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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/523,464	11/29/2023	Dean SOLON	S4079.10001US05	4515

97149 7590 06/18/2024

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

EXAMINER
CANNON, RYAN SMITH

ART UNIT	PAPER NUMBER
1726	

NOTIFICATION DATE	DELIVERY MODE
06/18/2024	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):

bisraelsen@mabr.com
d@mabr.com

APPLICATION NO.	ISSUE DATE	PATENT NO.
18/523,464	18-Jun-2024	12015376

Maschoff Brennan
1389 Center Drive, Ste. 300
Park City, UT 84098

EGRANT NOTIFICATION

Your electronic patent grant (eGrant) is now available, which can be accessed via Patent Center at https://patentcenter.uspto.gov

The electronic patent grant is the official patent grant under 35 U.S.C. 153. For more information, please visit https://www.uspto.gov/electronicgrants

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/523,464	06/18/2024	12015376	S4079.10001US05	4515

97149 7590 05/29/2024

Maschoff Brennan
1389 Center Drive, Ste. 300
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.

The USPTO is implementing electronic patent issuance with a transition period, during which period the USPTO will mail a ceremonial paper copy of the electronic patent grant to the correspondence address of record. Additional copies of the patent (i.e., certified and presentation copies) may be ordered for a fee from the USPTO's Certified Copy Center at https://certifiedcopycenter.uspto.gov/index.html. The Certified Copy Center may be reached at (800)972-6382.

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 Center (https://patentcenter.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 PATENT CENTER site https://patentcenter.uspto.gov for additional inventors):

Dean SOLON, Gallatin, TN;

APPLICANT(s) (Please see PATENT CENTER site https://patentcenter.uspto.gov for additional applicants):

SHOALS TECHNOLOGIES GROUP, LLC, Portland, TN;

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 USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

Change(s) applied
to document.
/E.B./
3/7/2024

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.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in an interview with Paul Johnson on 2/28/2024.

The application has been amended as follows:

In claim 1:

In line 11 12, please change "disposed about a region" to –disposed about and conforming to a region--.

In the final line, please change "electrical interconnection." to –electrical interconnection; and wherein, in the region of electrical interconnection, the first drop line and the second drop line extend in opposite directions along a longitudinal axis that is parallel to a longitudinal axis of the feeder cable.--.

In claim 22:

In line 9, please change "disposed about a region" to –disposed about and conforming to a region--.

In the final line, please change "1500 VDC." To –1500 VDC; wherein the drop line and the feeder cable extend parallel to one another within the region of electrical interconnection, and the mold structure has distinct openings through which the drop line and the feeder cable exit the mold structure.--.

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)				Application Number	18523464
				Filing Date	2023-11-29
				First Named Inventor	Dean SOLON
				Art Unit	OPAP
				Examiner Name	Unassigned
Sheet	1	Of	6	Attorney Docket Number	S4079.10001US05

U.S. PATENTS

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.	1,831,002		1931-11-10	Hickey	
	2.	2,700,085		1955-01-18	Breisch et al.	
	3.	2,808,487		1957-10-01	Jacobs	
	4.	3,085,138		1963-04-09	Brown et al.	
	5.	3,086,242		1963-04-23	Cook et al.	
	6.	3,243,211		1966-03-29	Wetmore	
	7.	3,296,399		1967-01-03	Kozacka	
	8.	3,559,141		1971-01-26	Hardy	
	9.	3,678,432		1972-07-18	Boliver	
	10.	3,686,603		1972-08-22	Lockie et al.	
	11.	3,686,604		1972-08-22	Link et al.	
	12.	3,781,745		1973-12-25	Vadnagara	
	13.	3,795,757		1974-03-05	Higgins	
	14.	3,818,407		1974-06-18	Edgerton	
	15.	3,852,516		1974-12-03	Vander et al.	
	16.	3,946,351		1976-03-23	Bronikowski et al.	
	17.	4,060,785		1977-11-29	Hanke et al.	
	18.	4,251,304		1981-02-17	Campbell et al.	
	19.	4,308,515		1981-12-29	Rooney et al.	
	20.	4,625,196		1986-11-25	Muench et al.	
	21.	4,778,948		1988-10-18	Fitch et al.	
	22.	4,780,598		1988-10-25	Fahey et al.	
	23.	4,947,149		1990-08-07	Pimpis et al.	
	24.	5,316,502		1994-05-31	Loet	
	25.	5,316,789		1994-05-31	Ookuma et al.	
	26.	5,726,851		1998-03-10	Knapp	
	27.	5,903,209		1999-05-11	Stepniak	
	28.	6,265,665		2001-07-24	Zahnen	
	29.	6,268,559		2001-07-31	Yamawaki	
	30.	7,387,537		2008-06-17	Daily	
	31.	7,422,458		2008-05-22	Arai	
	32.	8,207,637		2012-06-26	Marroquin et al.	
	33.	8,242,874		~~2009-12-17~~	Pavlovic et al.	08/2012
	34.	8,289,123		~~2007-01-25~~	Whitney et al.	10/2012

