11a is fitted is formed. The protrusion 12a has a wide upper half and a narrow lower half.
Draining projections 13 are formed on the rectangular portion of the roof base material 2 along the upper side, and the roofing material 1 is formed on the right and left two places of the draining projections 13 and on the back side overlapping portion 11 of the roof. A nail hole 14 for inserting a fixture such as a nail for fixing to the base is formed. In the rectangular part of the roofing material 1, the solar cell panel 5,
Two concave recesses 15, 15 for housing 5 are formed side by side in the horizontal direction. The recessed portions 15, 15 are preferably formed in a shape slightly larger than the size of the solar cell panels 5, 5 to be stored.
Here, one solar cell panel 5 will be described with reference to FIG. FIG. 6 is a vertical cross-sectional view of the roof member with a solar cell in a disassembled state along a recess for accommodating a lead wire.
The solar cell panel 5 is made of a material such as a silicon-based semiconductor or a compound semiconductor, and is made of a single-crystal or polycrystal crystalline semiconductor or an amorphous semiconductor. The solar cell panel 5 has a solar cell formed on a substrate 6 made of glass or the like having a rectangular front surface, and a terminal box 7 protruding from the back surface thereof. A lead wire 8 for extracting electric power is drawn from the terminal box 7. ing.
Further, as shown in FIG. 6, the surface material 10
The concave portion 15 has a shape in which the substrate 6 of the solar cell panel 5 is housed, and the back side projects in correspondence with the concave portion.
The recessed portion 15 is formed to a depth substantially equal to the thickness of the substrate 6,
A storage recess 16 for further housing the terminal box 7 is further formed by recessing from the recess, and a storage recess 17 for storing the lead wire 8 is formed. Small arc portions (see FIG. 1) are formed at the four corners of the concave portion 15 so that the corners of the substrate 6 such as glass can escape.
The storage recess 17 is formed up to the upper part of the recess 15 as shown in FIG. 1, and the lead wires 8, 8 can be led out to the upper part on the front surface side of the solar cell panels 5, 5.
Two mounting portions 19 (see FIG. 3) for fixing claws 18 for fixing the solar cell panels 5, 5 are provided on the upper and lower sides of the recessed portion 15. The fixed claw 18 is, for example, a stainless plate having a thickness of about 1 mm, a width of 40 mm, and a length of 25 m.
The mounting portion 1 is formed by cutting into about m and is formed on the stepped surface of the surface material 10 by a rivet, a child screw, or the like.
It is fixed at 9. About 5 mm at the tip of the fixing claw 18 protrudes above the roof material 1, and the solar cell panel 5 is pressed and fixed by using a double-sided tape made of acrylic foam as a base material, which is attached to the back surface of the protruding portion, as a buffer material.
A water collecting groove 20 is formed along the lower side of the concave portion 15 in the direction of water, that is, on the water side. Water collection groove 2
In the case of 0, the left and right sides of one concave portion 15 are shallow, and a slope is provided toward the center so that the central portion is deep. Recess 1
Drainage groove 21 is formed from 5 to the outer periphery on the underwater side,
The drain groove 21 is formed continuously at the same depth as the lowest part, corresponding to the lowest part where the depth of the central part of the water collection groove 20 is the deepest. Therefore, when rainwater enters through the gap between the outer periphery of the solar cell panel 5 and the recessed portion 15, it flows downward and is collected in the center by the water collecting groove 20, and then from the drain groove 21 to the outside of the surface material 10. It is configured to be discharged. As

described above, the surface material 10 constituting the roof substrate has the concave portion 15 and the storage concave portions 16 and 17, but there is no penetrating portion for drawing out the lead wires 8 and 8; Water does not leak from inside, improving waterproof performance.
A backup material 30 constituting the roof substrate 2
Is preferably formed of, for example, styrofoam resin, and is lightweight and excellent in heat insulation. In the present embodiment, the atrilonitrile styrene beads having a heat-resistant temperature of about 100 ° C. are foamed 40 times by molding and used.
Other foaming resins include polyethylene, styrene, polypropylene, atrilonitrile styrene, PPO, PE
It may be formed of a foam such as T. The backup material 30 is fixed to the back surface of the surface material 10 with, for example, a double-sided tape, and preferably has a surface that comes into close contact with the back surface of the surface material 10. It should be noted that it is sufficient to attach the double-sided tape to appropriate places, and after the roof material 1 is fixed to the roof base with nails, the surface material 10 and the backup material 30
And will never come off.
The backup material 30 has a concave portion 15 formed on the surface material 10, a concave portion 16 for accommodating the terminal box 7 and a concave portion 17 for accommodating the lead wire 8. Shaped portions and penetrating portions are formed. That is, as shown in FIG. 6, the concave portion 31 is formed corresponding to the protruding portion on the back side of the concave portion 15, and the protruding portion of the concave portion 15 can be fitted into the concave portion 31. . Also,
The penetrating portion 3 corresponding to the protruding portion on the back side of the storage concave portions 16 and 17.
2 and 33 are formed, and the protruding portions of the storage recesses 16 and 17 can be fitted into the penetrating portions 32 and 33, respectively.
As shown in FIGS. 4 and 7, the backup material 30 has a step portion 34 corresponding to the water collecting groove 20 of the surface material 10 and a drain groove 2 corresponding to the drain groove 21.
A cutout portion 35 is formed as a drainage portion to which 1 is fitted. As shown in FIG. 7A, the cutout portion 35 is cut out in a wide rectangular shape, and since the drainage groove 21 of the surface material 10 has a semicircular cross section, the drainage groove 21 and the cutout portion 35 are not formed. Are configured so as not to be in close contact with each other, and drainage can be performed even when rainwater enters between the surface material 10 and the backup material 30. The drainage portion may be formed at another position that does not coincide with the drainage groove, for example, the left and right end portions instead of the central portion.
Further, the drainage portion may be a drainage hole provided on the underwater side of the concave portion 31 through the backup material.
As shown in FIGS. 5 and 6, a plurality of ventilation grooves 36 are formed in the vertical direction on the back surface of the backup material 30, and the bottom surface of the ventilation groove 36 is a deep inclined surface on the water side. In addition, a plurality of leg portions 37 are formed on the back surface of the backup material 30 so as to project, and the leg portions are formed in a wedge shape so that the thickness increases toward the water side. For this reason, when the backup material 30 is fixed to the roof substrate R such as a roof plate, a space is formed by the plurality of leg portions 37, and the space communicates with the upper and lower spaces along the roof slope and the ventilation groove 36. Along with it, it is configured to allow air flow. At the lower end of the backup material 30, there is a relief portion 38 for the lead wire.
Is formed, and when the roofing materials 1 are vertically stacked, the lead wire 8 of the lower roofing material 1 is escaped.
As shown in FIG. 2, in the upper part of the roof base material 2, recesses 39 are formed in the horizontal direction to the both ends in the horizontal direction. The recess 39 is composed of the surface material 10 that constitutes the roof substrate 2 and the upper end surface of the backup material 30. While connecting two solar cell panels 5 and 5 to this recess,
A cable 40 that connects a number of roofing materials 1 is stored. Then, at both ends of the cable 40, connectors 41 and 42 for connecting to the other roofing material 1 are fixed. One of the connectors 41 and 42 is a male connector and the other is a female connector.
As shown in FIG. 5A, three cutouts are formed in the hanging portion formed by bending the outer periphery

above the surface material 10, and these cutouts communicate with the recess 39. ing. The notch 10a at the left end is connected to the cable 40 by the lead wire 8 drawn from the left solar cell panel 5 being guided from the front side to the recess on the back side through the outer periphery of the surface material 10. In both cases, the left end of the cable 40 is the recess 3
It is drawn out from the roof substrate 2 from 9. The cutout portion 10b at the right end portion is for drawing out the right end portion of the cable 40 from the recess 39 to the outside. In addition, the central cutout 10
The reference character c is for pulling the lead wire 8 of the solar cell panel 5 on the right side while changing its direction outside the outer periphery. That is, the lead wires 8 and 8 are turned around outside the outer periphery of the surface material 10 and guided into the recess 39. Connectors 41 and 42 are fixed to both ends of the cable 40, and the connectors are pulled out from the notches 10a and 10b together with the ends of the cable.
In addition, three cutouts are formed in FIG.
The example in which the notch 10a at the left end of is used for both lead-in of the lead wire 8 and lead-out of the cable 40 is shown.
Alternatively, two may be formed so that two are used for leading in the lead wire and the other two are used for leading out the cable. In addition, two cutouts may be formed, and each cutout may be commonly used for drawing out a cable and drawing in a lead wire.
Now, with reference to FIG. 2, the connection between the lead wires 8 of the two solar cell panels 5 and 5 and the cable 40 will be described below. The cable 40 is composed of a plus side line 40a and a minus side line 40b, and is not directly connected to the solar cell panels 5 and 5. The lead wire 8 that directly projects from the solar cell panels 5 and 5 is composed of a plus side lead wire 8a and a minus side lead wire 8b.
Then, the cable 40 and the lead wires 8 and 8 are connected via a relay section 43 such as a joint box. That is, the relay part 43 connects the lead wires 8 and 8 to the cable 40, connects the plus side lead wire 8a of one solar cell panel to the plus side wire 40a of the cable 40, and connects the other solar cell panel. Minus lead wire 8
Connect b to the negative side wire 40b of the cable 40. And the negative side lead wire 8b of one solar cell panel
And the positive side lead wire 8a of the other solar cell panel are directly connected, whereby the two solar cell panels 5 and 5 are connected in series and connected to the cable 40, and power can be taken out.
As described above, the lead wires 8 and 8 drawn out from the solar cell panels 5 and 5 are guided by being turned from the front surface side of the roof base material 2 to the recess 39 on the back surface, and drawn in. , 40 are not directly connected to the cable 40 and are accommodated in the recess 39, and both ends of the cable 40 are pulled out from the cutouts 10a and 10b to connect the connector 4 to the terminal.
1, 42 are fixed. Therefore, the lead wire 8,
8 and the cable 40 are connected to each other by the concave portion 3 opened on the rear surface side. Since it is carried out by the relay portion 43 in 9, the workability of the roofing material 1 can be improved without the connecting portion protruding outside.
As described above, the nail holes 1 for fixing the roofing material 1 to the roof substrate with nails along the upper and right sides of the roof base material 2
4 are formed. Since the nail hole 14 on the upper side overlaps with the recess 39 through which the cable 40 formed on the upper back surface of the roofing material 1 passes, the cable 40 arranged in the recess is bound by the binding band 4.
It is fixed at 5. The binding band 45 constitutes a fixing means for the cable, and although not shown in detail, a base portion is attached to the back surface of the surface material, a tightening band portion extends from the base portion, and a clamp for fixing the tightening band portion to the base portion. Parts are formed. The nail hole 14 is provided in the roof substrate 2 while avoiding the fixed cable 40 and the lead wires 8 and 8. Therefore, the cable 40 does not move in the recess 39, and the nail does not damage the cable when the nail hole 14 and the cable 40 overlap and are fixed. The lead wire may be fixed with a binding band.
The roofing operation of the roof member with a solar cell of the present embodiment having the above-described structure will be described with reference to FIGS. FIG. 8 is a front view showing an operating state of a roofing construction of a roof material with a solar cell panel, and FIG. 9 is a longitudinal sectional view of a main part of the roofing material with a solar cell panel. The roofing materials 1 are arranged

horizontally on the roof base R from below the roof,
Grab one by one upwards. In addition, on the upper surface of the roof substrate R,
Asphalt roofing (not shown) etc. are laid. For example, on the right side rear surface side overlapping portion 11 of the roofing material 1, the left side front surface side overlapping portion 12 of the roofing material 1 is overlapped, and the nail holes 14 are used sequentially in the right direction. And nail it down.
When the nail is driven through the nail hole 14, the lead wire 8 and the cable 40 in the recess 39 are bound by the binding band 45.
Since the lead wire 8 and the cable 40 can be prevented from moving inside the recess 39 and being positioned below the nail hole 14, the lead wire 8 and the cable 40 are not damaged by the nail. In addition, most of the cables 40 that electrically connect each roofing material are the recesses 3
Since it is stored in 9, the number of protrusions from the roof base material 2 is small and nailing can be performed easily. Then, the roofing material 1 is electrically connected by an extremely simple operation of simply connecting the adjacent connectors 41 and 42.
After roofing the roofing material 1 in one row in the horizontal direction, the roofing material 1 on the upper step is roofed. That is, the lower roof material 1
The roofing material 1 on the upper tier is roofed so that the lower end side of the roofing material 1 overlaps the draining protrusion 13 and is horizontally laid from left to right. Then, the connectors 41 and 42 are connected in the same manner as described above to electrically connect the roofing material 1. This electrical connection also
The operation can be performed simply by connecting the connector fixed to the end of the cable, and the connection can be made easily and surely. Also,
Since most of the cable 40 is housed in the recess 39, the appearance of the roofing material 1 is good, and it is possible to prevent injuries during transportation or roofing.
A plurality of leg portions 37 are formed on the back surface of the backup material 30 so that the roof base material R and the backup material 30 are not in close contact with each other to form a space. The space and the ventilation groove 36 communicate with each other. Since the upper and lower spaces are in communication with each other, an air flow W (see FIG. 9) flowing in the space between the plurality of legs is formed. As a result, the roof base R and the roofing material 1
Drying is promoted even if rainwater enters between the backup material 30 and the backup material 30, and the air heated by solar radiation is convected and discharged from the upper portion, so that the heat insulating performance is improved.
Another embodiment of the present invention will be described in detail with reference to FIG. FIG. 10 (a) is a front view of a main part of another embodiment of a roof member with a solar cell according to the present invention, FIG. 10 (b).
FIG. 4 is a schematic wiring diagram showing the connection state. It should be noted that this embodiment is characterized in that one solar cell panel is provided and the cable housed in the recess and the lead wire guided to the recess and connected to the cable are different from the above-described embodiments. Then, other substantially equivalent configurations are denoted by the same reference numerals, and detailed description thereof will be omitted.
In FIG. 10, the roof material 51 is one solar cell panel 55 fixed to the front surface side, and the lead wire 56 drawn from the solar cell panel 55 to the front surface side is
The roof base material 52 is turned around outside the outer periphery of the roof base material 52 and guided and drawn into the recess 53 on the rear surface side, one of which is connected to one terminal of the connector 57 located at one end of the roof base material, and the other is connected. It is connected to one terminal of a connector 58 located at the other end of the roof substrate. Then, the other terminals of the connectors 57 and 58 are connected by the cable 59. That is, the lead wire 56 is connected to the cable 59 via the connectors 57 and 58. Further, the lead wire 56 and the cable 59 are fixed by the same banding band 54 and the like as in the above-mentioned embodiment to prevent the lead wire 56 and the cable 59 from moving inside the recess 53.
As described above, the lead wires 56 directly connected to the solar cell panel 55 are guided from the front surface side of the roof substrate 52 through the outer periphery and retracted into the recess 53 on the rear surface to be housed. A cable 59 that is not directly connected to 55 is stored in the recess 53. The ends of the lead wire 56 and the cable 59 are pulled out from both ends of the recess 53, and the connectors 57 and

58 are fixed to the terminals. As described above, most of the lead wires 56 and the cables 59 are housed in the recesses 53 and are not exposed, and only the both ends are pulled out from the recesses 53. Therefore, the roofing material 51 has improved workability and a large number of roofs. The materials 51 ... Can be easily connected.

When a plurality of roofing members 51 of this embodiment are connected and used, the connectors 57 and 58 are connected to each other, and the return connector 60 is connected to the connector at the end so as to conduct electricity, and the other end is connected. Output from the connector and connect to an inverter (not shown). Also in this example, when a large number of roofing materials are used, electrical connection can be made only by connecting the connectors at both ends of the cable. Most of the cables and lead wires are housed in the recess 53 on the rear surface side of the roof substrate, and only the portions including the connectors at both ends are exposed, so that the appearance is good and the caving work is facilitated. . Furthermore, it is possible to prevent the cables and the lead wires from being damaged when the roof material 51 is nailed.

In the above embodiment, the lead wire is drawn into the recess and the cable is drawn out from the recess through the notch. However, as shown in FIG. 11A, the recess is formed. The upper wall surface is the bottom surface 2 of the roof substrate 2.

When there is a space d floating from a, the direction of the lead wire may be changed by using this space d to guide the lead wire, and the lead wire may be pulled into and out of the recess across the outer peripheral wall surface. Good. Alternatively, as shown in FIG. 11 (b), a circular through hole 2b may be used as the cutout portion to allow the lead wire or the cable to pass therethrough.

The relay section 43 has shown an example in which the two cables 40 and one lead wire 8 are connected. However, as shown in FIG. 12A, the two cables 40 and the two lead wires 8 are connected. The relay unit 43A for connecting 8 may be used. In addition, the cable 40

An example in which the connectors 41 and 42 are fixed to the ends of the

As in the lead wire 8A shown in FIG. 12B, the crimp terminal 44 may be fixed to the end portion and screwed to the relay portion.

Instead of fixing anything like the lead wire 8B of (c), the bare wire may be fixed to the relay portion as it is.

Although the roof base material is shown to be composed of the surface material and the backup material, it may be formed of cement roof tile, burnt roof tile or the like. As an example of a recess for accommodating a cable, a space between the surface material and the upper end of the backup material is used as a recess, but a recess or groove may be formed on the back surface of the backup material made of foam resin to form a recess. Good.

[0043]

As can be understood from the above description, in the roof material with a solar cell of the present invention, the lead wire drawn out from the solar cell panel does not penetrate the roof substrate, so that the waterproof performance can be improved. In addition, since most of the cables that make electrical connection when the roofing materials with solar cells are installed in parallel are stored in the recesses on the back side of the roof base material, the appearance can be improved and the caving work can be facilitated. Therefore, a large number of roofing materials with solar cells can be easily electrically connected. Furthermore, when fixing the roofing material with solar cells with nails or the like, the lead wires and cables are not damaged.

[Brief description of drawings]

FIG. 1 is a front view of an embodiment of a roof member with a solar cell according to the present invention.

FIG. 2 is a rear view of FIG.

FIG. 3 is a front view of the surface material of FIG.

FIG. 4 is a front view of the backup material of FIG.

5 (a) is a plan view of the roof member with a solar cell of FIG. 1,

4B is a plan view of the backup material of FIG. 4, and FIG.

Bottom view of the backup material.

6 is a vertical cross-sectional view of the lead wire accommodating recess of FIG. 1 in a disassembled state.

7A is a horizontal cross-sectional view showing a main part of a drainage groove and a drainage part, and FIG. 7B is a vertical cross-sectional view of a main part of FIG. 7A.

FIG. 8 is a front view showing an operating state of the roofing construction of the roof member with a solar

cell of FIG.
9 is a vertical cross-sectional view of a main part of the roofing material with a solar cell of FIG.
FIG. 10A is a front view of a main part of another embodiment of the present invention, and FIG. 10B is a schematic wiring diagram showing a connection state of FIG.
FIG. 11 is a front view of a main part of still another embodiment of the present invention.
FIG. 12A is a front view of a main part of another embodiment of a relay section, and FIGS. 12B and 12C are front views of main parts of another embodiment of a lead wire.
[Explanation of symbols]
1,51 roof material with solar cells, 2,52 roof substrate, 5,55 solar panel, 8,8A, 8B, 56 lead wire, 10 surface materials, 10a, 10b, 10c cutouts, 14 nail holes (fixture insertion holes), 30 backup material, 39, 53 recess, 40, 59 cable, 41, 42, 57, 58 connectors, 43, 43A relay section, 45, 54 Binding band (fixing means)

Claims

1. A roof material with a solar cell, comprising a roof base material having a front surface side fixed with a solar cell panel and a rear surface side provided with a recess for accommodating a cable, wherein the lead is drawn from the solar cell panel. A wire is led from the front surface side to the recess on the back surface side through the outer periphery of the roof base material to be connected to the cable, and the cable is pulled out from the recess to the outside of the roof base material. A roofing material with a solar cell characterized by being used.
2. A cutout portion that communicates with the recess is formed around the outer periphery of the roof base material, and the lead wire is drawn into the recess and the end portion of the cable is drawn out through the cutout. The roofing material with a solar cell according to claim 1.
3. The roof material with a solar cell according to claim 1, wherein a fixing means is provided in the recess, and the cable and / or the lead wire is fixed to the recess by the fixing means.
4. The both ends of the cable are drawn out from both ends of the roof base material.
The roof material with a solar cell according to any one of 1.
5. The roof with a solar cell according to claim 3, wherein a fixing tool insertion hole is provided in the roof base material while avoiding the cable and / or the lead wire fixed to the recess. Material.

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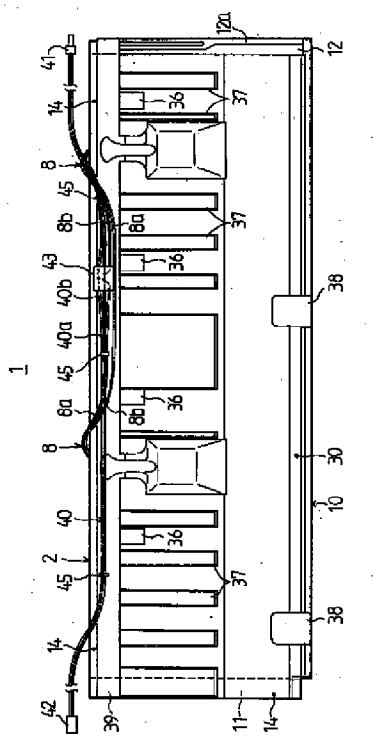
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(54)【発明の名称】　太陽電池付き屋根材

(57)【要約】
【課題】　防水性能が高く、屋根下地に固定するときケーブルを傷つけることがない太陽電池付き屋根材を提供する。
【解決手段】　表面側に太陽電池パネル５を固定し、裏面側にケーブル４０を収納する凹部３９を形成した屋根基材２を備え、太陽電池パネル５から引出されたリード線８が、屋根基材２の外周辺を介して表面側から裏面側の凹部３９に導かれてケーブル４０に接続されると共に、ケーブル４０が、凹部３９から屋根基材２の外部に引出される。ケーブル４０の端部にはコネクタ４１，４２が固定される。屋根基材２に凹部３９と連通する切欠き部１０ａ，１０ｂ，１０ｃを形成し、これらの切欠き部を通してリード線８を導いて引込むと共に、ケーブル４０の端部を引出す。ケーブル４０は結束バンド４５により凹部３９に固定される。



Voltage, LLC
EX1021-252

【特許請求の範囲】
【請求項１】　表面側に太陽電池パネルを固定し、裏面側にケーブルを収納する凹部を形成した屋根基材を備えた太陽電池付き屋根材であって、
前記太陽電池パネルから引出されたリード線が、前記屋根基材の外周辺を介して前記表面側から前記裏面側の前記凹部に導かれて前記ケーブルに接続されると共に、該ケーブルが、前記凹部から前記屋根基材の外部に引出されていることを特徴とする太陽電池付き屋根材。
【請求項２】　前記屋根基材の外周辺に前記凹部と連通する切欠き部を形成し、該切欠き部を通して前記リード線を前記凹部に引込むと共に前記ケーブルの端部を引出すことを特徴とする請求項１に記載の太陽電池付き屋根材。
【請求項３】　前記凹部内に固定手段を設け、前記ケーブル及び／又はリード線を前記固定手段により前記凹部に固定することを特徴とする請求項１又は２に記載の太陽電池付き屋根材。
【請求項４】　前記ケーブルの両端部は、前記屋根基材の両端部から引出されることを特徴とする請求項１～３のいずれか１項に記載の太陽電池付き屋根材。
【請求項５】　前記凹部に固定された前記ケーブル及び／又はリード線を避けて前記屋根基材に固定具挿入孔が設けられていることを特徴とする請求項３に記載の太陽電池付き屋根材。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、太陽電池付き屋根材に係り、特に、防水性能が高く、釘等を打ち込んで屋根下地へ固定する時に、釘がリード線やケーブルを傷つける等の不都合を防止できる太陽電池付き屋根材に関する。
【０００２】
【従来の技術】従来、この種の太陽電池付き屋根材としては、特開２０００－１１４５７８号公報に記載の太陽電池モジュールがある。この太陽電池モジュールは、金属屋根材に端子ボックスを収納する収納凹部が設けられている。そして、太陽電池の端子ボックスから突出した一対のリード線が収納凹部の通孔から金属屋根材の下面側に引出されている。
【０００３】前記のように構成された太陽電池モジュールは、通常、多数個が屋根上に配列され、それぞれの太陽電池モジュールから引出されるリード線をコネクタで接続し、太陽電池モジュールの外周辺に沿わせて引き回す必要があり、多数のリード線が接続された出力線から発電電力を得ている。そして、太陽電池モジュールを屋根下地上に固定するとき、太陽電池モジュールの周囲の複数個所を釘やビス等で打ち付けて固定している。
【０００４】
【発明が解決しようとする課題】前記構造の太陽電池モジュールは、金属屋根材に、端子ボックスから突出した一対のリード線が引出される通孔が設けられているため、防水上のシーリングが困難であり、且つ隣家に火災等が発生したとき、火炎が屋根の野地板に到達して火災を引き起こす原因となり得る。また、前記のように、太陽電池を固定した太陽モジュールは、その外周辺に沿ってリード線が位置しており、屋根下地に釘等で固定する際に、これらのリード線や出力線を傷つけないように施工することが必要であり、不用意に施工すると太陽電池モジュールの外周辺に引き回されたケーブル等が釘で打ち抜かれる虞があった。
【０００５】本発明は、このような問題に鑑みてなされたものであって、その目的とするところは、太陽電池パネルから引出され電力を取り出すリード線が屋根基材を貫通しないため防水性能が高く、複数の太陽電池パネルを接続するケーブルやリード線の大部分が屋根基材の裏側の凹部に収納されているため、屋根基材を屋根下地に固定するときケーブルやリード線に傷をつけることが少ない太陽電池付き屋根材を提供することにある。また、複数の太陽電池付き屋根材を連結するときコネクタで接続しやすいため、施工が容易な太陽電池付き屋根材を提供することにある。
【０００６】
【課題を解決するための手段】前記目的を達成すべく、本発明に係る太陽電池付き屋根材は、表面側に太陽電池パネルを固定し、裏面側にケーブルを収納する凹部を形成した屋根基材を備え、太陽電池パネルから引出されたリード線が、屋根基材の外周辺を介して表面側から裏面側の凹部に導かれてケーブルに接続されると共に、該ケーブルが、凹部から屋根基材の外部に引出されており、ケーブルの端部にはコネクタや接続端子が固定されることが好ましい。
【０００７】太陽電池パネルは屋根材の表面側に形成された凹窪部に止め金具等で固定され、太陽電池パネルから発電電力を取り出すリード線は太陽電池パネルの上部から表面側に引出されている。ケーブルは、太陽電池付き屋根材を屋根下地に多数並設するときに、各太陽電池パネル同士を接続すると共に、太陽電池パネルのリード線と接続されるものであり、ケーブルを収納する凹部は、屋根基材の裏面側の上方に水平に形成されると好適である。
【０００８】この構成によれば、太陽電池パネルから引出されるリード線は、屋根基材の表面側から外周辺を介して屋根基材の裏面側の凹部に導かれて引込まれ、ケーブルも端部又はコネクタの近傍のみを除く大部分が凹部に収納されて屋根基材の表面側の露出部分を少なくできる。このため、太陽電池付き屋根材を釘等で屋根下地に固定するとき、リード線やケーブルを傷つけることが防止できる。また、凹部内でリード線とケーブルとの接続ができるため、中継コネクタ等が外部に露出せず屋根下

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地への取付施工が容易となる。

【０００９】そして、前記の太陽電池付き屋根材において、屋根基材の外周辺に凹部と連通する切欠き部を形成し、この切欠き部を通してリード線を凹部に引込むと共にケーブルの端部を引出すと好適である。切欠き部は凹部を構成する壁面を切欠いて形成してあり、屋根基材の外部空間と凹部の内部空間を連通している。これにより、リード線の凹部内への引込みと、ケーブル端部又はケーブル端部に固定されたコネクタの凹部からの引出しが容易に行える。なお、リード線の引込みとケーブルの端部の引出しを１つの切欠き部で共用するようにしてもよい。また、切欠き部は、凹部を構成する壁面を貫通する通孔でもよい。

【００１０】本発明に係る太陽電池付き屋根材の好ましい具体的な態様としては、前記の太陽電池付き屋根材において、凹部内に結束バンド等の固定手段を設け、ケーブル及び／又はリード線を固定手段により凹部に固定することを特徴としている。太陽電池付き屋根材を屋根下地に釘等で固定するときに使用する釘孔は、上辺に沿って穿設されることが多いため、ケーブルを収納する凹部と釘孔が重なることが多いが、この構成によれば、複数の太陽電池付き屋根材を接続するケーブルが、屋根基材の裏面側の凹部に固定され、移動が防止されるため、この太陽電池付き屋根材を固定するとき、誤ってケーブルやリード線を釘等で傷つけることが防止できる。また１つの太陽電池付き屋根材に複数の太陽電池パネルが固定される場合、複数の太陽電池パネル同士を、このケーブルで直列或いは並列に接続できる。

【００１１】さらに、本発明に係る太陽電池付き屋根材の好ましい具体的な他の態様としては、前記の太陽電池付き屋根材において、ケーブルの両端部は、屋根基材の両端部から引出されることを特徴としている。引出す位置が両端に近いほうがケーブルの露出部が少なくなり好ましい。この構成によれば、多数の太陽電池付き屋根材同士を接続するケーブルは、両端部又は先端のコネクタ部分を除いて大部分が凹部内に収納されるため、太陽電池付き屋根材の屋根下地への取付施工が容易となる。また、リード線も露出部分が少なく、リード線とケーブルとの接続が凹部内で行えるため中継コネクタ等が露出せず、外観を良好とすることができる。さらに、太陽電池パネルとケーブルとの接続や、太陽電池付き屋根材同士の接続が効率よく行える。

【００１２】凹部に固定手段により固定されたケーブル及び／又はリード線を避けて、屋根基材に釘等の固定具挿入孔が設けることが好ましい。このように構成することにより、屋根基材に設けられた固定具挿入孔に釘やビスを挿入して太陽電池付き屋根材を屋根下地に固定するとき、固定具でケーブルやリード線を傷つけることが防止される。

【００１３】

【発明の実施の形態】以下、本発明に係る太陽電池付き屋根材の一実施形態を図面に基づき詳細に説明する。図１は本実施形態に係る太陽電池付き屋根材の正面図、図２は図１の背面図、図３は太陽電池付き屋根材の表面材の正面図、図４は太陽電池付き屋根材のバックアップ材の正面図、図５（ａ）は図１の太陽電池付き屋根材の平面図、（ｂ）は図４のバックアップ材の平面図、（ｃ）は図４のバックアップ材の底面図である。

【００１４】図１～５において、太陽電池付き屋根材（以下、屋根材という）１は、屋根基材２を備えており、屋根基材２は２つの太陽電池パネル５，５を設置する２つの凹窪部（後述する）が表側に形成されている表面材１０と、この表面材１０の裏面に固定されるバックアップ材３０とを備えている。表面材１０は金属板材等から形成され、本実施の形態では、０．８ｍｍ厚のガルバニウム鋼板をプレス成形して形成されている。表面材１０の大きさ、形状は、屋根面に併設する一般屋根材、例えば平面瓦等と略同じ形状にすることが好ましい。また、一般屋根材を軒に平行に、または流れ方向に複数葺設した形状、つまり複数枚が一体になった形状でもよい。

【００１５】表面材１０は、正面の矩形部から右側に裏面側重ね合わせ部１１が突設され、この裏面側重ね合わせ部１１は表面材１０の表面から落ち込んだ段差部として形成され、屋根材の厚さの約２分の１の厚さで形成されている。裏面側重ね合わせ部１１には、浸入した雨水を排水する水切り溝１１ａが表面に形成されている。水切り溝１１ａは、上半部が２本の溝で形成され、中間部で合流して下半部は１本の溝となっており、重ね合わせ部の奥に浸入した雨水を手前側に排水できる構成となっている。

【００１６】また、矩形部の左側には、屋根材１を水平方向に並べたとき、隣接する裏面側重ね合わせ部１１が挿入される表面側重ね合わせ部１２が形成されている。表面側重ね合わせ部１２は屋根材１の裏面からの段差部として形成され、屋根材１の厚さの約２分の１の厚さで形成され、裏面側重ね合わせ部１１と表面側重ね合わせ部１２とを重ねたときに、２つの屋根材１が平坦となるように構成されている。表面側重ね合わせ部１２の裏面には、水切り溝１１ａが嵌合する突部１２ａが形成されている。突部１２ａは上半部が幅広に形成され、下半部は幅が狭く形成されている。

【００１７】屋根基材２の矩形部には、上辺に沿って水切り突部１３が形成され、水切り突部１３の左右の２個所と、裏面側重ね合わせ部１１には屋根材１を屋根の下地に固定する釘等の固定具を挿入する釘孔１４が形成されている。屋根材１の矩形部には、太陽電池パネル５，５を収納する２つの凹窪部１５，１５が水平方向に並んで形成されている。凹窪部１５，１５は、収納される太陽電池パネル５，５の大きさより僅かに大きい形状に形

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成されることが好ましい。

【００１８】ここで、１つの太陽電池パネル５について、図６を参照して説明する。図６は太陽電池付き屋根材のリード線収納凹部に沿う分解した状態の縦断面図である。太陽電池パネル５はシリコン系半導体や化合物半導体等の材料からなり、単結晶系や多結晶系の結晶系半導体や、アモルファス系半導体から形成される。太陽電池パネル５は正面形状が長方形のガラス等の基板６上に太陽電池が形成され、裏面には端子ボックス７が突設されており、端子ボックス７から電力取り出し用のリード線８が引出されている。

【００１９】また、図６に示されるように、表面材１０の凹窪部１５は、太陽電池パネル５の基板６が収納される形状であり、凹窪部に対応して裏側が突出している。凹窪部１５は基板６の厚さと略同等の深さに形成され、凹窪部からさらに陥没して端子ボックス７が収納される収納凹部１６と、リード線８を収納する収納凹部１７とが形成されている。凹窪部１５の４つの角部はガラス等の基板６の角部が逃げるように小円弧部（図１参照）が形成されている。収納凹部１７は、図１のように凹窪部１５の上部まで形成され、リード線８，８を太陽電池パネル５，５の表面側の上部に引出すことができる。

【００２０】凹窪部１５の上下の辺には、太陽電池パネル５，５を固定する固定爪１８用の取付部１９（図３参照）が２個所ずつ設けてある。固定爪１８は例えば厚さが１mm程度のステンレス板を、横４０mm、縦２５mm程度に切断して形成したものであり、リベットや、子ネジ等により表面材１０の段差面で形成された取付部１９に固定される。固定爪１８は先端の５mm程度が屋根材１の上部に突出し、突出部の裏面に貼着したアクリルフォームを基材とした両面テープを緩衝材として太陽電池パネル５を押圧固定している。

【００２１】凹窪部１５の水下方向の下辺に沿って、すなわち水下側には集水溝２０が形成してある。集水溝２０は１つの凹窪部１５の左右側が浅く、中央部が深くなるように中央に向けて勾配がつけられている。凹窪部１５から水下側の外周辺まで排水溝２１が形成してあり、この排水溝２１は集水溝２０の中央部の深さが一番深い最低部に対応して、最低部と同じ深さで連続して形成してある。したがって、太陽電池パネル５の外周と凹窪部１５との間の隙間から雨水が浸入すると、水下側に流れて集水溝２０で中央に集められ、排水溝２１から表面材１０の外部に排出される構成となっている。このように、屋根基材を構成する表面材１０は、凹窪部１５、収納凹部１６，１７が形成されているがリード線８，８を引出す貫通部は無いため、雨水等は表面材１０から内部に浸水することはなく、防水性能が向上する。

【００２２】屋根基材２を構成するバックアップ材３０は、例えば発泡スチロール樹脂等から形成され、軽量で断熱性に優れたものが好ましい。本実施の形態では、耐熱温度１００℃程度のアトリロニトリルスチレンビーズを型成形にて４０倍発泡させたものが用いられている。発泡樹脂としては、他にポリエチレン、スチレン、ポリプロピレン、アトリロニトリルスチレン、ＰＰＯ、ＰＥＴ等の発泡体で形成してもよい。バックアップ材３０は表面材１０の裏面に、例えば両面テープにて固定されるものであり、表面材１０の裏面に密着するような表面を有することが好ましい。なお、両面テープは適宜の複数個所に貼着するだけで十分であり、屋根材１を屋根下地に釘で固定した後は、表面材１０とバックアップ材３０とが外れることはない。

【００２３】バックアップ材３０は、表面材１０に形成された凹窪部１５、端子ボックス７の収納凹部１６及びリード線８の収納凹部１７に対応して裏側が突出する突出部が嵌合する凹形状部や貫入部が形成されている。すなわち、図６に示されるように、凹窪部１５の裏側の突出部に対応して凹形状部３１が形成され、凹窪部１５の突出部は凹形状部３１に嵌合することができる。また、収納凹部１６，１７の裏側の突出部に対応して貫入部３２，３３が形成され、収納凹部１６，１７の突出部は貫入部３２，３３にそれぞれに嵌合することができる。

【００２４】また、バックアップ材３０は、図４，７に示されるように、表面材１０の集水溝２０に対応して段差部３４が形成され、排水溝２１に対応して、排水溝２１が嵌合する排水部として切欠き部３５が形成されている。切欠き部３５は、図７（ａ）に示されるように、幅広の矩形状に切り欠かれ、表面材１０の排水溝２１が断面半円形であるため、排水溝２１と切欠き部３５とが密着しないように構成され、表面材１０とバックアップ材３０との間に雨水が浸入したときでも排水できるようになっている。なお、排水部は排水溝と一致しない他の位置、例えば中央部でなく左右の端部に形成してもよい。また、排水部は凹形状部３１の水下側にバックアップ材を貫通して設けた排水孔でもよい。

【００２５】バックアップ材３０の裏面には図５，６に示されるように、上下方向に複数の通気用溝３６が形成され、通気用溝３６の底面は水上側が深い傾斜面となっている。また、バックアップ材３０の裏面には、複数の脚部３７が突出して形成され、脚部は水下側に行くほど厚さが大きくなるように楔型に形成されている。このため、バックアップ材３０は野地板等の屋根下地Ｒに固定されたとき、複数の脚部３７により空間が形成され、この空間は屋根勾配に沿った上下の空間が連通し、通気用溝３６と共に空気流ができるように構成されている。バックアップ材３０の下端辺にはリード線用の逃げ部３８が形成され、屋根材１を上下に重ねたときに下方の屋根材１のリード線８の引込む部分を逃げるものである。

【００２６】屋根基材２の上部には、図２に示すように、裏面側に水平方向に両端部まで凹部３９が形成されている。凹部３９は屋根基材２を構成する表面材１０と

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バックアップ材３０の上方端面から構成される。この凹部には２つの太陽電池パネル５，５を接続すると共に、多数の屋根材１を接続するケーブル４０が収納されている。そして、ケーブル４０の両端には他の屋根材１と接続するためのコネクタ４１，４２が固定されている。コネクタ４１，４２は、一方が雄形コネクタで、他方が雌形コネクタとなっている。

【００２７】表面材１０の上方の外周辺を折り曲げて形成した垂下部には、図５（ａ）に示すように３つの切欠き部が形成され、これらの切欠き部は凹部３９と連通している。左端部の切欠き部１０ａは、左側の太陽電池パネル５から引出されたリード線８が、表面材１０の外周辺を介して表面側から裏面側の凹部に導かれてケーブル４０に接続される共に、ケーブル４０の左端部が凹部３９から屋根基材２の外部に引出されている。右端部の切欠き部１０ｂは、ケーブル４０の右端部を凹部３９から外部に引出すものである。また、中央部の切欠き部１０ｃは、右側の太陽電池パネル５のリード線８を外周辺の外側で向きを変えて引込むものである。すなわち、リード線８，８を、表面材１０の外周辺の外側で向きを変えて凹部３９に導き引込んでいる。ケーブル４０の両端部にはコネクタ４１，４２が固定されており、ケーブルの端部と共にコネクタが切欠き部１０ａ，１０ｂから引出される。

【００２８】なお、切欠き部を３つ形成し、図５（ａ）の左端の切欠き部１０ａをリード線８の引込みとケーブル４０の引出しに共用する例を示したが、切欠き部を４つ形成して２つをリード線の引込みに使用し、他の２つをケーブルの引出しに使用するようにしてもよい。また、切欠き部を２つ形成し、それぞれをケーブルの引出しとリード線の引込みに共用するようにする等、適宜変更してもよい。

【００２９】ここで、図２を参照して、２つの太陽電池パネル５，５のリード線８，８と、ケーブル４０との接続について以下に説明する。ケーブル４０はプラス側線４０ａとマイナス側線４０ｂとから構成され、太陽電池パネル５，５には直接接続されていない。また、太陽電池パネル５，５から直接突出するリード線８はプラス側リード線８ａとマイナス側リード線８ｂとから構成される。そして、ケーブル４０とリード線８，８はジョイントボックス等の中継部４３を介して接続される。すなわち、中継部４３はケーブル４０にリード線８，８を接続するものであり、一方の太陽電池パネルのプラス側リード線８ａをケーブル４０のプラス側線４０ａに接続すると共に、他方の太陽電池パネルのマイナス側リード線８ｂをケーブル４０のマイナス側線４０ｂに接続する。そして、一方の太陽電池パネルのマイナス側リード線８ｂと、他方の太陽電池パネルのプラス側リード線８ａとを直接接続し、これにより２つの太陽電池パネル５，５は直列接続されてケーブル４０と接続され、電力を取り出すことができる。