Change(s) applied to document, /M.D./

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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Dean Solon	
Application No.:	18/523,464	Art Unit 1726
Filed:	November 29, 2023	
Conf. No.:	4515	
For:	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER	
Examiner:	Ryan Smith Cannon	
Customer No.:	97149	
Attorney Docket No.:	S4079.10001US05	

COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE

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

Dear Commissioner:

Applicant acknowledges Examiner's statements of Reasons for Allowance of the above-referenced patent application and agrees that the claimed subject matter is patentable. However, Applicant takes no position regarding the Reasons for Allowance presented by the Examiner other than the positions Applicant may have previously taken during prosecution. Applicant submits that it is the claim as a whole, rather than any particular limitation, that makes each of the claims in the above-identified application allowable. No single limitation should be construed as the reason for allowance of a claim because it is each of the elements of the claim that makes it allowable.

The Examiner's Reasons for Allowance should not be attributed to Applicant as an indication of the basis for Applicant's belief that the claims are patentable. Furthermore, there may be additional reasons for patentability of the claimed subject matter, whether or not explicitly

stated in this record, and Applicant expressly reserves the right to make these and other arguments in the future.

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 CFR § 1.16; (2) any patent application and reexamination processing fees under 37 CFR § 1.17; and/or (3) any post issuance fees under 37 CFR § 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.

Dated this 7th day of May, 2024.

Respectfully submitted,

/Paul G. Johnson/ Reg. # 58539

PAUL G. JOHNSON
Registration No. 58539
Attorney for Applicant
Customer No. 97149
Telephone No. (435) 252-1360

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via the USPTO patent electronic filing system.

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

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

97149 7590 03/06/2024
Maschoff Brennan
1389 Center Drive, Ste. 300
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 the USPTO patent electronic filing system 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.
18/523,464	11/29/2023	Dean SOLON	S4079.10001US05	4515

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	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	06/06/2024

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 Paul G. Johnson
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, Tennessee

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)

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

☒ Electronic Payment via the USPTO patent electronic filing system ❑ 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
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.

❑ Applicant asserting small entity status. See 37 CFR 1.27
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.

❑ Applicant changing to regular undiscounted fee 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 /Paul G. Johnson, Reg. # 58,539/ Date May 7, 2024

Typed or printed name Paul G. Johnson Registration No. 58,539

PTOL-85 Part B (11/23) Approved for use through 03/31/2026 OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/523,464	**05/07/2024 06:55:15 PM Z ET**	**S4079.10001US05**

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 #	4515	FILED BY	JOLIN JOHNSON
PATENT CENTER #	65411046	FILING DATE	11/29/2023
CUSTOMER #	97149	FIRST NAMED INVENTOR	Dean SOLON
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Paul Johnson

Documents

TOTAL DOCUMENTS: 2

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
S4079.10001US05_2024-05-07_IssueFeeTransmittal.pdf	1	Issue Fee Payment (PTO-85B)	1822 KB
Warning: The attached file contains comments or annotations. Comments are not recommended and may cause processing problems with the document.			
S4079.10001US05_2024-05-07_CommentsonStatementofReasonsforAllowance.pdf	2	Post Allowance Communication - Incoming	122 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)

S4079.10001US05_2024-05-07_IssueFeeTransmittal.pdf	DAC50C085F2253C867EFC7AC3706E2FDF96CF0D6EE3D5BC267D32E32136FAEF6316D62D034F326D4878AB0F5F20B596330471444953F34B2AF2CDED0238A6082
S4079.10001US05_2024-05-07_CommentsonStatementofReasonsforAllowance.pdf	8AEDD0F05AD74CB23E275F03C2402B462DC77F59DBEFB97A6794C680B477B87B6253FA00510B41027787A535B99BD6A58137679C11DE1FA167A0D7796323AC9D

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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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
18/523,464	11/29/2023	Dean SOLON	S4079.10001US05

CONFIRMATION NO. 4515

97149
Maschoff Brennan
1389 Center Drive, Ste. 300
Suite 300
Park City, UT 84098

PUBLICATION NOTICE

OC000000070030644

Date Mailed: 03/22/2024

Title:LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

Publication No.US-2024-0097614-A1
Publication Date:03/21/2024

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.