【００３０】このように、太陽電池パネル５，５から引出されたリード線８，８は屋根基材２の表面側から裏面の凹部３９に向きを変えて導かれて引込まれ、太陽電池パネル５，５に直接接続されていないケーブル４０は凹部３９に収納されており、ケーブル４０の両端部が切欠き部１０ａ，１０ｂから引出され、端末にコネクタ４１，４２が固定されている。したがって、リード線８，８とケーブル４０との接続は、裏面側に開口する凹部３９内で中継部４３により行われるため、接続部が外部に突出せず屋根材1の施工性を高めることができる。

【００３１】前記したように、屋根基材２の上辺と右辺に沿って、屋根材１を屋根下地に釘等で固定する釘孔１４が形成されている。上辺の釘孔１４は屋根材１の上部裏面に形成されたケーブル４０を通す凹部３９と重なるため、凹部内に配置されたケーブル４０は結束バンド４５で固定されている。結束バンド４５はケーブルの固定手段を構成し、詳細には図示しないがベース部が表面材の裏面に貼着され、ベース部から締付けバンド部が延出し、ベース部に締付けバンド部を固定するクランプ部が形成されている。そして、釘孔１４は固定されたケーブル４０及びリード線８，８を避けて屋根基材２に設けられている。このため、ケーブル４０は凹部３９内を移動することなく、釘孔１４とケーブル４０が重なって固定時に釘がケーブルを傷つけることはない。なお、リード線を結束バンドで固定するようにしてもよい。

【００３２】前記の如く構成された本実施形態の太陽電池付き屋根材の葺設動作について、図８，９を参照して説明する。図８は太陽電池パネル付き屋根材の葺設施工の動作状態を示す正面図、図９は太陽電池パネル付き屋根材を葺設した状態の要部縦断面図である。屋根材１は屋根下地Ｒの上に、屋根の下方から水平方向に並べて、順次上方に葺いていく。なお、屋根下地Ｒの上面には、アスファルトルーフィング（図示せず）等が敷設されている。例えば、１つの屋根材１の右側の裏面側重ね合わせ部１１に、次に葺く屋根材１の左側の表面側重ね合わせ部１２を重ねて、順次右方向に重ねて釘孔１４を使用して釘止めして葺いていく。

【００３３】釘孔１４を貫通して釘を打ち込むとき、凹部３９内のリード線８やケーブル４０は結束バンド４５で固定されているため、リード線８やケーブル４０が凹部３９内を移動して釘孔１４の下方に位置することを防止できるため、釘により傷付くことはない。また、各屋根材を電気的に接続するケーブル４０の大部分が凹部３９に収納されているため、屋根基材２からの突出部が少なく釘打ちが容易に行える。そして、隣接するコネクタ４１，４２を接続するだけの極めて単純な操作で、屋根材１は電気的に接続される。

【００３４】水平方向に１列に屋根材１を葺いた後、その上の段の屋根材１を葺く。すなわち、下段の屋根材１

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の水切り突部１３の上に上段の屋根材１の下端辺が重なるように葺き、水平方向に左から右に向かって葺いていく。そして、前記と同様にコネクタ４１，４２を接続して、屋根材１の電気的接続を行う。この電気的接続も、ケーブルの端部に固定されたコネクタを連結するだけの操作で行え、容易に、しかも確実に接続できる。また、ケーブル４０の大部分が凹部３９に収納されるため、屋根材１の外観が良好となり、運搬や葺設時における怪我を防止できる。

【００３５】バックアップ材３０は裏面側に複数の脚部３７が突出して形成され、屋根下地Ｒとバックアップ材３０とは密着せず空間が形成されており、この空間と通気用溝３６とが連通して上下の空間が連通しているため、複数の脚部の間の空間を流れる空気流Ｗ（図９参照）が形成される。これにより、屋根下地Ｒと屋根材１のバックアップ材３０との間に雨水が浸入しても乾燥が促進され、また日射により熱せられた空気が対流して上部より排出されるため、断熱性能が向上する。

【００３６】本発明の他の実施形態を図１０に基づき詳細に説明する。図１０（ａ）は本発明に係る太陽電池付き屋根材の他の実施形態の要部正面図、図１０（ｂ）は、その接続状態を示す概略配線図である。なお、この実施形態は前記した実施形態に対し、太陽電池パネルが１つで、凹部に収納されるケーブルと、凹部に導かれてケーブルに接続されるリード線が異なることを特徴とする。そして、他の実質的に同等の構成については同じ符号を付して詳細な説明は省略する。

【００３７】図１０において、屋根材５１は１つの太陽電池パネル５５を表面側に固定したものであり、太陽電池パネル５５から表面側に引出されたリード線５６は、屋根基材５２の外周辺の外側で向きを変えて裏面側の凹部５３に導かれて引込まれ、その一方は屋根基材の一端部に位置するコネクタ５７の１端子に接続され、その他方は屋根基材の他端部に位置するコネクタ５８の１端子に接続される。そして、コネクタ５７，５８の他方の端子同士がケーブル５９で接続される。すなわち、リード線５６はコネクタ５７，５８を介してケーブル５９に接続される。また、リード線５６、ケーブル５９は、前記の実施形態と同様の結束バンド５４等により固定し、リード線５６、ケーブル５９が凹部５３内を移動することを防止している。

【００３８】このように、太陽電池パネル５５に直接接続されているリード線５６は、屋根基材５２の表面側から外周辺を介して導かれ裏面の凹部５３に引込んで収納され、太陽電池パネル５５に直接接続されていないケーブル５９は凹部５３に収納されている。そして、リード線５６の端部とケーブル５９の端部が凹部５３の両端部から引出され、端末にコネクタ５７，５８が固定されている。このように、リード線５６とケーブル５９の大部分が凹部５３に収納されて露出せず、両端部のみが凹部５３から引出されているため、屋根材５１は施工性が向上し、多数の屋根材５１…の接続も容易に行える。

【００３９】この実施形態の屋根材５１を、複数個を連結して使用するときにはコネクタ５７，５８同士を接続し、端部のコネクタに戻りコネクタ６０を接続して導通させ、他方の端部のコネクタから出力して、図示していないインバータに接続する。この例においても、多数の屋根材を使用するときは、ケーブルの両端部のコネクタを接続するだけで電気的接続が行える。また、ケーブルやリード線は屋根基材の裏面側の凹部５３に大部分が収納され、両端のコネクタを含む部分だけが露出しているので、外観が良好となると共に葺設施工が容易となる。さらに、屋根材５１を釘止めするときに、ケーブルやリード線を傷つけることを防止できる。

【００４０】なお、前記した実施形態では、凹部へのリード線の引込み及び凹部からのケーブルの引出しは切欠き部を通して行う例を示したが、図１１（ａ）に示すように、凹部を構成する上方の壁面が屋根基材２の底面２ａから浮いて間隙ｄがあるときは、この間隙ｄを使用してリード線の向きを変えて導き、外周辺の壁面を跨いで凹部への引込みと、凹部からの引出しを行うようにしてもよい。また、切欠き部として図１１（ｂ）に示すように、円形の通孔２ｂを用いてリード線やケーブルを通すようにしてもよい。

【００４１】中継部４３は、２本のケーブル４０と１本のリード線８を接続する例を示したが、図１２（ａ）に示すように、２本のケーブル４０と２本のリード線８を接続する中継部４３Ａでもよい。さらに、ケーブル４０の端部にコネクタ４１，４２を固定した例を示したが、図１２（ｂ）に示すリード線８Ａのように端部に圧着端子４４を固定し、中継部にビス止めしてもよく、図１２（ｃ）のリード線８Ｂのように何も固定せずに裸線のままで中継部に固定するようにしてもよい。

【００４２】屋根基材は表面材とバックアップ材とから構成する例を示したが、セメント瓦や、焼瓦等から形成したものでもよい。ケーブルを収納する凹部として、表面材とバックアップ材の上端との間の空間を凹部とした例を示したが、発泡樹脂で形成されたバックアップ材の背面に窪みや溝を形成して凹部としてもよい。

【００４３】

【発明の効果】以上の説明から理解できるように、本発明の太陽電池付き屋根材は、太陽電池パネルから引出されたリード線が屋根基材を貫通しないため、防水性能を向上できる。また、太陽電池付き屋根材を並設するとき電気的接続をとるケーブルの大部分が屋根基材の裏面側の凹部に収納されるため、外観を向上でき、葺設施工を容易とすることができ、多数の太陽電池付き屋根材の電気的接続が容易に行える。さらに、太陽電池付き屋根材を釘等で固定するとき、リード線やケーブルに傷つけることがない。

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【図面の簡単な説明】

【図１】本発明に係る太陽電池付き屋根材の一実施形態の正面図。

【図２】図１の背面図。

【図３】図１の表面材の正面図。

【図４】図１のバックアップ材の正面図。

【図５】（ａ）は図１の太陽電池付き屋根材の平面図、（ｂ）は図４のバックアップ材の平面図、（ｃ）は図４のバックアップ材の底面図。

【図６】図１のリード線収納凹部に沿う分解した状態の縦断面図。

【図７】（ａ）は排水溝及び排水部の要部を示す横断面図、（ｂ）は（ａ）の要部縦断面図。

【図８】図１の太陽電池付き屋根材の葺設施工の動作状態を示す正面図。

【図９】図１の太陽電池付き屋根材を葺設した状態の要部縦断面図。

【図１０】（ａ）は本発明の他の実施形態の要部正面図、（ｂ）は（ａ）の接続状態を示す概略配線図。

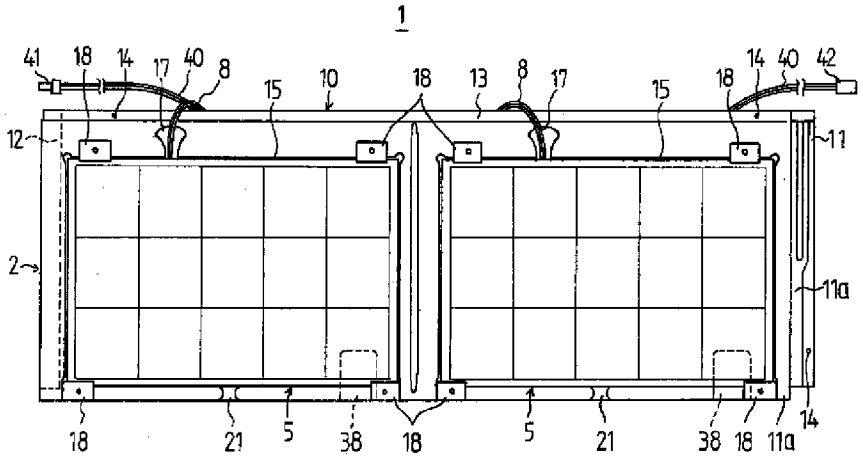
【図１１】本発明のさらに他の実施形態の要部正面図。

【図１２】（ａ）は中継部の他の実施形態の要部正面図、（ｂ）、（ｃ）はリード線の他の実施形態の要部正面図。

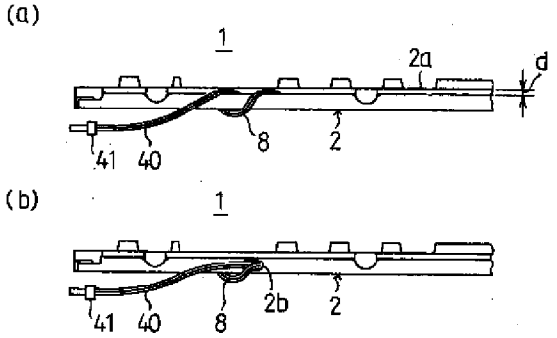
【符号の説明】

１，５１　太陽電池付き屋根材、
２，５２　屋根基材、
５，５５　太陽電池パネル、
８，８Ａ，８Ｂ，５６　リード線、
１０　表面材、
１０ａ，１０ｂ，１０ｃ　切欠き部、
１４　釘孔（固定具挿入孔）、
３０　バックアップ材、　３９，５３　凹部、
４０、５９　ケーブル、
４１，４２，５７，５８　コネクタ、
４３，４３Ａ　中継部、
４５，５４　結束バンド（固定手段）

【図１】

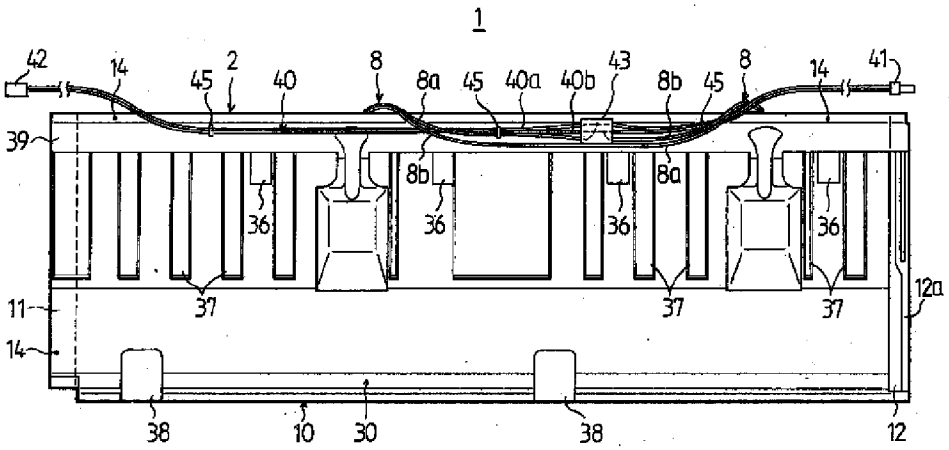


【図１１】

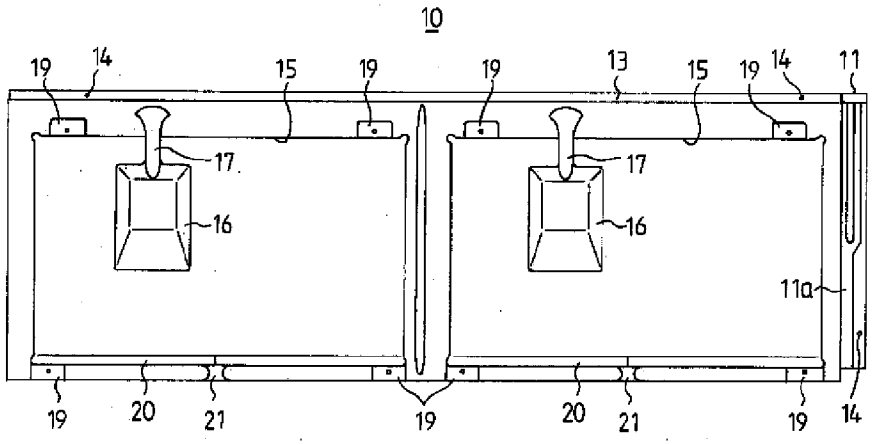


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【図２】

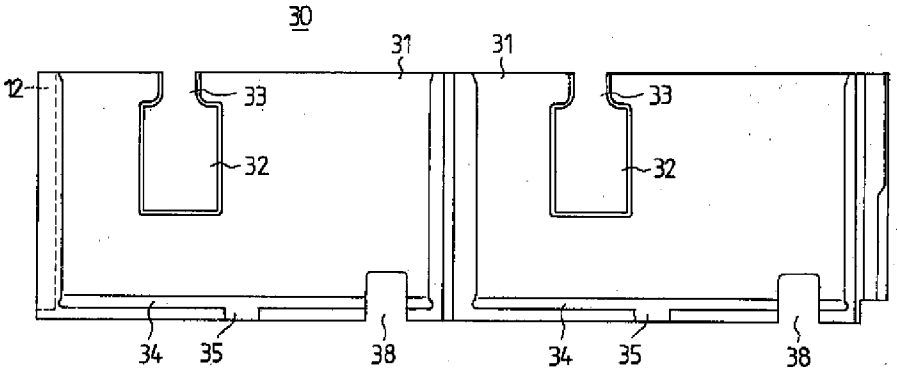


【図３】

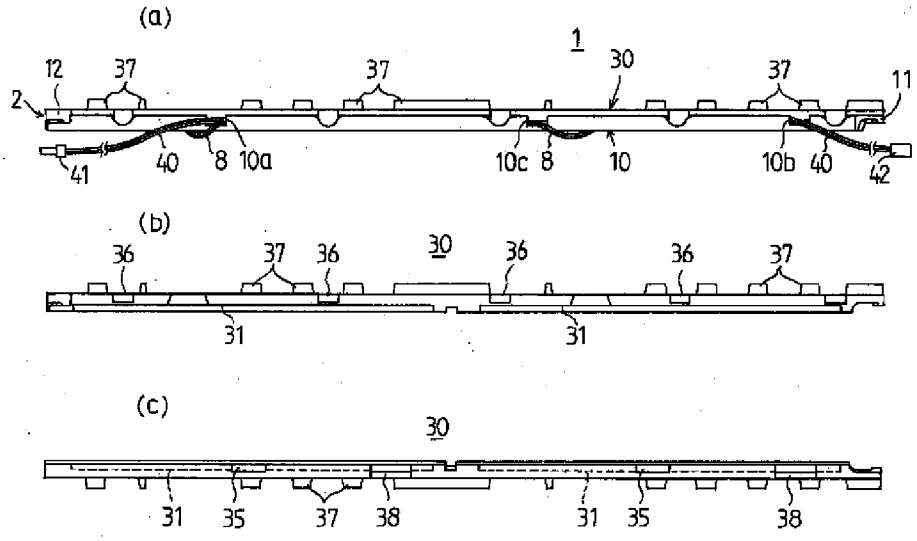


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【図４】

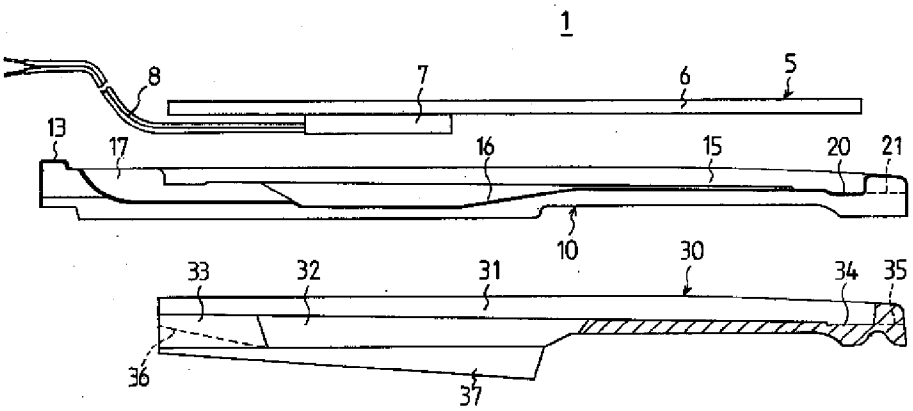


【図５】

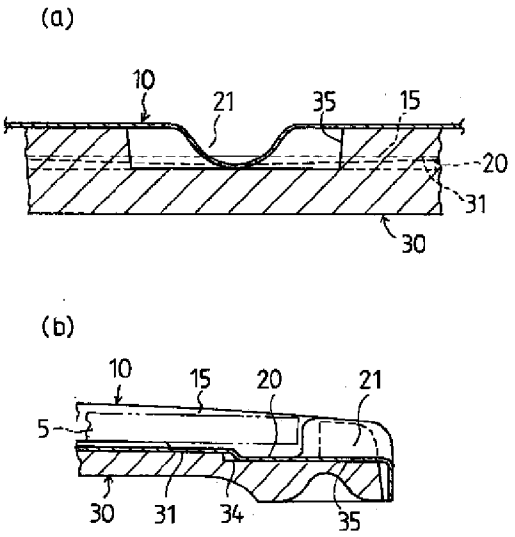


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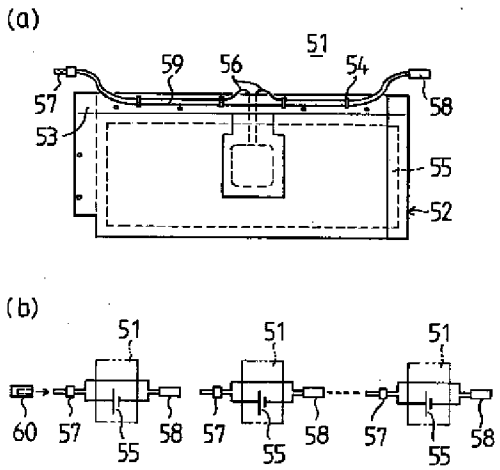
【図６】



【図７】

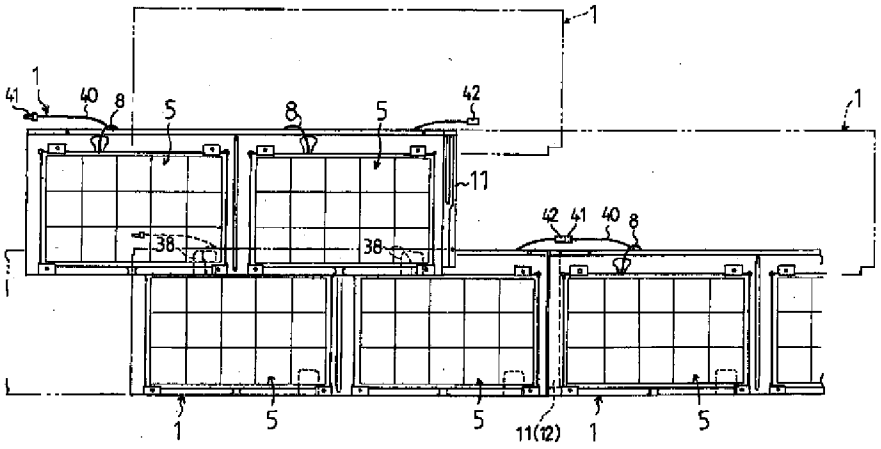


【図１０】

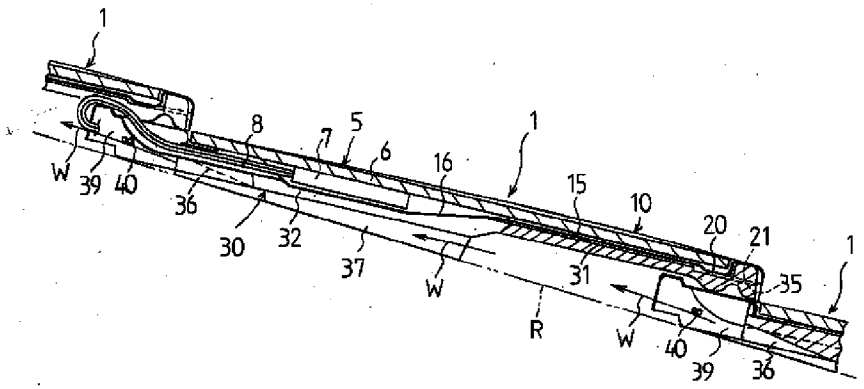


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【図８】

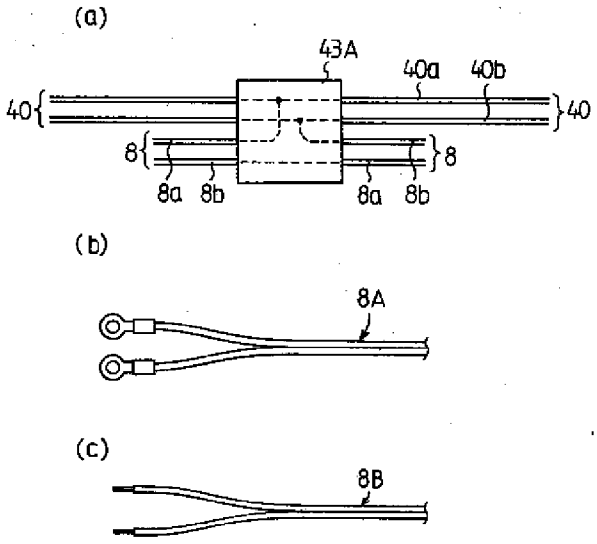


【図９】



Voltage, LLC
EX1021-262

【図１２】



Voltage, LLC
EX1021-263

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L704	1800	h02s40/30,36.cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2022/06/15 12:13 PM
L705	4982	h02s40/30,36.cpc.	(USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN))	OR	ON	ON	2022/06/15 12:13 PM
L706	14	L704 AND (feeder$1 AND drop$1)	(US-PGPUB; USPAT)	OR	ON	ON	2022/06/15 12:13 PM
L707	8	L706 AND feeder$1 AND drop$1	(USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO))	OR	ON	ON	2022/06/15 12:14 PM
L708	76154	h01r4/$4.cpc.	(USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO))	OR	ON	ON	2022/06/15 12:21 PM
L709	30627	h01r9/$4.cpc.	(USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL,	OR	ON	ON	2022/06/15 12:22 PM

			NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO))				
L710	249833	h01r13/$6.cpc.	(USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO))	OR	ON	ON	2022/06/15 12:22 PM
L711	49756	h01r24/$4.cpc.	(USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO))	OR	ON	ON	2022/06/15 12:23 PM
L712	14143	h01r25/$4.cpc.	(USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO))	OR	ON	ON	2022/06/15 12:23 PM
L713	321361	L712 OR L711 OR L710 OR L709 OR L708	(USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO))	OR	ON	ON	2022/06/15 12:24 PM

L714	44	L713 AND (feeder$1 WITH drop$1)	(USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO))	OR	ON	ON	2022/06/15 12:24 PM
L715	84	L713 AND (feeder$1 SAME drop$1)	(USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO))	OR	ON	ON	2022/06/15 12:25 PM
L716	135262	L712 OR L711 OR L710 OR L709 OR L708	(US-PGPUB; USPAT)	OR	ON	ON	2022/06/15 12:25 PM
L717	42	L716 AND (feeder$1 SAME drop$1)	(US-PGPUB; USPAT)	OR	ON	ON	2022/06/15 12:25 PM

PE2E SEARCH - Search History (Interference)

There are no Interference searches to show.

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/301,609	04/08/2021	Dean Solon	S4079.10001US03

CONFIRMATION NO. 3509

97149
Maschoff Brennan
1389 Center Drive, Suite 300
Park City, UT 84098

POA ACCEPTANCE LETTER

OC00000129659915

Date Mailed: 11/09/2021

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 11/04/2021.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/qtran/

Voltage, LLC
EX1021-267

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B or equivalent) to identify the application to which the Power of Attorney directed, in accordance with 37 CFR 1.5. If the Power of Attorney by Applicant form is not accompanied by this transmittal form or an equivalent, the Power of Attorney will not be recognized in the application.

Application Number	17/301,609
Filing Date	April 8, 2021
First Named Inventor	Dean Solon
Title	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER
Art Unit	Not Yet Assigned
Examiner Name	Not Yet Assigned
Attorney Docket Number	S4079.10001US03

SIGNATURE of Applicant or Patent Practitioner			
Signature	/Eric L. Maschoff/	**Date**	November 4, 2021
Name	Eric L. Maschoff	**Telephone**	(435) 252-1360
Registration Number	36,596		

MASCHOFF BRENNAN, PLLC
1389 Center Drive, SUITE 300
PARK CITY, UTAH 84098, USA

POWER OF ATTORNEY BY APPLICANT

[Assignee, Legal Representative or Person with Proprietary Interest]

I hereby revoke all previous powers of attorney given in the application identified in the attached Transmittal for Power of Attorney form.

■ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter:

97149

Please recognize or change the correspondence address for the above-identified patent to:

■ The address associated with the above-mentioned Customer Number.

I am the Applicant:

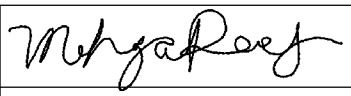
☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor

☐ Person Who Otherwise Shows Sufficient *Proprietary* Interest (*e.g.*, a petition under 37 CFR 1.46 (b)(2) was granted in the application or is concurrently being filed with this document)

SIGNATURE of Applicant for Patent

The individual whose signature and title is supplied below is authorized to act on behalf of the Applicant

Signature		Date	August 25, 2021
Name	Mehgan Peetz	Telephone	6153887696
Company	SHOALS TECHNOLOGIES GROUP, LLC	Title	CLO

NOTE: Signature - This form must be signed by the applicant or applicant's representative in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms for more than one signature, see below*.

*Total of 1 forms are submitted.

MASCHOFF BRENNAN, PLLC
1389 Center Drive, SUITE 300
PARK CITY, UTAH 84098, USA

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
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: SHOALS TECHNOLOGIES GROUP, LLC

Application No./Patent No.: 17/301,609 Filed/Issue Date: April 8, 2021

Titled: LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

_____, a _____

(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 _____, Frame _____, or for which a copy thereof is attached.

B. ☑ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Inventor To: SHOALS TECHNOLOGIES GROUP, LLC

   The document was recorded in the United States Patent and Trademark Office at

   Reel 055870, Frame 0763, or for which a copy thereof is attached.

2. From: _____ To: _____

   The document was recorded in the United States Patent and Trademark Office at

   Reel _____, Frame _____, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

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
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Eric L. Maschoff/	November 4, 2021
Signature	Date
Eric L. Maschoff	36,596
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

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

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

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

Electronic Acknowledgement Receipt

EFS ID:	44206374
Application Number:	17301609
International Application Number:	
Confirmation Number:	3509
Title of Invention:	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER
First Named Inventor/Applicant Name:	Dean Solon
Customer Number:	97149
Filer:	Eric L. Maschoff/Anika Corwell
Filer Authorized By:	Eric L. Maschoff
Attorney Docket Number:	S4079.10001US03
Receipt Date:	04-NOV-2021
Filing Date:	08-APR-2021
Time Stamp:	15:27:10
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	2021-11-04_POA_S4079-10001US03.pdf	117367 94c1bdf37cc3f48945afe4f2304d604a9298e4c6	no	2

Warnings:

Information:					
2	Assignee showing of ownership per 37 CFR 3.73	2021-11-04_373c_S4079-10001US03.pdf	117892 f049c76543b77cde9fdd825b769a6dafbda9f162	no	3
Warnings:					
Information:					
		Total Files Size (in bytes):	235259		

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.

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/301,609	04/08/2021	Dean Solon	S4079.10001US03

CONFIRMATION NO. 3509

97149
Maschoff Brennan
1389 Center Drive, Suite 300
Park City, UT 84098

PUBLICATION NOTICE



Title:LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

Publication No.US-2021-0226581-A1
Publication Date:07/22/2021

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Voltage, LLC
EX1021-275

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
17/301,609	04/08/2021	2833	830	S4079.10001US03	19	2

CONFIRMATION NO. 3509

97149
Maschoff Brennan
1389 Center Drive, Suite 300
Park City, UT 84098

FILING RECEIPT

OC000000124916323

Date Mailed: 04/16/2021

Receipt is acknowledged of this non-provisional utility 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)

Dean Solon, Gallatin, TN;

Applicant(s)

SHOALS TECHNOLOGIES GROUP, LLC, Portland, TN;

Assignment For Published Patent Application

SHOALS TECHNOLOGIES GROUP, LLC, Portland, TN

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 14/849,458 09/09/2015 PAT 10992254
which claims benefit of 62/047,773 09/09/2014

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Voltage, LLC
EX1021-276

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: 04/15/2021

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 17/301,609**

Projected Publication Date: 07/22/2021

Non-Publication Request: No

Early Publication Request: No

** **SMALL ENTITY** **

Title

LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

Preliminary Class

439

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

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

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).

SelectUSA

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.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 17/301,609

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	80		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	400		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	19 minus 20 =	*	x 50 =	0.00	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	830		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.

DocCode – SCORE

SCORE Placeholder Sheet for IFW Content

Application Number: 17301609 Document Date: 04/08/2021

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

Since this was an electronic submission, there is no physical artifact folder, no artifact folder is recorded in PALM, and no paper documents or physical media exist. The TIFF images in the IFW record were created from the original documents that are stored in SCORE.

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Form Revision Date: March 1, 2019

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/301,609	04/08/2021 07:41:25 PM ET	S4079.10001US03

Title of Invention

LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	3509	FILED BY	Brian Gonzalez
PATENT CENTER #	60173479	AUTHORIZED BY	Eric Maschoff
CUSTOMER #	97149	FILING DATE	-
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Dean Solon

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 4006	E202148J42060670	Brian Gonzalez

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
2111	UTILITY PATENT APPL. SEARCH FEE	350.00	1	350.00
4011	BASIC FILING FEE- UTILITY	80.00	1	80.00
2311	EXAMINATION OF ORIGINAL PATENT APPLICATION	400.00	1	400.00
			TOTAL AMOUNT:	$830.00

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

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) 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/AIA/01 (06-12)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [x] The attached application, or
- [ ] United States application or PCT international application number _____ filed on _____.

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

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

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.

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.

LEGAL NAME OF INVENTOR

Inventor: Dean Solon Date (Optional): 09/09/2015

Signature: _____

Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SB/AIA01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. 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 1 minute 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.**

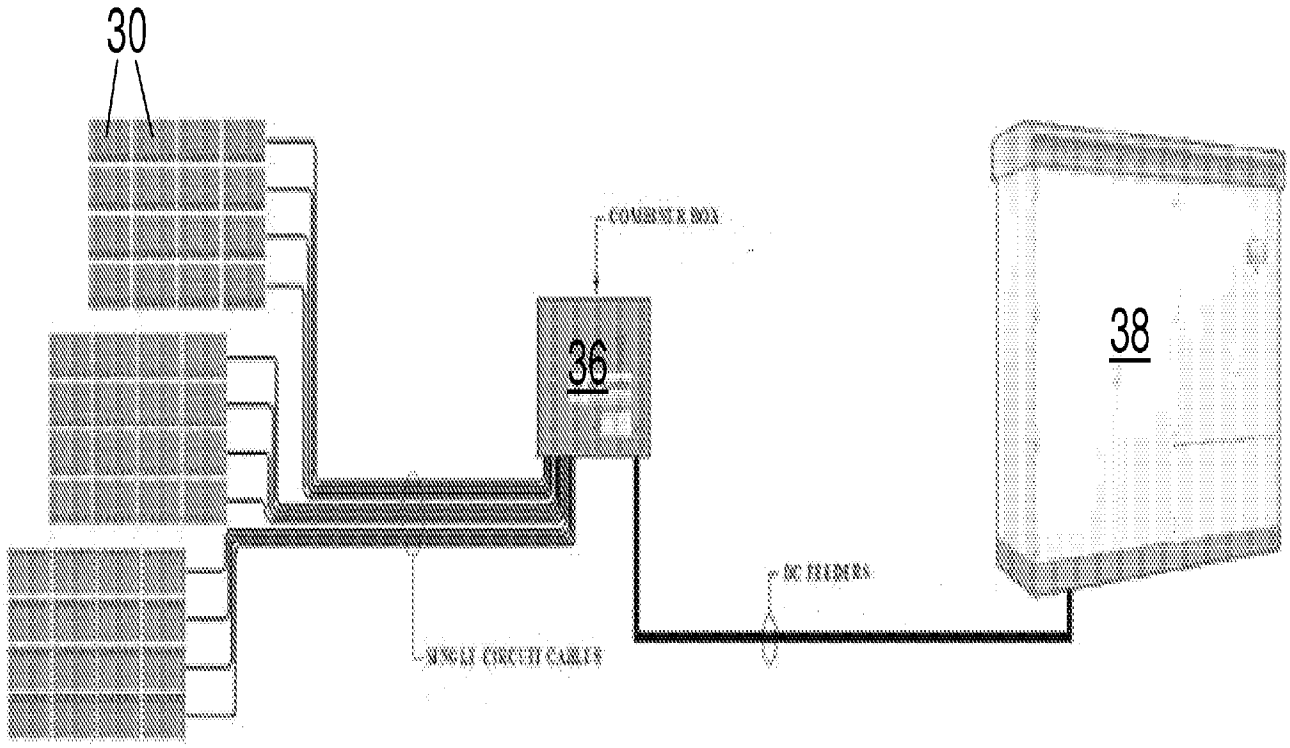
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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.

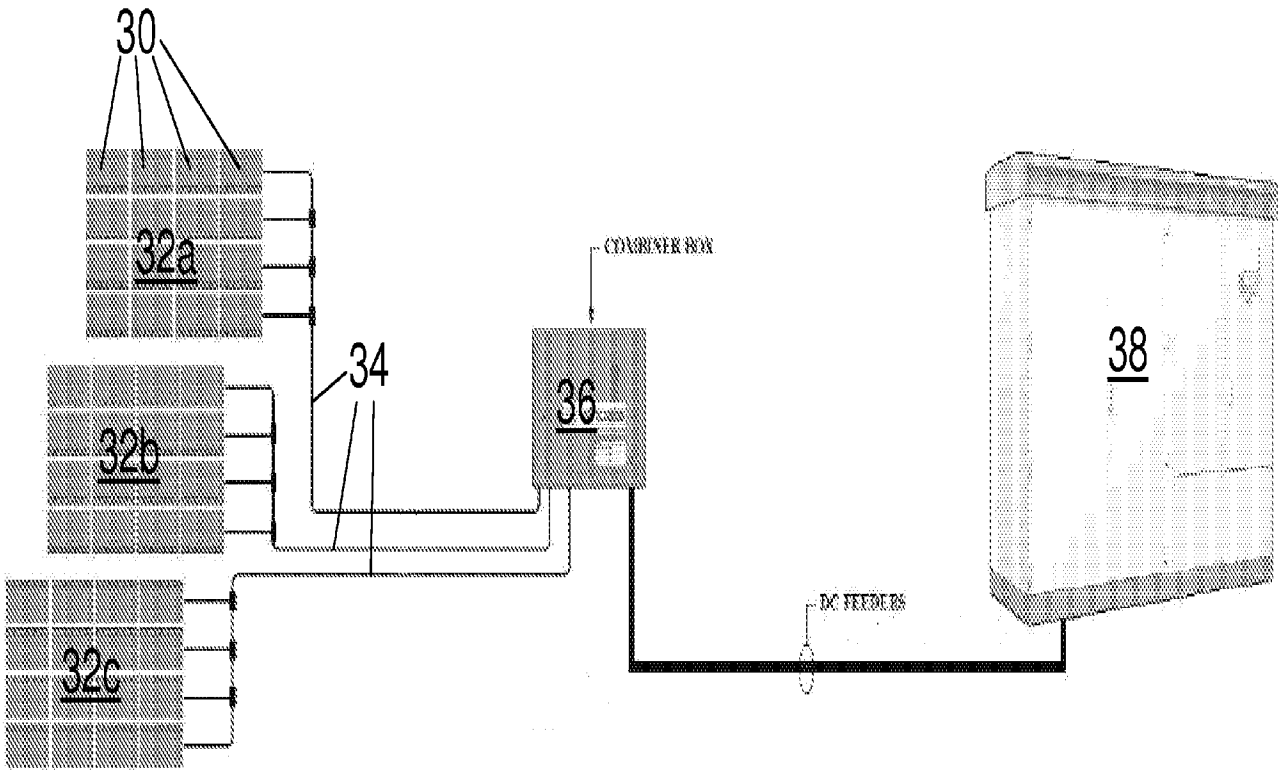
The information provided by you in this form will be subject to the following routine uses:

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.