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NOTICE OF ALLOWANCE AND FEE(S) DUE

97149 7590 03/06/2024

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

EXAMINER
CANNON, RYAN SMITH

ART UNIT	PAPER NUMBER
1726	

DATE MAILED: 03/06/2024

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/523,464	11/29/2023	Dean SOLON	S4079.10001US05	4515

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	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	06/06/2024

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.

PTOL-85 (Rev. 11/23)

PART B - FEE(S) TRANSMITTAL

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/523,464	11/29/2023	Dean SOLON	S4079.10001US05	4515

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	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	06/06/2024

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)

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

❑ Electronic Payment via the USPTO patent electronic filing system ❑ 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
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.

❑ Applicant asserting small entity status. See 37 CFR 1.27
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.

❑ Applicant changing to regular undiscounted fee 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
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/523,464	11/29/2023	Dean SOLON	S4079.10001US05	4515

97149 7590 03/06/2024

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

EXAMINER
CANNON, RYAN SMITH

ART UNIT	PAPER NUMBER
1726	

DATE MAILED: 03/06/2024

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

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

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

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

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

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

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

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. The United States Patent and Trademark Office (USPTO) collects the information in this record under authority of 35 U.S.C. 2. The USPTO's system of records is used to manage all applicant and owner information including name, citizenship, residence, post office address, and other information with respect to inventors and their legal representatives pertaining to the applicant's/ owner's activities in connection with the invention for which a patent is sought or has been granted. The applicable Privacy Act System of Records Notice for the information collected in this form is COMMERCE/PAT-TM-7 Patent Application Files, available in the Federal Register at 78 FR 19243 (March 29, 2013).
https://www.govinfo.gov/content/pkg/FR-2013-03-29/pdf/2013-07341.pdf

Routine uses of the information in this record may include disclosure to:

1) law enforcement, in the event that the system of records indicates a violation or potential violation of law;
2) a federal, state, local, or international agency, in response to its request;
3) a contractor of the USPTO having need for the information in order to perform a contract;
4) the Department of Justice for determination of whether the Freedom of Information Act (FOIA) requires disclosure of the record;
5) a Member of Congress submitting a request involving an individual to whom the record pertains, when the individual has requested the Member's assistance with respect to the subject matter of the record;
6) a court, magistrate, or administrative tribunal, in the course of presenting evidence, including disclosures to opposing counsel in the course of settlement negotiations;
7) the Administrator, General Services Administration (GSA), or their designee, during an inspection of records conducted by GSA under authority of 44 U.S.C. 2904 and 2906, in accordance with the GSA regulations and any other relevant (i.e., GSA or Commerce) directive, where such disclosure shall not be used to make determinations about individuals;
8) 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));
9) the Office of Personnel Management (OPM) for personnel research purposes; and
10) the Office of Management and Budget (OMB) for legislative coordination and clearance.

If you do not furnish the information requested on this form, the USPTO may not be able to process and/or examine your submission, which may result in termination of proceedings, abandonment of the application, and/or expiration of the patent.

Notice of Allowability	Application No. 18/523,464	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 amendment of 2/16/2024.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

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

3. ☑ The allowed claim(s) is/are 1-12 and 21-28 . 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 1/19/24.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☑ Interview Summary (PTO-413), Paper No./Mail Date. 20240228.
5. ☑ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☑ Other Email exchanges.

/RYAN S CANNON/
Primary Examiner, Art Unit 1726

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.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in an interview with Paul Johnson on 2/28/2024.

The application has been amended as follows:

In claim 1:

In line 11, please change "disposed about a region" to –disposed about and conforming to a region--.

In the final line, please change "electrical interconnection." to –electrical interconnection; and wherein, in the region of electrical interconnection, the first drop line and the second drop line extend in opposite directions along a longitudinal axis that is parallel to a longitudinal axis of the feeder cable.--.

In claim 22:

In line 9, please change "disposed about a region" to –disposed about and conforming to a region--.