PRIOR ART

FIG. 1



PRIOR ART

FIG. 2

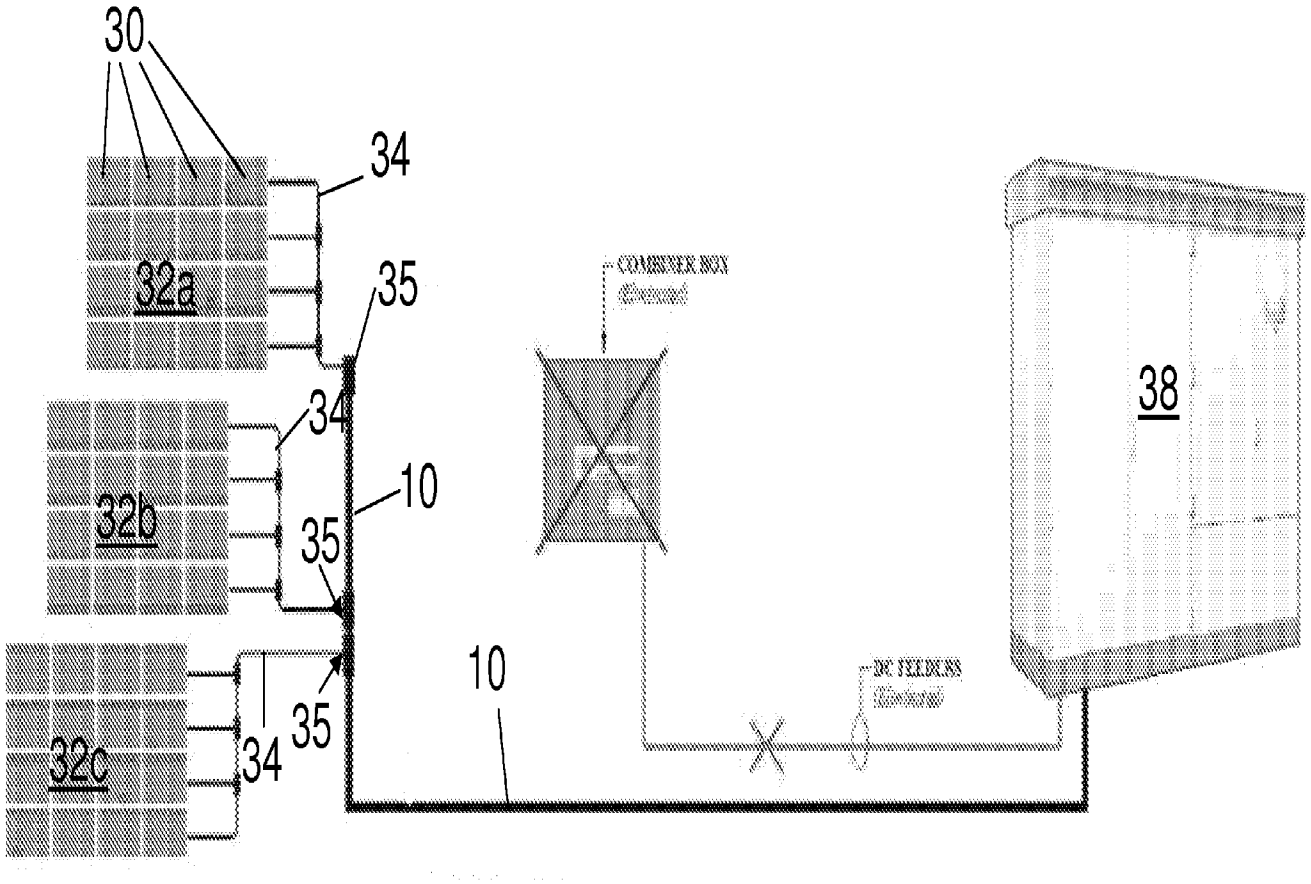


FIG. 3

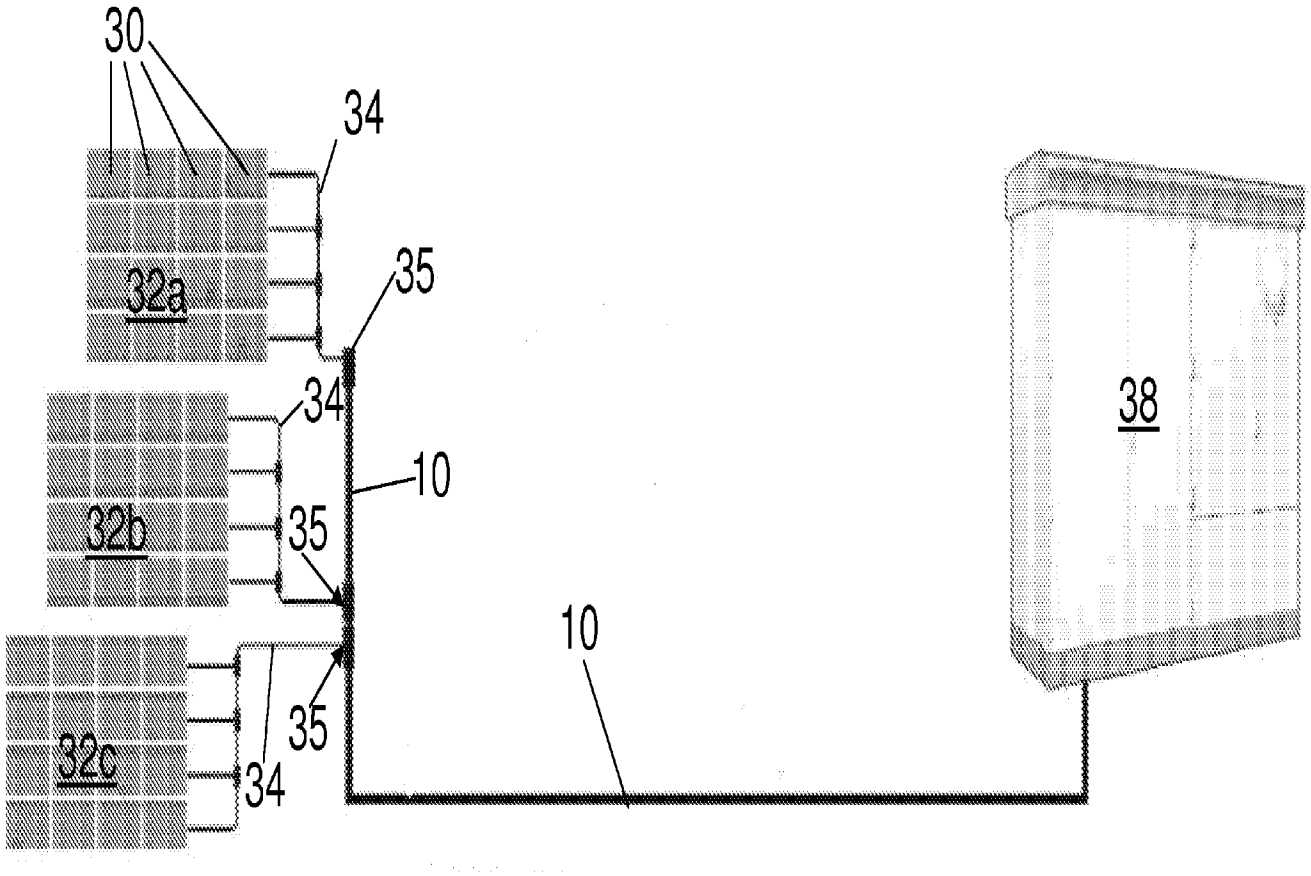


FIG. 4

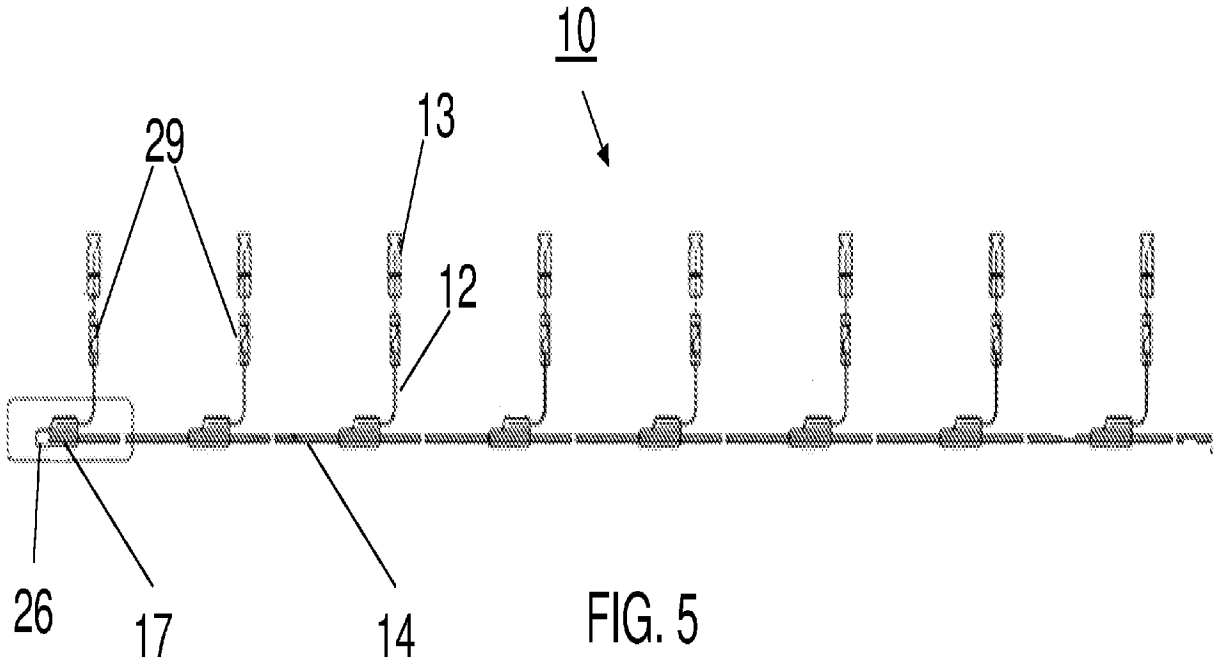


FIG. 5

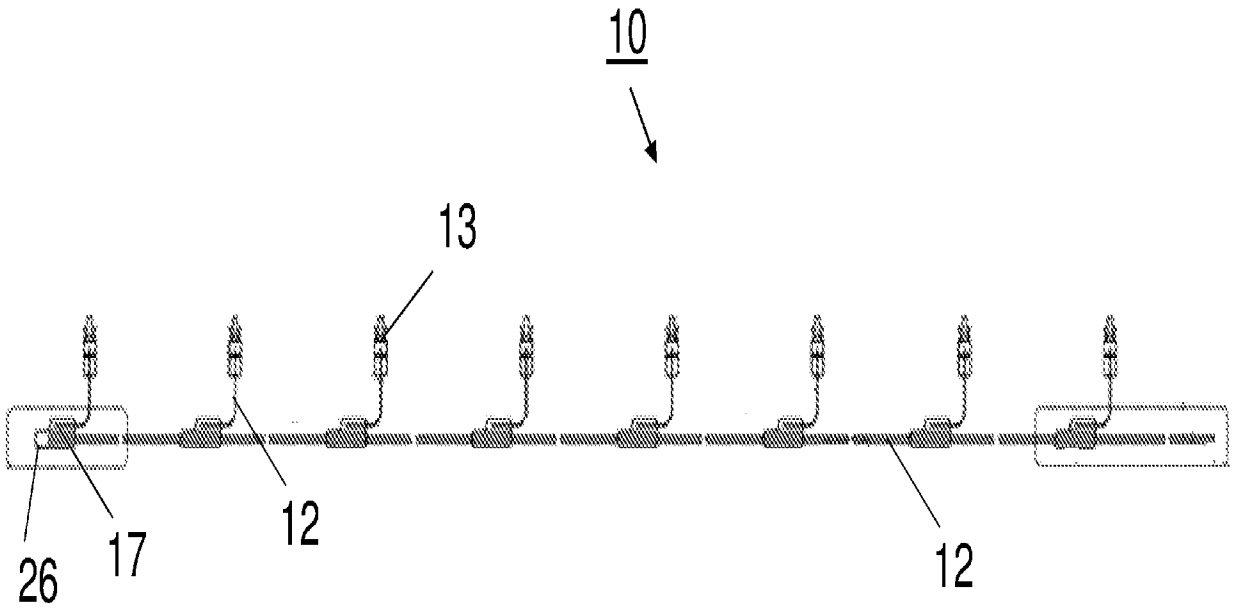


FIG. 6

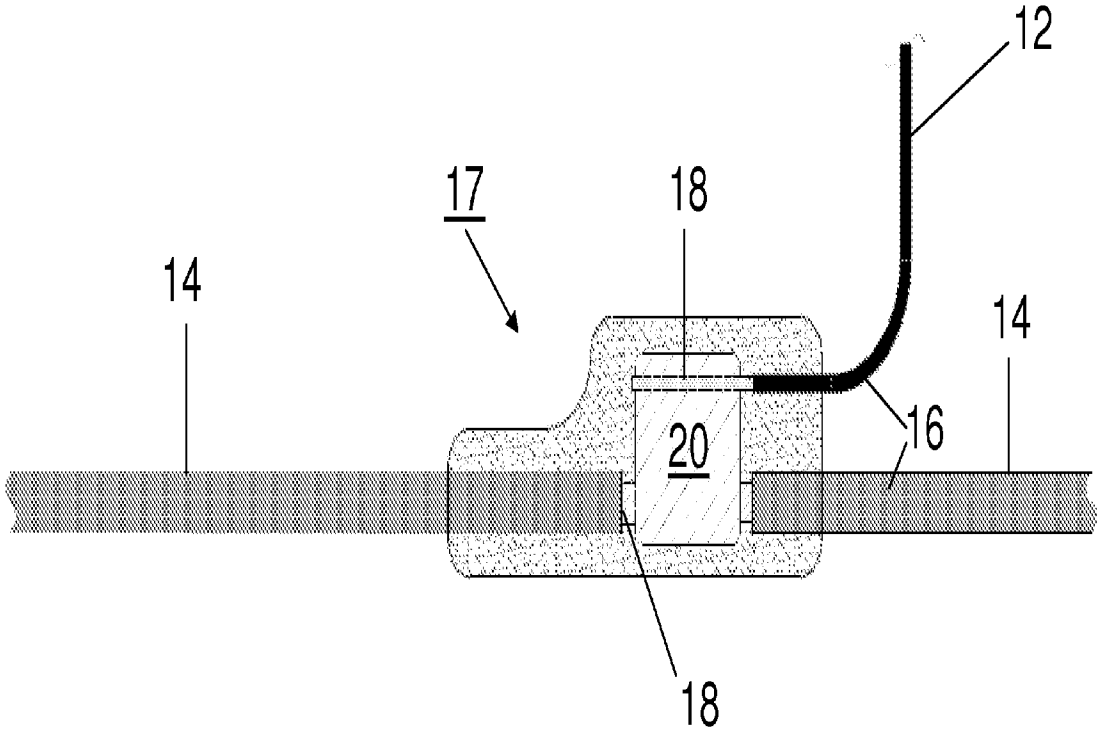


FIG. 7

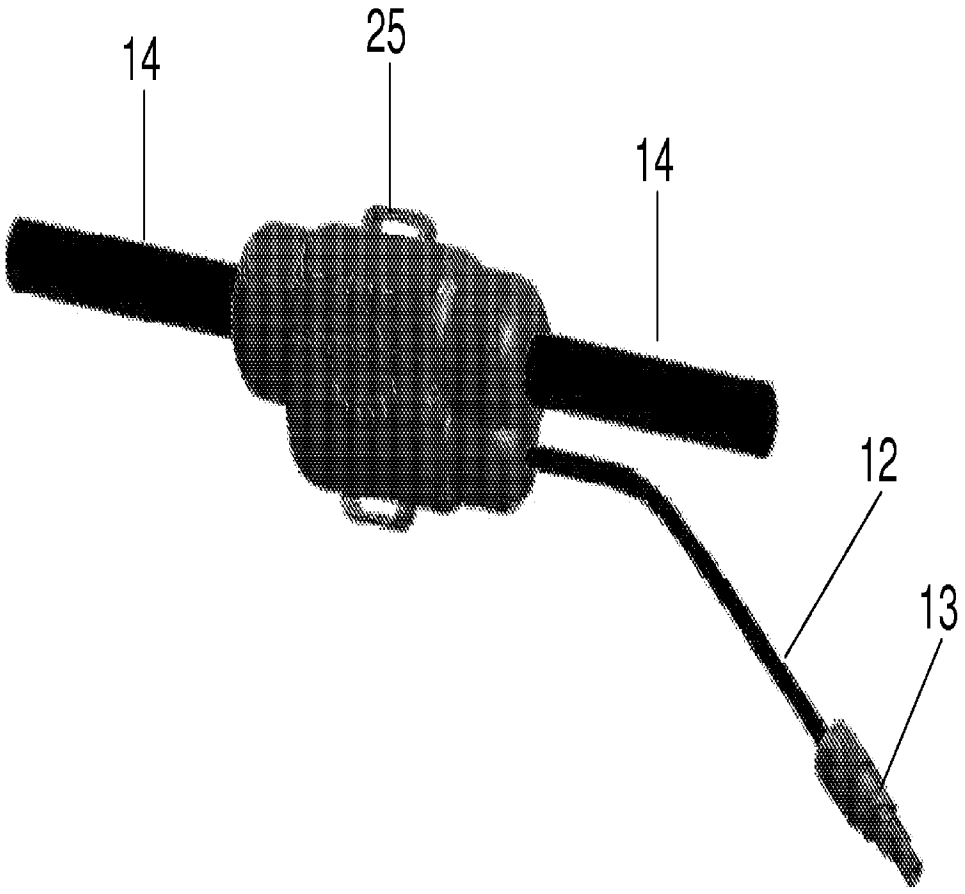


FIG. 8

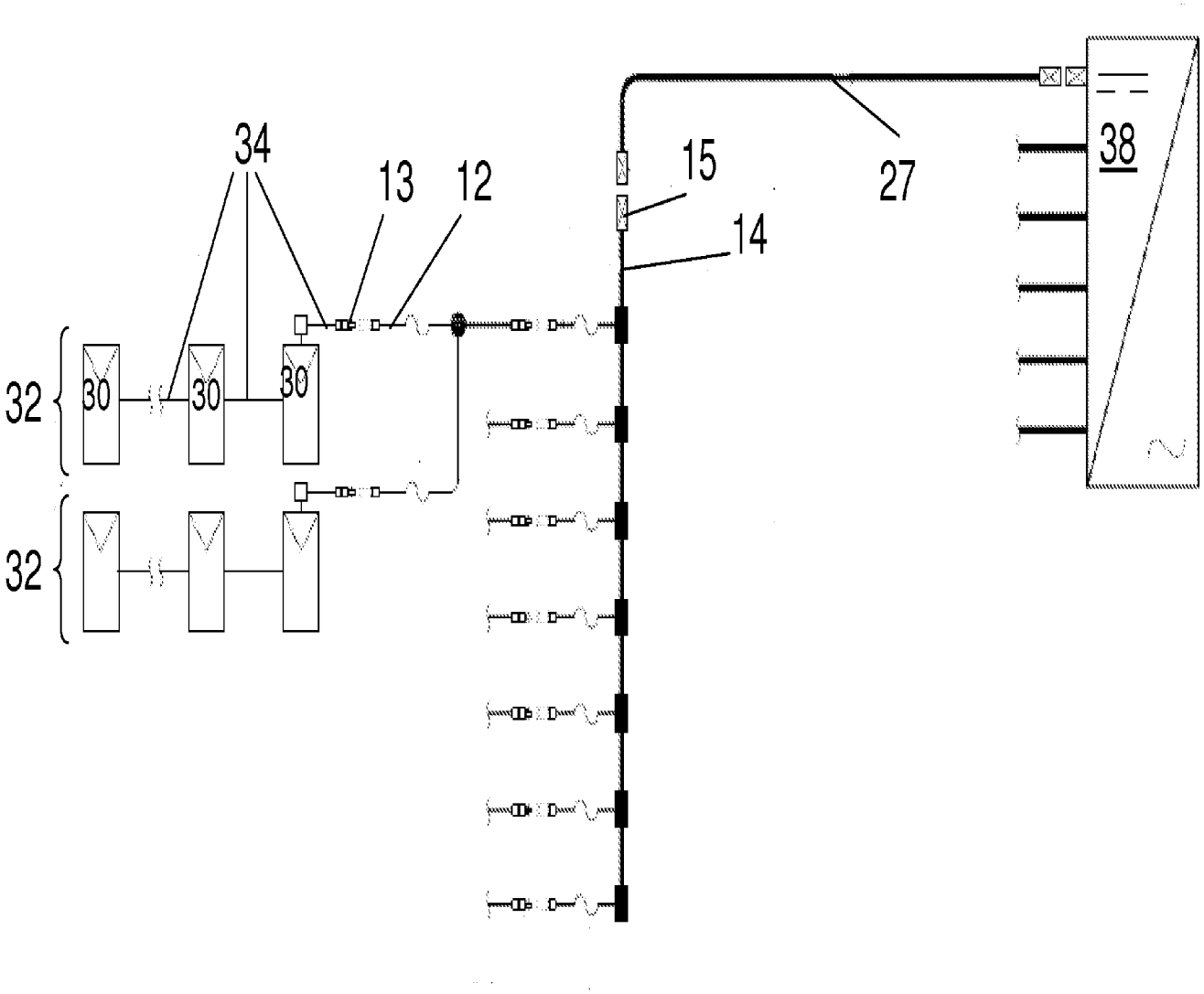


FIG. 9

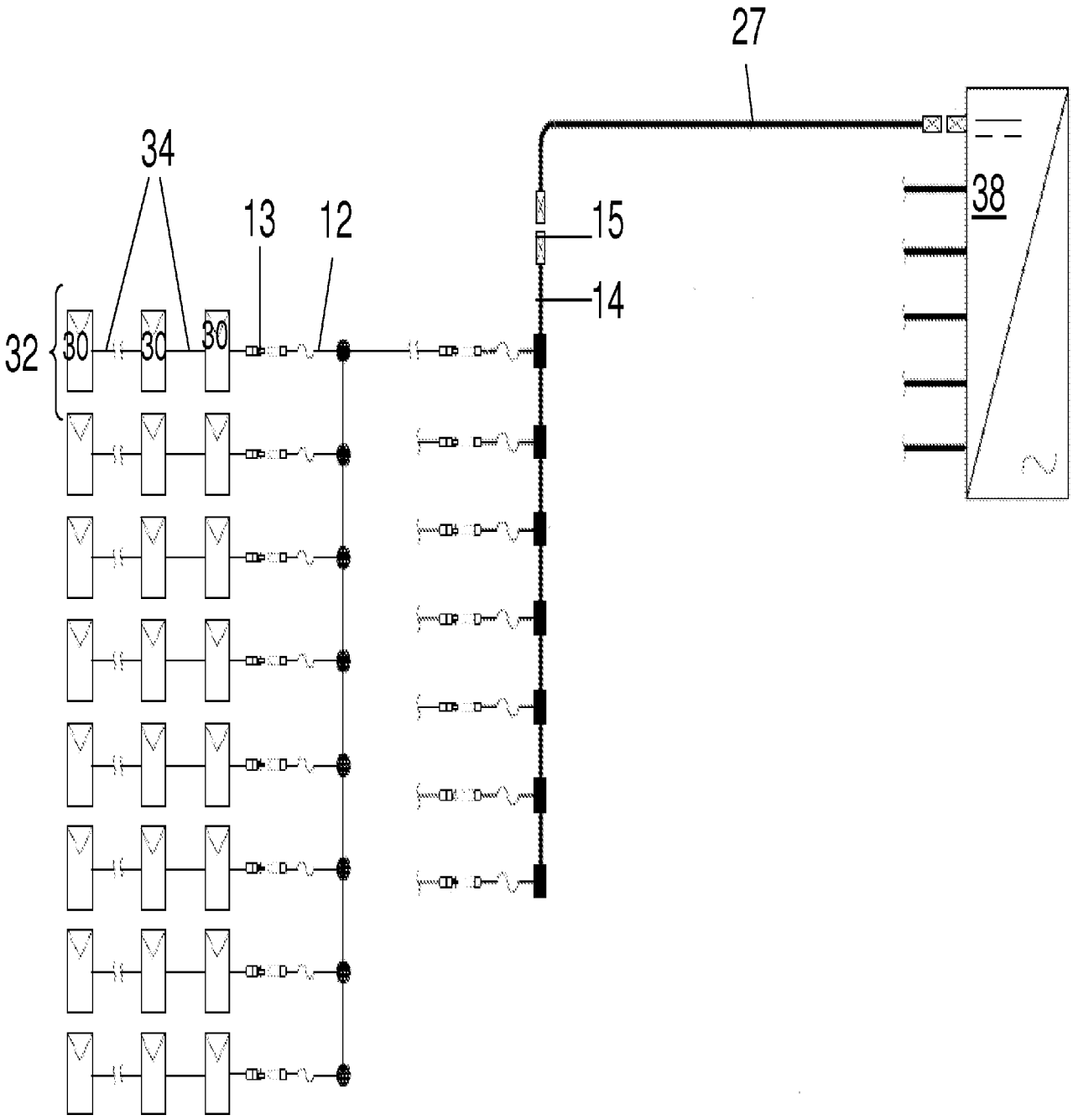


FIG. 10

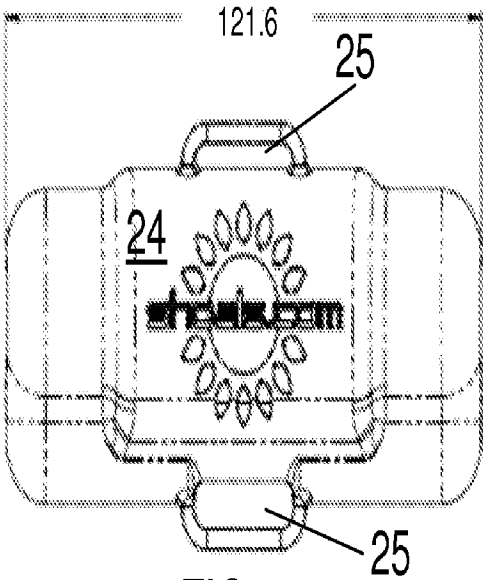


FIG. 11

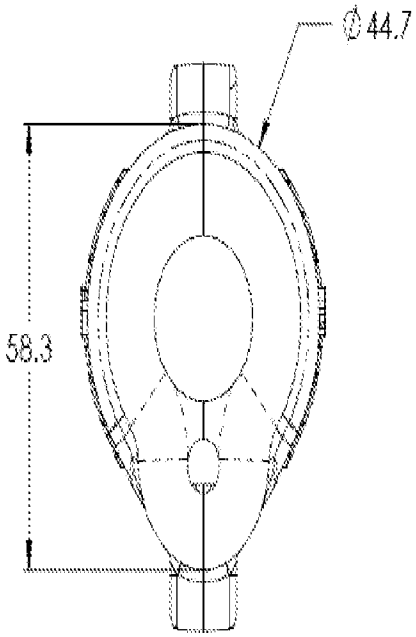


FIG. 12

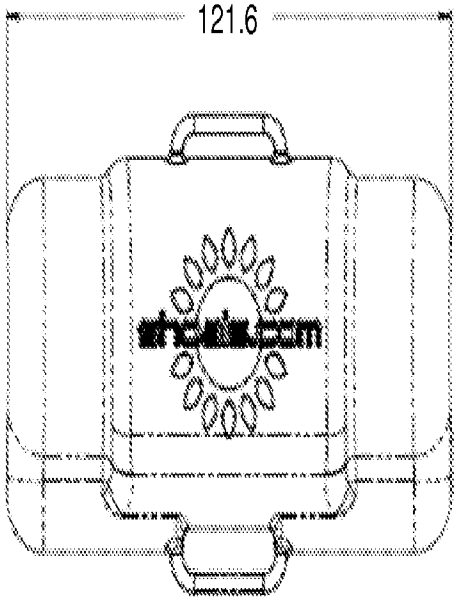


FIG. 13

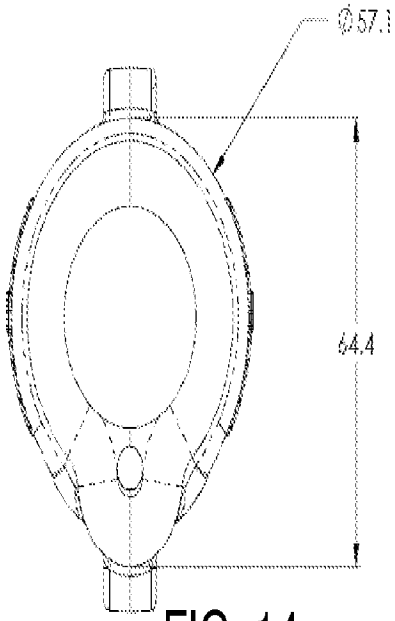


FIG. 14

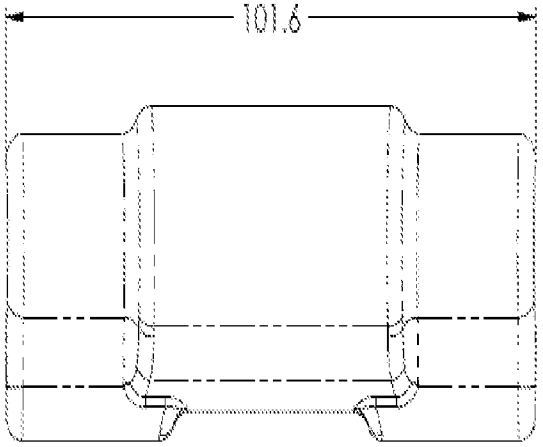


FIG. 15

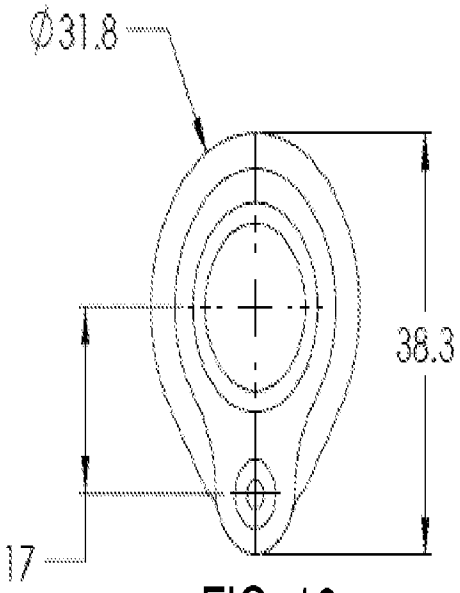


FIG. 16

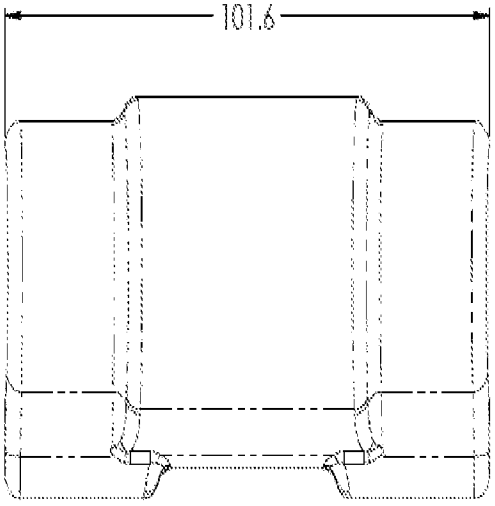


FIG. 17

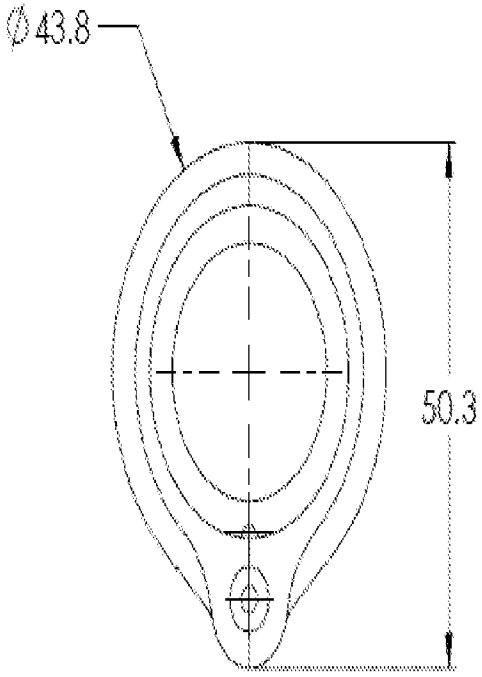


FIG. 18

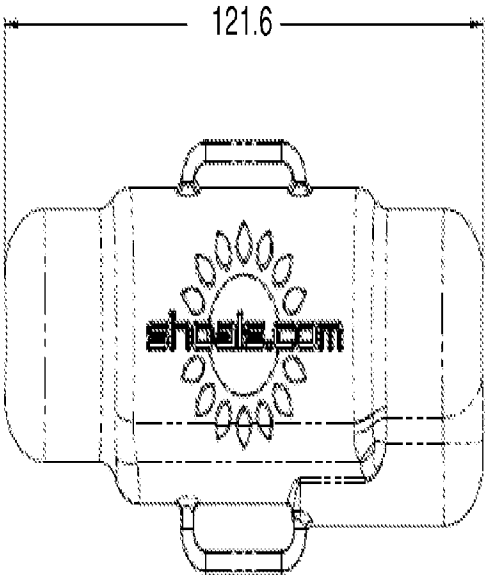


FIG. 19

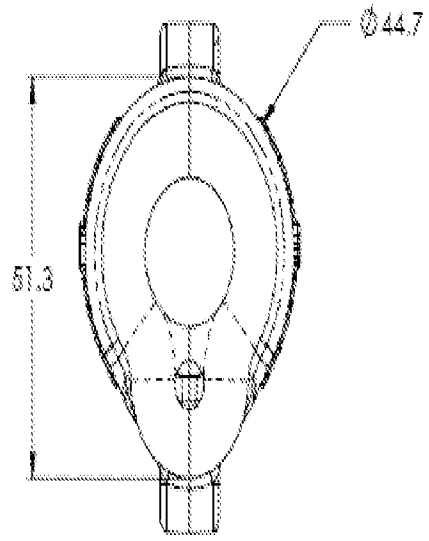


FIG. 20

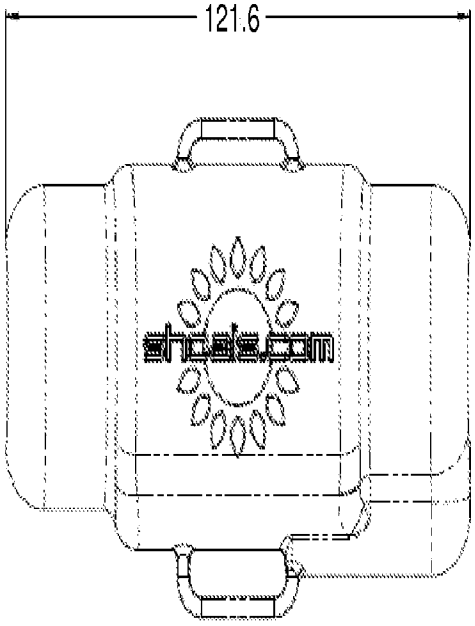


FIG. 21

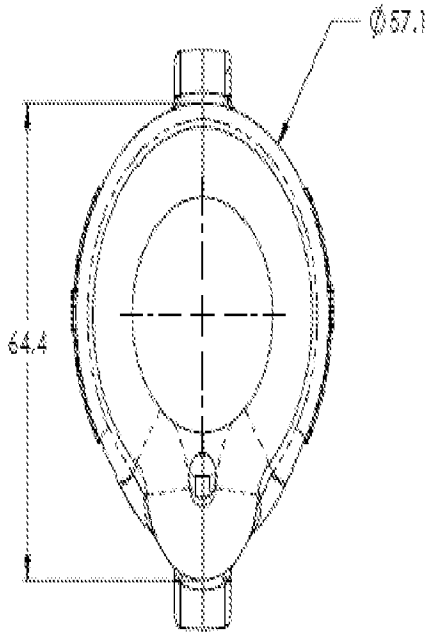


FIG. 22

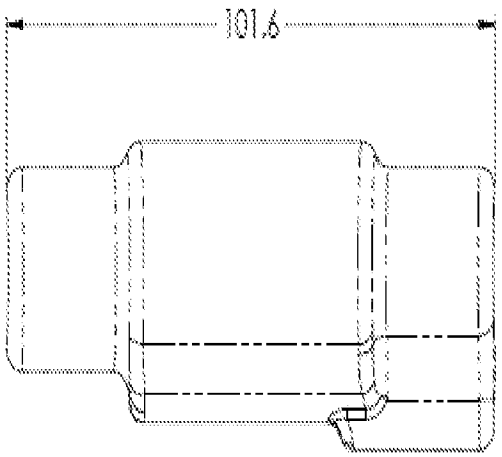


FIG. 23

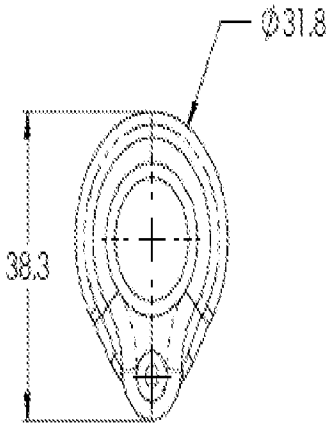


FIG. 24

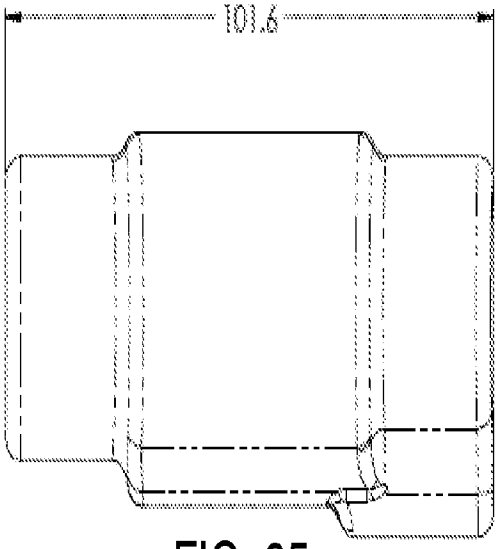


FIG. 25

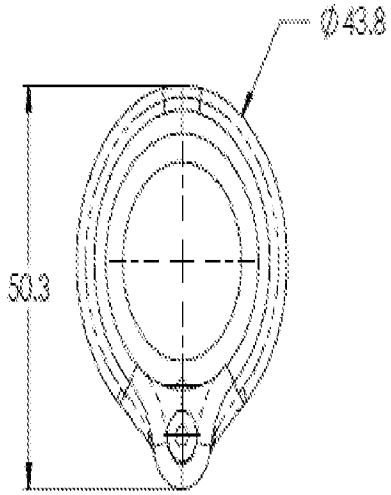


FIG. 26

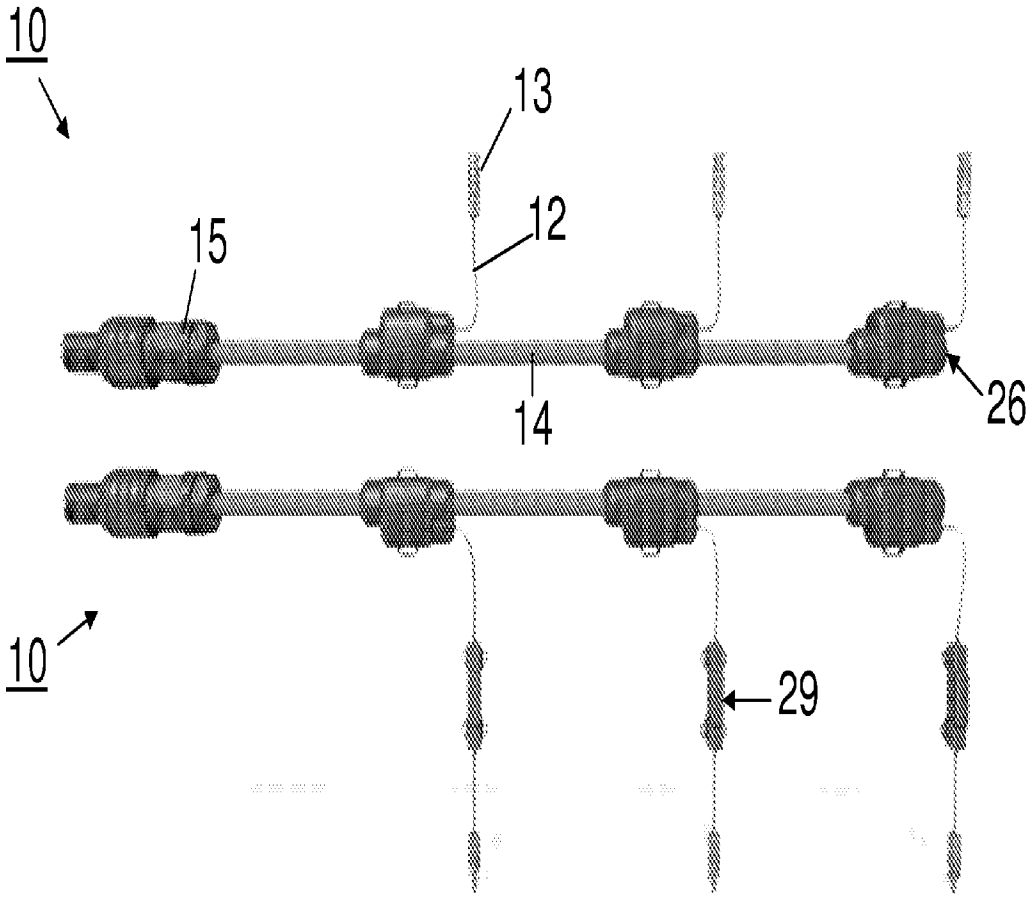


FIG. 27

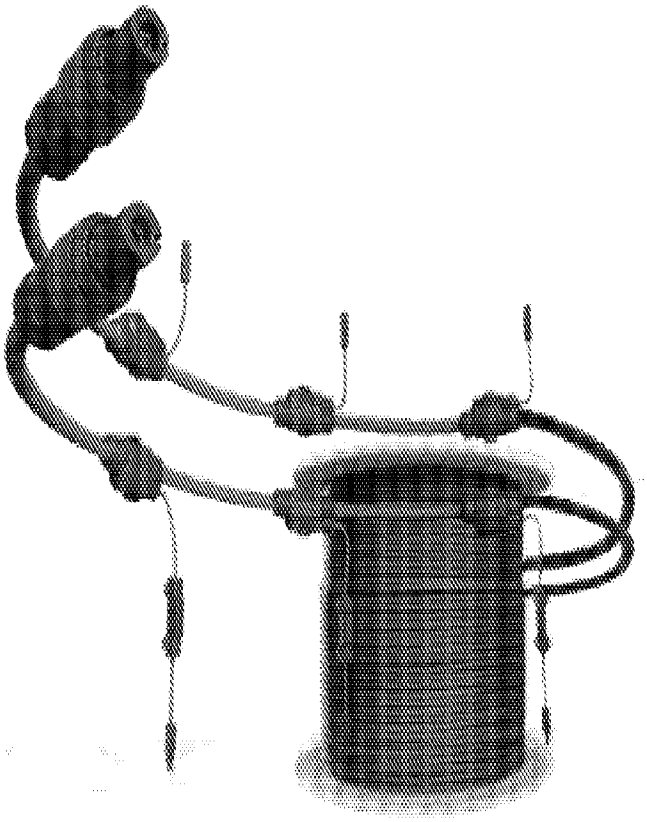


FIG. 28

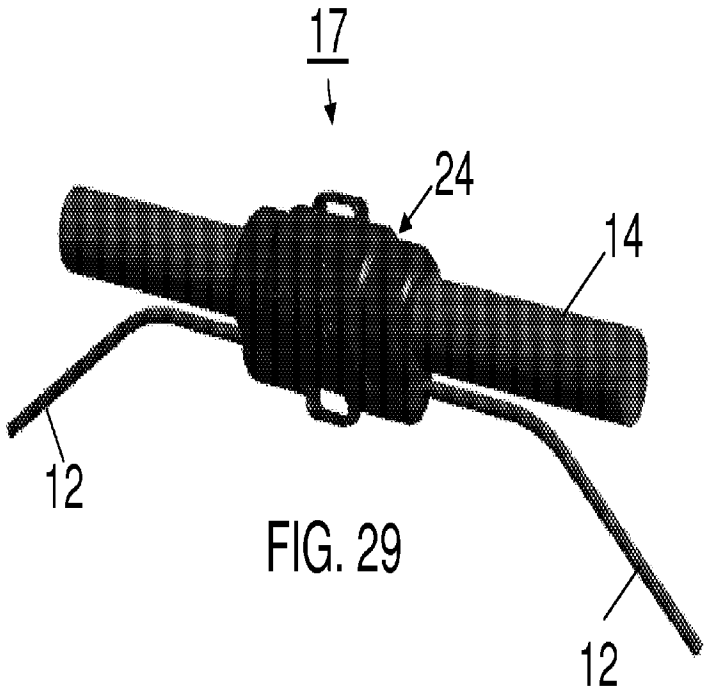


FIG. 29

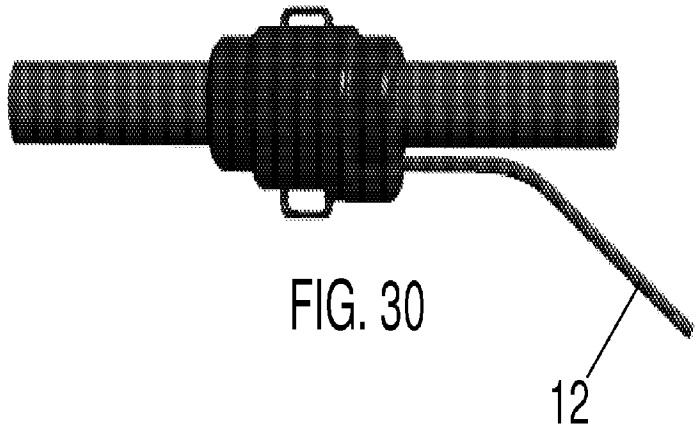


FIG. 30

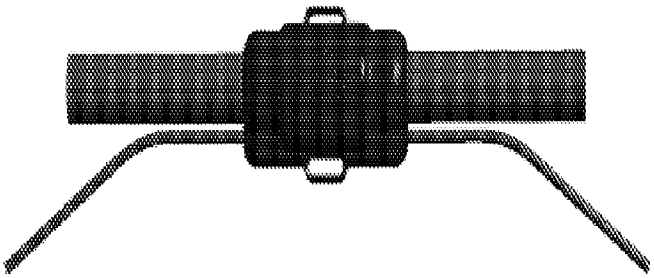


FIG. 31



FIG. 32

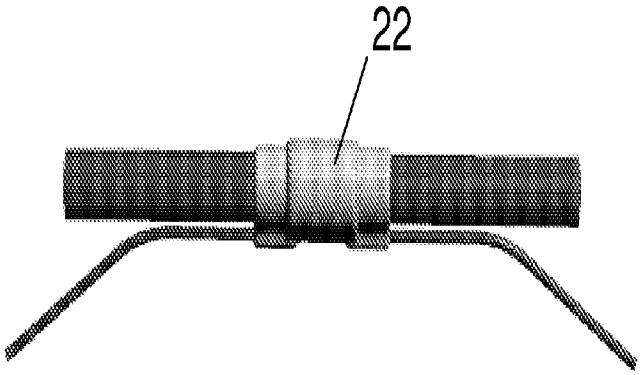


FIG. 33

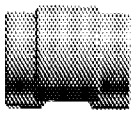


FIG. 34

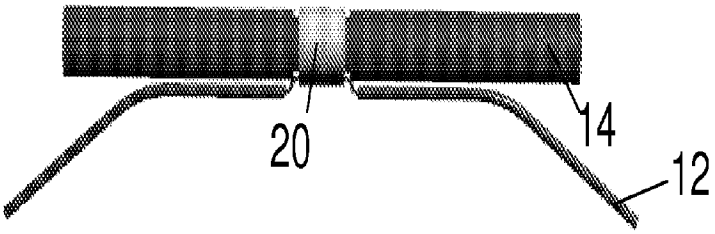


FIG. 35

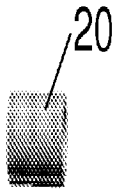


FIG. 36

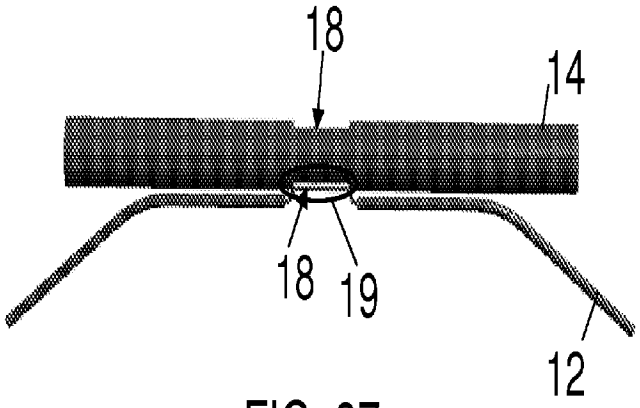


FIG. 37

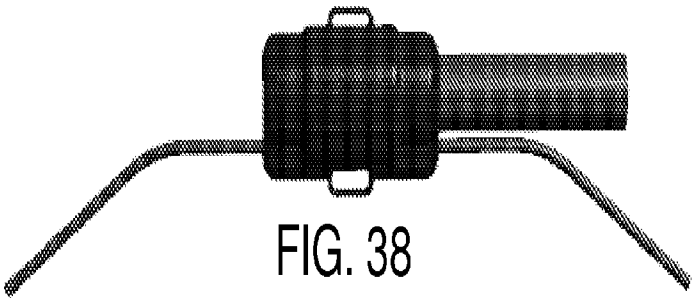


FIG. 38

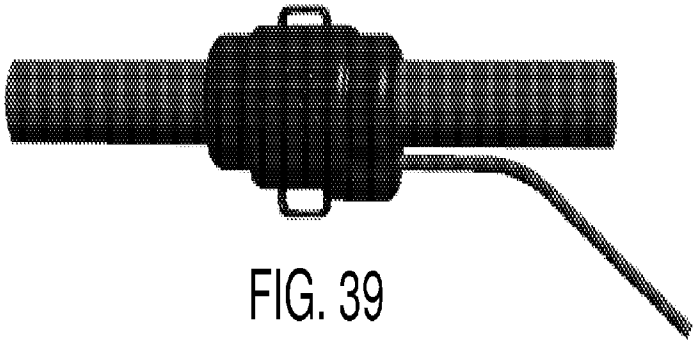


FIG. 39



FIG. 40

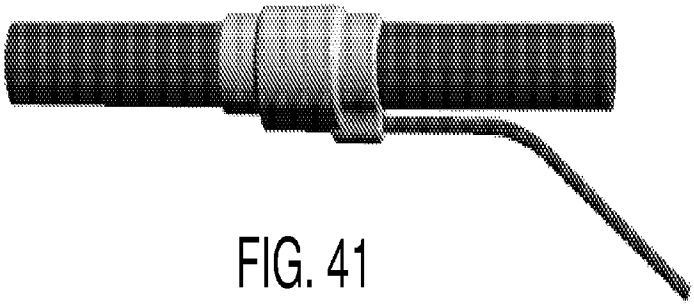


FIG. 41

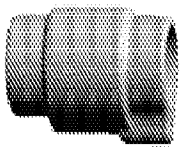


FIG. 42

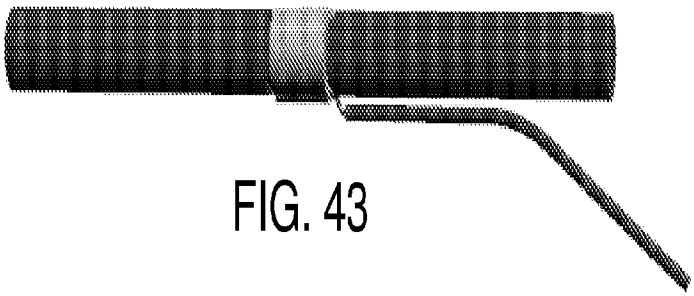


FIG. 43



FIG. 44

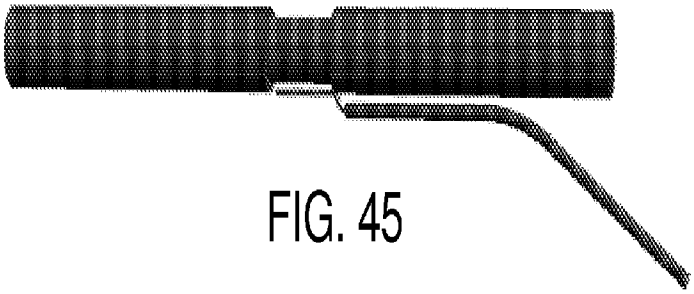


FIG. 45