In the final line, please change "1500 VDC." To –1500 VDC; wherein the drop line and the feeder cable extend parallel to one another within the region of electrical interconnection, and the mold structure has distinct openings through which the drop line and the feeder cable exit the mold structure.--.

In claim 27:

In the first line, please change "wherein:" to –wherein: the drop line comprises a first drop line and the drop line connector comprises a first drop line connector;--.

In line 8, please change "cable;" to –cable; the lead assembly further comprises a second drop line and a second drop line connector'--.

In claim 28:

In line 11, please change "wherein:" to –wherein: the drop line comprises a first drop line, the drop line connector comprises a first drop line connector, and the lead assembly further comprises a second drop line and a second drop line connector;--.

Reasons for Allowance

The following is an examiner's statement of reasons for allowance: JP2015-198508A, JP2014-050227A, US Patent 4,464,583, and US Patent 3,852,516 (of record) each teach some of the limitations claimed in claims 1 and 22; but no combination of references, alone or in combination with the art of record, teaches or suggests all of the limitations of those claims as currently amended. Therefore those claims, and the claims reciting the limitations of those claims, are clear, 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 PST.

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

Examiner-Initiated Interview Summary	**Application No.** 18/523,464	**Applicant(s)** SOLON, Dean		
	Examiner Ryan S Cannon	**Art Unit** 1726	**AIA (First Inventor to File) Status** Yes	**Page** 1 of 1

All Participants (applicant, applicants representative, PTO personnel)	**Title**	**Type**
Ryan S Cannon	Primary Examiner	Telephonic
Paul Johnson	Attorney	

Date of Interview: 28 February 2024

Issues Discussed:

Proposed Amendment(s)

Examiner Smith proposed amendments (attached as an appendix) to bring the case into condition for allowance. Mr. Johnson proposed alternative amendments, which are incorporated into the instant office action.

☑ Attachment

/RYAN S CANNON/ Primary Examiner, Art Unit 1726	

Applicant is reminded that a complete written statement as to the substance of the interview must be made of record in the application file. It is the applicants responsibility to provide the written statement, unless the interview was initiated by the Examiner and the Examiner has indicated that a written summary will be provided. See MPEP 713.04
Please further see:
MPEP 713.04
Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews, paragraph (b)
37 CFR § 1.2 Business to be transacted in writing

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

Notice of References Cited	Application/Control No. 18/523,464	Applicant(s)/Patent Under Reexamination SOLON, Dean	
	Examiner Ryan S Cannon	Art Unit 1726	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date YYYY-MM-DD	Name	CPC Classification	US Classification
*	A	US-3700786-A	1972-10-24	Lawrenson; Thomas	H01B7/08	174/72A
*	B	US-4464583-A	1984-08-07	Holmgren; Nils V.	H01B9/029	439/736
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date YYYY-MM-DD	Country	Name	CPC Classification
	N	JP-2014050227-A	2014-03-17	JP	FUJIMOTO T	
	O	JP-2015198508-A	2015-11-09	JP	SHINOHARA H	
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Machine translation of JP2014-050227A (Year: 2014)
	V	
	W	
	X	

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

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/523,464	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**

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/523,464	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
	18/523,464	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
MLTD search of prior art	1/8/2024	RSC
Updated inventor search	1/8/2024	RSC
Updated inventor search	1/23/2024	RSC
MLTD search of prior art	2/28/2024	RSC
Updated inventor search	2/28/2024	RSC

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/523,464	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
H02S40	30	2/24/2024	RsC
H01R9	03	2/24/2024	RSC
H01R4	70	2/24/2024	RSC

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/523,464	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)	20	
/RYAN S CANNON/ Primary Examiner, Art Unit 1726	28 February 2024	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	54

U.S. Patent and Trademark Office — Part of Paper No.: 20240228

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/523,464	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 (Assistant Examiner) (Date)	**Total Claims Allowed:** 20	
/RYAN S CANNON/ Primary Examiner, Art Unit 1726 (Primary Examiner) 28 February 2024 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 54

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/523,464	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

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	20	
/RYAN S CANNON/ Primary Examiner, Art Unit 1726	28 February 2024	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	54

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
N728	2962	h02s40/30.cpc. h01r9/03.cpc. h01r4/70.cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2024/02/28 08:55 PM
N729	5	N728 AND (drop ADJ line).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2024/02/28 08:56 PM
N730	5	N728 AND (feeder ADJ cable).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2024/02/28 08:57 PM