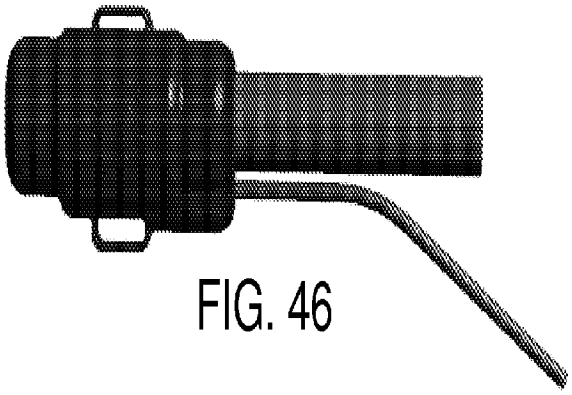


FIG. 46

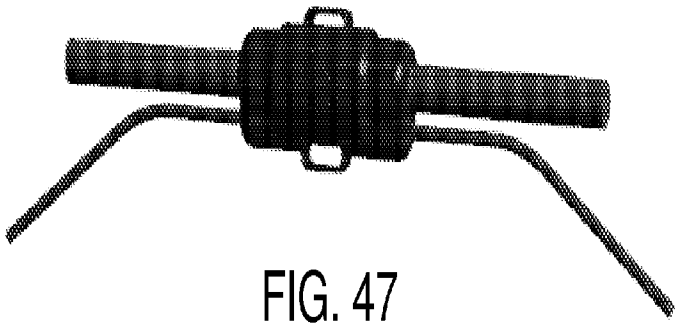


FIG. 47

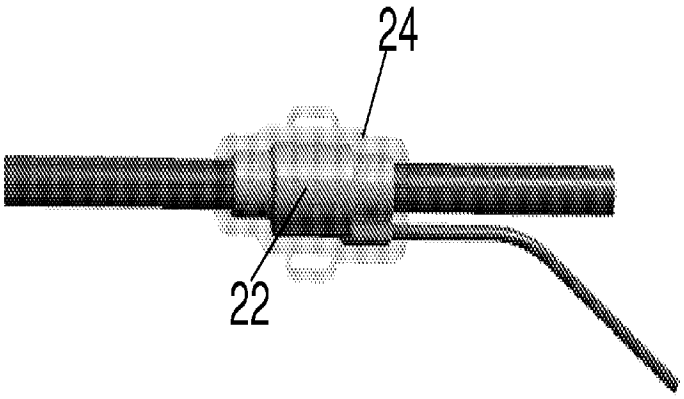


FIG. 48

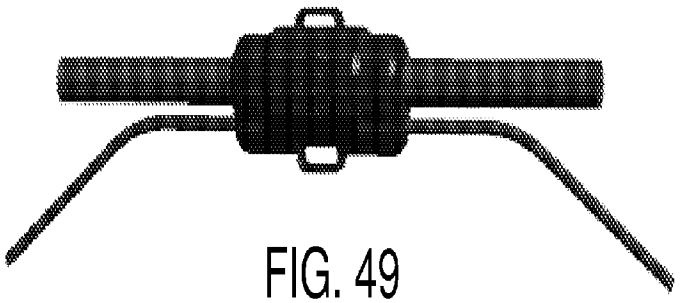


FIG. 49



FIG. 50

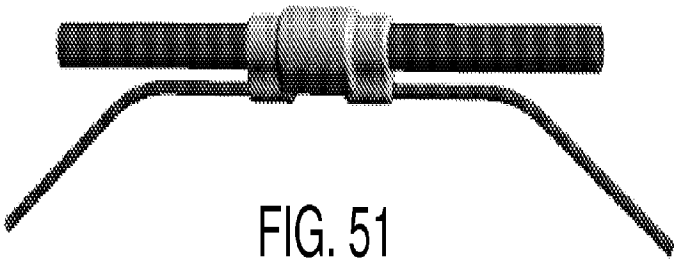


FIG. 51

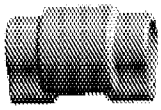


FIG. 52

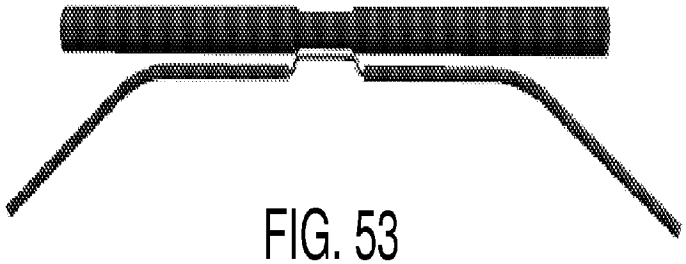


FIG. 53

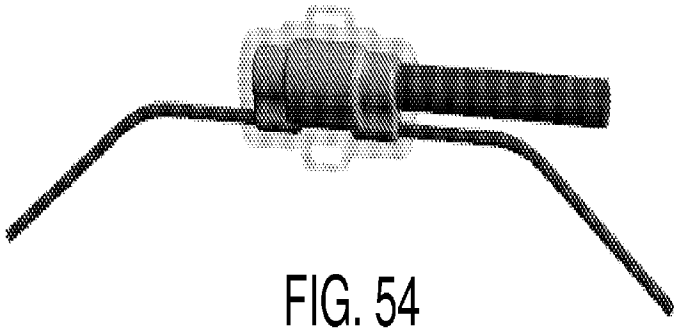


FIG. 54

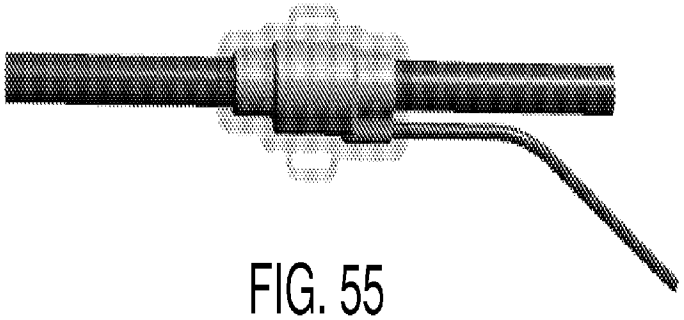


FIG. 55

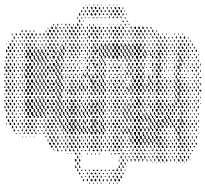


FIG. 56

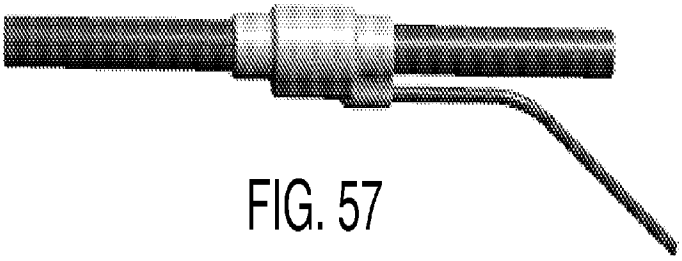


FIG. 57

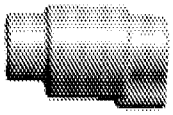


FIG. 58

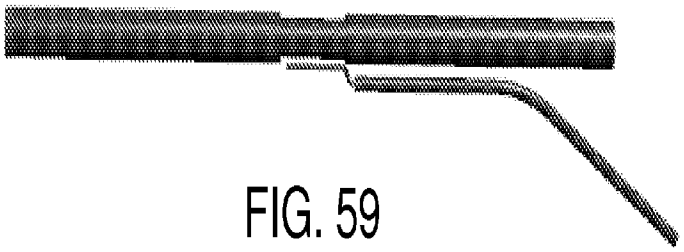


FIG. 59

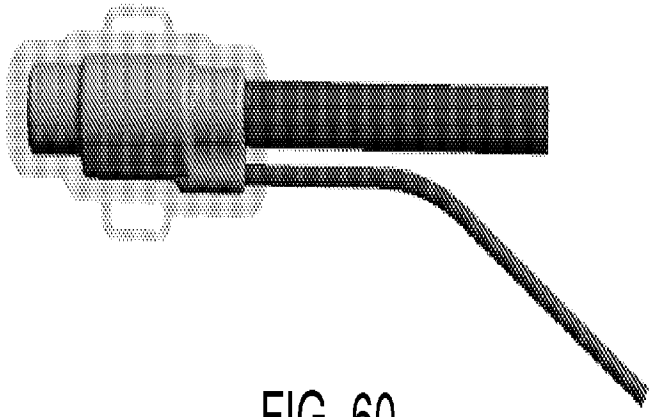


FIG. 60

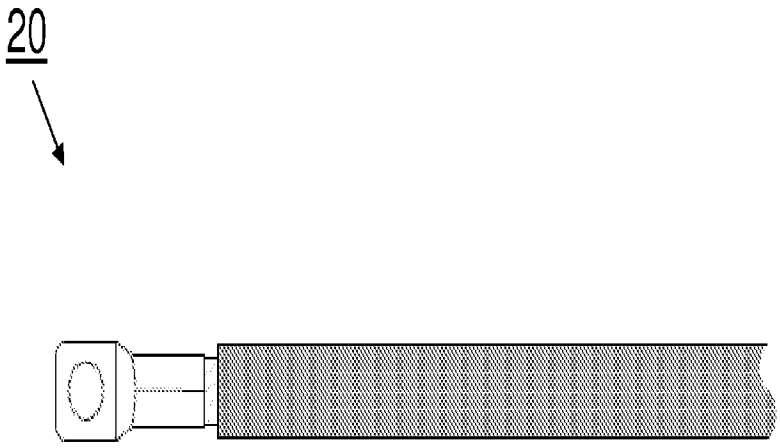


FIG. 61

LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a Continuation Application of 14/849,458, filed September 9, 2015, entitled LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER, which claims the benefit of and priority from the United States provisional patent application entitled PRE-PANELIZED THIN FILM, RACK, CONNECTORLESS DUAL CORDPLATE, MOBILE SKIDGET, POWERHOUSE AND BLA TRUNK BUSS, which was filed on September 9, 2014, and assigned the serial number 62/047,773, both of which are incorporated herein by reference in their entireties.

BACKGROUND

Disclosed embodiments relate to electrical components, and more specifically to assemblies for connecting solar panel arrays to an inverter, without the need of a combiner box.

As depicted in FIG. 1, a conventional solar power configuration includes a plurality of solar panels 30 each connected to a central combiner box 36, and a plurality of combiner boxes (not shown) connected to an inverter. The inverter converts the direct current (DC) generated by the solar panels into alternating power (AC), which goes in the "grid".

The configuration of FIG. 1 has been simplified in recent years by the wire harness of US Patent 8,604,342 which issued 12/10/13; and US Applications 14/057,089 filed 10/18/13; and 14/296,726 filed 6/5/14, all of which are hereby incorporated by reference. More specifically, as shown in FIG. 2, wire harnesses 34 connect multiple solar panels 30 in an array 32, so each array has a single input via wire harness 34 into the combiner box. This has drastically reduced the number of connections going into a combiner box, which is safer, more reliable, easier to install, maintain and troubleshoot, and saves money over the conventional configuration of FIG. 1.

Unfortunately, however, a combiner box is still a necessary component in known solar power installations because the energy coming from solar arrays must be combined prior to going into the inverter. Combiner boxes are problematic because they are clumsy, prone to

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damage and malfunctioning, must be periodically maintained, and require extensive planning and skill for installation. Due to the many connections going into a combiner box, a combiner box cannot easily be moved without disconnecting and reconnecting all the connections and wiring, which requires considerable manpower, danger, and expense.

As can be seen, there is a need for a device that renders a combiner box unnecessary. It is desirable that this device is small, inexpensive to manufacture and transport, and easy to use. It is also desirable that the device is extremely durable and can be adapted for a variety of circumstances.

SUMMARY OF DISCLOSED EMBODIMENTS

Disclosed embodiments are directed to a lead assembly including at least one drop line joined to a feeder cable at a nexus. The assembly is preferably undermolded and overmolded at the nexus. In use, the drop line is connected to solar arrays, and the feeder cable is connected to an inverter, or to a buss trunk jumper, which connects to the inverter. In this manner a plurality of solar arrays are electrically coupled together, with a common feeder cable connecting them all to the inverter. Alternatively, a plurality of feeder cables can be connected end to end, optionally terminating in a buss trunk jumper, for connection to an inverter. A combiner box is not necessary, and in fact would be redundant. In line fuses may be integrated into drop lines.