PE2E SEARCH - Search History (Similarity Search)

No Similarity Results available

(19)日本国特許庁(JP)　(12)公開特許公報(A)　(11)特許出願公開番号
特開2015-198508
(P2015-198508A)
(43)公開日　平成27年11月9日(2015.11.9)

(51)Int.Cl.		F I			テーマコード（参考）
H02S 40/36	(2014.01)	H02S	40/36		2E108
H02S 40/32	(2014.01)	H02S	40/32		5F151
E04D 13/18	(2014.01)	E04D	13/18	ETD	5H007
H02M 7/48	(2007.01)	H02M	7/48	R	
H02S 20/23	(2014.01)	H02S	20/23	A	

審査請求 未請求　請求項の数 12　ＯＬ　（全 21 頁）

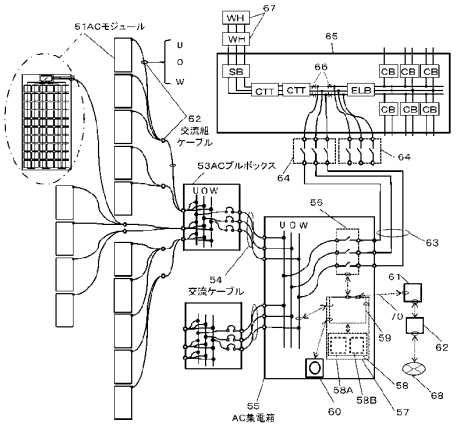
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(54)【発明の名称】太陽光発電装置

(57)【要約】
【課題】電力損失を抑え、施工性を高め、系統連系の安全性を確保し、さらにはメンテナンス性の向上を図った太陽光発電装置を得る。
【解決手段】太陽光発電装置は、交流電力を出力するＡＣモジュール５１と、ＡＣモジュール５１を相互に並列接続する交流組ケーブル５２を、屋根に複数設置する。屋根またはその近傍にＡＣプルボックス５３を設置し、複数の交流組ケーブル５２をＡＣプルボックス５３に接続する。家屋内に交流電力を集めるＡＣ集電箱５５を設置し、ＡＣプルボックス５３からＡＣ集電箱５５までを交流ケーブル５４で接続する。ＡＣモジュール５１は、屋根の水流れ方向に沿って取り付けられた固定レール４３によって屋根に固定する。固定レール４３上には交流組ケーブル５２を収納可能なダクト部４２を設ける。
【選択図】図１



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【特許請求の範囲】
【請求項１】
交流電力を出力するＡＣモジュールと、前記ＡＣモジュール相互を並列接続する交流組ケーブルと、交流電力を集めるＡＣ集電箱を有する太陽光発電装置において、
屋根に前記ＡＣモジュールおよび前記交流組ケーブルを複数設置し、
屋根またはその近傍にＡＣプルボックスを設置し、
前記ＡＣプルボックスに複数の前記交流組ケーブルを接続し、
前記ＡＣプルボックスから前記ＡＣ集電箱までを交流ケーブルで接続することを特徴とする太陽光発電装置。
【請求項２】
前記ＡＣプルボックス内に直流コンタクターを有することを特徴とする請求項１に記載の太陽光発電装置。
【請求項３】
屋根の水流れ方向に沿って前記ＡＣモジュールを屋根に固定するための固定レールを取り付け、
前記固定レールに近接して前記交流組ケーブルを収納可能なダクト部を設けることを特徴とする請求項１または２に記載の太陽光発電装置。
【請求項４】
前記ダクト部の上面部に開口部を形成し、前記開口部を覆うカバー部材を設けることを特徴とする請求項３に記載の太陽光発電装置。
【請求項５】
前記ＡＣモジュールは屋根材となるフレームと一体化された建材型ＡＣモジュールであることを特徴とする請求項３または４に記載の太陽光発電装置。
【請求項６】
前記交流組ケーブルに代替して、表面を絶縁樹脂で被覆した銅またはアルミニウム製の導体ブスバーを有することを特徴とする請求項１～５のいずれか１項に記載の太陽光発電装置。
【請求項７】
前記導体ブスバーに端子を介してケーブルを接続し、前記導体ブスバーと共に前記端子および前記ケーブルを絶縁樹脂で被覆することを特徴とする請求項６に記載の太陽光発電装置。
【請求項８】
前記ＡＣ集電箱に前記ＡＣモジュールの運転を制御する制御装置を設け、
前記制御装置は、
前記ＡＣモジュールの動作健全性を判定する判定部と、
前記判定部の判定結果に基づいて前記ＡＣモジュールに運転許可を与える運転許可部を有することを特徴とすることを特徴とする請求項１～７のいずれか１項に記載の太陽光発電装置。
【請求項９】
前記運転許可部は、前記判定部が健全に動作しないと判定した前記ＡＣモジュールを除外して前記ＡＣモジュールに運転許可を与えることを特徴とする請求項８に記載の太陽光発電装置。
【請求項１０】
前記ＡＣ集電箱および前記ＡＣプルボックスの少なくとも一方に、前記ＡＣモジュールへ非常停止指令を送信する非常停止ボタンを設けることを特徴とする請求項１～９のいずれか１項に記載の太陽光発電装置。
【請求項１１】
前記ＡＣ集電箱および前記ＡＣプルボックスの少なくとも一方に、前記ＡＣモジュールの動作状態を表示する表示装置を設けることを特徴とする請求項１～１０のいずれか１項に記載の太陽光発電装置。