The terminal end of each drop line includes a drop line connector for fast and easy connection to the wire harness that interconnects the solar panels of a solar array. A lead assembly preferably includes one or two drop lines, depending on the particular configuration in a solar field. A lead assembly preferably includes a capping end piece at one end of the feeder cable, and a feeder cable connector at the other end. The feeder cable connector would plug into an inverter, buss trunk jumper, or possibly another feeder cable.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 depicts a conventional wiring configuration with each solar panel individually wired to a central combiner box;

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FIG. 2 depicts an improved but known wiring configuration with solar panels harnessed together to form solar arrays, with each solar array individually wired to a central combiner box;

FIG. 3 depicts the present invention of a plurality of wire harnesses coupled to a lead assembly that connects to an inverter, with the unnecessary combiner box shown for demonstration only;

FIG. 4 schematically represents a system of the present invention;

FIG. 5 depicts a positive lead assembly having a single drop line per joint;

FIG. 6 depicts a negative lead assembly having a single drop line per joint;

FIG. 7 schematically depicts a joint with a compression lug;

FIG. 8 depicts a single drop joint;

FIG. 9 depicts a configuration where a lead assembly has a single drop line as may be appropriate in use with crystalline panels;

FIG. 10 depicts a configuration where a lead assembly has a single drop line as may be appropriate in use with thin film panels;

FIGS. 11-12 depict the overmold for a dual drop lead assembly for 250 mcm cable;

FIGS. 13-14 depict the overmold for a dual drop lead assembly for 750MCM cable;

FIGS. 15-16 depict the undermold for a dual drop lead assembly for 250MCM cable;

FIGS. 17-18 depict the undermold for a dual drop lead assembly for 750MCM cable;

FIGS. 19-20 depict the overmold for a single drop lead assembly for 250MCM cable;

FIGS. 21-22 depict the overmold for a single drop lead assembly for 750MCM cable;

FIGS. 23-24 depict the undermold for a single drop lead assembly for 250MCM cable;

FIGS. 25-26 depict the undermold for a single drop lead assembly for 750MCM cable;

FIG. 27 depicts two lead assemblies with single drop, with the lower assembly including in line fuses;

FIG. 28 depicts a spooled lead assembly with single drop;

FIG. 29 depicts a dual drop lead assembly for 750MCM cable;

FIG. 30 depicts a single drop lead assembly for 750MCM cable;

FIG. 31 depicts a dual drop lead assembly for 750MCM cable with overmold shown;

FIG. 32 depicts the overmold for a dual drop lead assembly for 750MCM cable;

FIG. 33 depicts a dual drop lead assembly for 750MCM cable with undermold shown;

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FIG. 34 depicts the undermold for a dual drop lead assembly for 750MCM cable;

FIG. 35 depicts a dual drop lead assembly for 750MCM cable with compression lug shown;

FIG. 36 depicts the compression lug for a dual drop lead assembly for 750MCM cable;

FIG. 37 depicts a dual drop lead assembly for 750MCM cable with wires exposed at nexus;

FIG. 38 depicts the end piece for a dual drop lead assembly for 750MCM cable;

FIG. 39 depicts a single drop lead assembly for 750MCM cable with overmold shown;

FIG. 40 depicts the overmold for a dual single lead assembly for 750MCM cable;

FIG. 41 depicts a single drop lead assembly for 750MCM cable with undermold shown;

FIG. 42 depicts the undermold for a single drop lead assembly for 750MCM cable;

FIG. 43 depicts a single drop lead assembly for 750MCM cable with compression lug shown;

FIG. 44 depicts the compression lug for a single drop lead assembly for 750MCM cable;

FIG. 45 depicts a single drop lead assembly for 750MCM cable with wires exposed at nexus;

FIG. 46 depicts the end piece for a single drop lead assembly for 750MCM cable;

FIG. 47 depicts a dual drop lead assembly for 250MCM cable;

FIG. 48 depicts a single drop lead assembly for 250MCM cable with the overmold depicted in phantom;

FIG. 49 depicts a dual drop lead assembly for 250MCM cable with overmold shown;

FIG. 50 depicts the overmold for a dual drop lead assembly for 250MCM cable;

FIG. 51 depicts a dual drop lead assembly for 250MCM cable with undermold shown;

FIG. 52 depicts the undermold for a dual drop lead assembly for 250MCM cable;

FIG. 53 depicts a dual drop lead assembly for 250MCM cable with wires exposed at nexus;

FIG. 54 depicts the end of string for a dual drop lead assembly for 250MCM cable with the overmold depicted in phantom;

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FIG. 55 depicts a single drop lead assembly for 250MCM cable with the overmold depicted in phantom;

FIG. 56 depicts the overmold for a single drop lead assembly for 250MCM cable;

FIG. 57 depicts a single drop lead assembly for 250MCM cable with undermold shown;

FIG. 58 depicts the undermold for a single drop lead assembly for 250MCM cable;

FIG. 59 depicts a single drop lead assembly for 250MCM cable with wires exposed at nexus;

FIG. 60 depicts the end of string for a single drop lead assembly for 250MCM cable with the overmold depicted in phantom; and

FIG. 61 depicts a compression lug.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

The following detailed description describes exemplary embodiments of the invention. The description is not to be taken in a limiting sense but is made merely for the purpose of illustrating the general principles of the invention, since the scope of the invention is best defined by the appended claims.

The following structure numbers shall apply to the following structures among the various FIGS.:

10 — Lead assembly;

12 — Drop line;

13 — Drop line connector;

14 — Feeder cable;

15 — Feeder cable connector;

16 — Insulation;

17 — Joint;

18 — Exposed wire;

19 — Nexus;

20 — Compression lug;

22 — Undermold;

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24 — Overmold;

25 — Aperture;

27 — Trunk buss jumper;

29 — In line fuse;

30 — Solar panel;

32 - Solar array;

34 —Wire harness;

35 — Wire harness connector;

36 — Combiner box; and

38 — Inverter.

Referring to FIG. 3, a system of the present invention generally includes a plurality of solar panels 30 that are electrically coupled to form solar arrays 32a, 32b, and so forth. Panels 30 are preferably coupled using wire harnesses 34 which are commercially available from Shoals Technologies Group of Portland, TN. Each wire harness includes a plurality of branches each connecting to one solar panel, and a central trunk that terminates in wire harness connector 35. Each wire harness is connected at wire harness connector 35 to drop line connector 13 (not shown) of lead assembly 10.

As shown in FIG. 3, solar arrays 32a, 32b and 32c are connected to a lead assembly 10. A single lead assembly 10 can reasonably accommodate approximately 200Kw.

While FIG. 5 depicts a positive lead assembly having in line fuses 29, and FIG. 6 depicts a negative lead assembly without in line fuses, it should be understood that positive lead assemblies may lack in line fuses and negative lead assemblies may include in line fuses.

Referring now to FIG. 5, lead assembly 10 generally includes drop line 12 joined to feeder cable 14 at joint 17. As shown in FIG. 35, the drop line and feeder cable are held together by compression lug 20, which is surrounded by undermold 22 (FIG. 33), which is surrounded by overmold 24 (FIG. 29). Overmold 24 preferably defines at least one aperture 25 for receiving zip-ties, and the like, for securing the assembly upon installation.

Each drop line 12 terminates in drop line connector 13, which connects drop line 12 to wire harness connector 35. Drop line 12 is preferably constructed of 18 to 4 gauge wire, and drop line connectors 13 are preferably off-the-shelf connectors such as MC4/ PV-

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KBT4/61-UR & PV-KST4/61-UR from Multi-Contact of Windsor, CA .Joint 17 of lead assembly 10 may include a single drop line 12, as shown in FIG. 30, or dual drop lines 12, as shown in FIG 29, corresponding with connecting to a single wire harness or two wire harnesses, respectively. Whether a single or dual drop line is most suitable depends on the configuration of the solar arrays in a field.

By way of example and referring to FIG. 10, in a solar installation having thin film panels, which occupy a large area of space, it may be advantageous to employ single drop assemblies because it is impractical to physically reach wire harnesses that are very spread out. Alternatively and referring to FIG. 9, in a solar installation having crystalline panels, which occupy a smaller area of space, it may be advantageous to employ dual drop assemblies because the associated wire harnesses are relatively close to one another and can be connected to a single lead assembly.

It is also important to understand that the configuration of a particular lead assembly can be modified to accommodate different solar installations. For example, joints 17 and corresponding drop lines 12 can be spaced close together (approximately 15 cm), or far apart (approximately 15000 cm), along feeder cable 14, depending on the density of solar panels. Also, spacing of joints 17 and corresponding drop lines 12 can vary on a single lead assembly.

Each feeder cable 14 terminates in feeder cable connector 15, which connects to trunk buss jumper 27 (FIG. 27), to inverter 38 (FIG. 3), or to connection unit, recombiner, or disconnect unit (not shown). Trunk buss jumper 27 is essentially an "extension cord" which is economical to use in some configurations, for example where portions of feeder cable 14 are installed at different times. In another situation, trunk buss jumper 27 could be buried underground and feeder cable 14 above ground. Being able in install these conponents independent of one another can offer much more diversity. Trunk buss jumper 27 could also be utilized if there are a significant number of varying lengths from solar array 32 to inverter 38. Trunk buss jumper 27 could also be utilized if there is a substantial distance (greater than >50 meters) to travel from closest solar array 32 to inverter 38 and it would be wasteful to use a lead assembly with unused drop lines. The other end of feeder cable 14 terminates in joint 17 having end piece 26, which is typically installed at the solar array located furthest from the inverter. In alternative embodiments, feeder cable 14 includes feeder cable connector 15 at both terminal ends so feeder cables 14 can be connected one-to-another in an end-to-end

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orientation. In yet another embodiment, one or both ends of feeder cables 14 are blunt cut for subsequent manual connection, for example stripping and crimping to connectors or other segments of feeder cable.

Feeder cable 14 is preferably constructed of 6 gauge to 1000 MCM wire, with the specific wire chosen based on factors such as the number of associated drop lines and the distance between the connection and downstream inverter and whether or not feeder cable 14 is of aluminum or copper construction. Feeder cable connectors 15 are preferably off-the-shelf connectors such as KBT10BV & KST10BV from Multi-Contact of Windsor, CA.

Referring to FIG. 37, drop line 12 and feeder cable 14 electrically couple at nexus 19 of joint 17. This is preferably accomplished by stripping wire insulation 16 from corresponding segments of drop line 12 and feeder cable 14, adjoining respective segments of exposed wire 18, and securing contact between the segments of exposed wire by employing compression lug 20. It should be understood that securing contact between the segments could be achieved by other means including soldering, splicing, crimping, and so forth. Compression lug 20 is preferably surrounded by undermold 22, which is preferably composed of RTP 2099E x 127663 from RTP Co. of Winona, MN that has been applied by injection molding. As shown in FIG. 48, undermold 22 is preferably surrounded by overmold 24, which is preferably composed of RTP 199 x 124807 from RTP Co of Winona, MN that has been applied by injection molding. The resulting assembly is profoundly durable, resistant to environmental factors such as temperature fluctuations, debris, and moisture, and is strong enough to be buried.

In an alternative embodiment, there is no undermold, just an overmold, which is applied in a single molding process.

It is a very important feature that a system of the present invention doesn't require a combiner box. Rather, lead assemblies 10 effectively "combine" the power from solar arrays 32 and deliver it to inverter 38. As shown in FIG. 3, the present invention also eliminates the need of DC feeders, which would carry power from the combiner box to the inverter in a conventional system. Also, the need for fuses can be eliminated by using drop lines including in line fuses 29, as shown in the lower assembly of FIG. 27. Appropriate fuses include of HP10x from Mersen of Newburyport, MA.

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An embodiment of the present invention preferably has the following specifications: Voltage rating of 600 VDC / 1000 VDC / 1500 VDC; Maximum branch current of 30 amps per string; Maximum overcurrent protection of 30 amps per string; maximum trunk cable size of 750MCM; and Maximum ambient operating temperature of 50° C, although other embodiments beyond these specifications are within the scope of the inventions.

It should also be understood that the illustrations are for the purpose of describing a preferred embodiment of the inventions and are not intended to limit the inventions thereto. By way of example, the present invention can be scaled up or down to accommodate any feeder cable size, including the common 250 and 750MCM cable sizes. Also, while the current invention has been described in association with DC applications, it should be understood that it could also be implemented into feeders deployed in AC systems, which would negate the need for AC recombiner boxes. It should also be understood that approximations allow variances of +/- 10%, unless otherwise noted or nonsensical such as a length less than zero. It should also be understood that all ranges set forth inherently include the endpoints themselves, as well as all increments, there between.

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CLAIMS

What is claimed is:

1. A lead assembly for use in a solar energy installation including:

a drop line;

a feeder cable electrically coupled to the drop line at a nexus;

an undermold that fully encases the nexus, the undermold further comprising:

a first aperture extending completely through the undermold and having a first diameter, wherein the feeder cable extends through the first aperture along a first longitudinal axis; and

a second aperture extending partially through the undermold and having a second diameter different than the first diameter, wherein the drop line extends from the second aperture along a second longitudinal axis; and

an overmold surrounding the undermold and forming an undermold-overmold interface at an outer surface of the undermold.

2. The lead assembly of claim 1 wherein the drop line includes a section of exposed wire at the nexus.

3. The lead assembly of claim 2 wherein the feeder cable includes a section of exposed wire at the nexus.

4. The lead assembly of claim 1 wherein the overmold defines at least one attachment aperture.

5. The lead assembly of claim 1, wherein the feeder cable terminates at a feeder cable connector.

6. The lead assembly of claim 5, wherein the feeder cable connector is configured to attach directly to an inverter.

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7. The lead assembly of claim 5, wherein the feeder cable connector is configured to attach directly to a jumper cable, which in turn connects directly to an inverter.

8. The lead assembly of claim 1, wherein the first longitudinal axis and the second longitudinal axis are substantially parallel.

9. The lead assembly of claim 1, wherein the second diameter is smaller than the first diameter.

10. The lead assembly of claim 1, further comprising a third aperture extending partially through the undermold and having a third diameter different than the first diameter, wherein a second drop line extends from the third aperture along a third longitudinal axis.

11. The lead assembly of claim 10, wherein the third longitudinal axis is substantially concentric with the second longitudinal axis, and substantially parallel with the first longitudinal axis.

12. The lead assembly of claim 1, wherein the drop line includes a fuse.

13. The lead assembly of claim 1, wherein the drop line terminates at a drop line connector.

14. The lead assembly of claim 13, wherein the drop line connector connects to a wire harness connecting to a plurality of solar panels.

15. The lead assembly of claim 14, wherein said lead assembly combines power received from the plurality of solar panels and conducts that power directly to an inverter electrically connected to the feeder cable.

16. A solar power system comprising:

a plurality of solar panels electrically coupled by a wire harness to form a first solar array;

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a lead assembly comprising:

a drop line electrically connected to the wire harness and configured to receive power from the plurality of solar panels;

a feeder cable, the feeder cable electrically connected to the drop line at a nexus; and

a primary mold that fully encases the nexus so as to substantially seal the nexus from external environmental conditions, the primary mold further comprising:

a first aperture extending completely through the primary mold and having a first diameter, wherein the feeder cable extends through the first aperture along a first longitudinal axis; and

a second aperture extending partially through the primary mold and having a second diameter smaller than the first diameter, wherein the drop line extends into the second aperture along a second longitudinal axis.

17. The solar power system of claim 16, further comprising a second drop line electrically connected to a second wire harness that connects to a plurality of solar panels, the second drop line electrically connected to the feeder cable at a second nexus fully encased by the primary mold, wherein the second drop line extends into a third aperture defined by the primary mold along a third longitudinal axis.

18. The solar power system of claim 16, wherein the feeder cable is directly electrically connected to a component selected from the group consisting of a trunk buss jumper, an inverter, a connection unit, a recombiner, and a disconnect unit.

19. The solar power system of claim 16, further comprising a secondary mold surrounding the primary mold and forming an undermold-overmold interface at an outer surface of the primary mold.

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ABSTRACT

A lead assembly includes at plurality of drop line joined to a feeder cable at joints each having a compression lug that is preferably surrounded by undermolding and overmolding. In use, each drop line is connected to a solar array, and the feeder cable is connected to an inverter. In this manner a plurality of solar arrays are electrically coupled together, with a common feeder cable connecting them all to the inverter. A system of the present invention doesn't require a combiner box which is conventionally employed directly upstream of the inverter.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S4079.10001US03
	Application Number	
Title of Invention	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER	

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
	Dean		Solon	

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

City	State/Province	Country of Residence
Gallatin	TN	US

Mailing Address of Inventor:

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Address 2	

City	State/Province	Postal Code	Country
Portland	TN	37148	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. — Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	97149		
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Application Information:

Title of the Invention	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER		
Attorney Docket Number	S4079.10001US03	**Small Entity Status Claimed**	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	26	**Suggested Figure for Publication (if any)**	

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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	97149		

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)
	Continuation of	14849458	2015-09-09	10992254	2021-04-27

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S4079.10001US03
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Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14849458	Claims benefit of provisional	62047773	2014-09-09

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).

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Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

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Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S4079.10001US03
	Application Number	
Title of Invention	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER	

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.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S4079.10001US03
	Application Number	
Title of Invention	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER	

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	SHOALS TECHNOLOGIES GROUP, LLC		
Mailing Address Information For Applicant:			
Address 1	1400 Shoals Way		
Address 2			
City	Portland	**State/Province**	TN
Country	US	Postal Code	37148
Phone Number		Fax Number	
Email Address			

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Assignee Information including Non-Applicant Assignee Information:

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S4079.10001US03
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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	SHOALS TECHNOLOGIES GROUP, LLC

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1	1400 Shoals Way		
Address 2			
City	Portland	**State/Province**	TN
Country i	US	Postal Code	37148
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	/ERIC L. MASCHOFF/			Date (YYYY-MM-DD)	2021-04-08
First Name	Eric	Last Name	Maschoff	Registration Number	36596

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S4079.10001US03
	Application Number	
Title of Invention	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER	

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.**

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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 the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent CooperationTreaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/301,609	**04/08/2021 07:41:25 PM ET**	**S4079.10001US03**

Title of Invention

LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	3509	FILED BY	Brian Gonzalez
PATENT CENTER #	60173479	FILING DATE	-
CUSTOMER #	97149	FIRST NAMED INVENTOR	Dean Solon
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Eric Maschoff

Documents

TOTAL DOCUMENTS: 6

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
2021.04.08 ADS_S4079.10001US03.pdf	8	Application Data Sheet	1780 KB
Warning: The attached version of the AIA/14 form is not the current version and data may not fully load to USPTO systems.			
2021.04.08 Declaration_S4079.10001US03.pdf	2	Oath or Declaration filed	238 KB
2021.04.08 Figures_S4079.10001US03.pdf	26	Drawings-other than black and white line drawings	821 KB

2021.04.08 Continuation Application_S4079.10001US03.pdf		13	-	179 KB
2021.04.08 Continuation Application_S4079.10001US03-SPEC.pdf	(1-9)	9	Specification	122 KB
2021.04.08 Continuation Application_S4079.10001US03-CLM.pdf	(10-12)	3	Claims	91 KB
2021.04.08 Continuation Application_S4079.10001US03-ABST.pdf	(13-13)	1	Abstract	64 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
2021.04.08 ADS_S4079.10001US03.pdf	3FE89F028FCD5977FCFDF495FCC0DEEBA1AAE8BF41A8FA9EE42AFC6522C8CE5EAE949E2BC39B7A79D5FFAD4F11523AF2FD69C9CE3193B4D4098432F62E1B9C1B
2021.04.08 Declaration_S4079.10001US03.pdf	BECD4A8213313FD59179C15799703EED2A3D326CDBE78CCC793B9437DA3668C8E8F4B91B28737E8A76E5ED2856F96F1C35FA54BD96FEE2A2563F5310C2E6ECA7
2021.04.08 Figures_S4079.10001US03.pdf	B16516EC960096AE3D2C7BDB88F8BAF6102AF10789291C167A98FDA636847F467055ADB3FA73B11A4F1BA28A774D81A8B9B5558FBAC4CF4A10276C593BCF49AC
2021.04.08 Continuation Application_S4079.10001US03.pdf	84174E786D716772B7FEF23E3897A24804905EE0873A39354AD9115FAD8DF9479D07DB3D7FB0F33F932E174F73D1AF32C6737E642DB7A03DC51F7A45ADD05CFD
2021.04.08 Continuation Application_S4079.10001US03-	F2164BD1E3ABB82E64865A0FC1247A8384A3463CB5161E6E085F1A8997C311DD154E0D561F20AF610A7AD75C37A72912A4

SPEC.pdf	348934E7EF23A34D0E9089216300AE
2021.04.08 Continuation Application_S4079.10001US03-CLM.pdf	89B02BEAE1B611087F5A92637AFF97A0EBB3184FEF9D259A309464030119A6A9B1B4457EBCAD360DD06FD27222D6D55AE163E30408C49637EB2EDB607BF418B4
2021.04.08 Continuation Application_S4079.10001US03-ABST.pdf	5EF0D2D956F8ED5894CE037854192BFC2FB75F3C265EB8F826A39011622C1AEF8A8842548E62EA6215BB460D616E157FF66B1B26BA87CB289FBFDB7D1C540CA9

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New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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