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【請求項１２】
前記ＡＣモジュールに近接して前記ＡＣモジュールの動作状態を示す表示器を設けることを特徴とする請求項１～１１のいずれか１項に記載の太陽光発電装置。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明の実施形態は、交流出力のＡＣモジュールを用いた太陽光発電装置に関する。
【背景技術】
【０００２】
近年、電力系統に連系する分散電源として太陽光発電装置が多く設置されている。住宅に設置する太陽光発電装置は、複数の太陽電池セルから太陽電池モジュールを構成し、複数の太陽電池モジュールを直列及び並列に接続して住宅の屋根などに固定する。各太陽電池モジュールは直流電力を出力し、複数の太陽電池モジュールで出力した直流電力を合成する。
【０００３】
太陽電池モジュールを構成する太陽電池セルにおける直列回路についてはサブストリングと呼び、複数の太陽電池モジュールを直列に組み合わせたものをストリングと呼んでいる。ストリング間には逆流防止ダイオードを直列に接続し、複数のストリングを接続箱で並列に接続する。
【０００４】
接続箱にはプラス・マイナス２本の出力ケーブルを介して、系統連系用のパワーコンディショナーを接続する。パワーコンディショナーは太陽電池モジュールの直流電力を入力し、トランジスタースイッチング素子のオン・オフ動作を行うことにより直流電力を交流電力に変換して、交流電力を電力系統に連系する。
【０００５】
ところで、太陽光発電装置は、太陽電池モジュールに障害物の影が掛かると、影が掛かった太陽電池モジュールは発電しなくなってストリングの出力電圧が下がる。前述したように、ストリングは逆流防止ダイオードを接続しているので、影が掛かったストリングの電圧は、影が掛かっていないストリングの電圧に負けてしまい、影が掛かったストリングでは発電電力をパワーコンディショナーに出力することができなくなる。
【０００６】
また、各太陽電池モジュールのサブストリングに影がかかると、他のサブストリングからの電流が、太陽電池セルのマイナス極からプラス極に向かって強制的に流れる。したがって、影がかかったサブストリングでは内部抵抗が増え、電流を流し続けると、これらのサブストリングに含まれる太陽電池セルが発熱する。その結果、太陽電池セル周囲の樹脂材料が劣化し、太陽電池モジュールに故障が生じる可能性がある。
【０００７】
このような不都合を修正するために、直流電力ではなく交流電力を出力するＡＣモジュールを採用し、サブストリングにバイパス回路を設けた太陽光発電装置が提案されている（例えば、特許文献１など）。ＡＣモジュールとは、太陽電池モジュールの裏側または近傍にマイクロインバーターを固定したものである。
【０００８】
マイクロインバーターは、太陽電池モジュール１枚の発電出力に対応する、容量約２００Ｗ程度の小型インバーターであって、内部に直流電圧を調整する回路と、直流を交流に変換する回路を持つ。このようなマイクロインバーターの回路構成は３ｋＷ程度以上のパワーコンディショナーと同様である。
【０００９】
ここでＡＣモジュールについて、図１８、図１９を用いて説明する。図１８はＡＣモジュールの構成図である。図１８に示すＡＣモジュール１０は、複数の太陽電池セル２と、太陽電池セル２同士を直列に接続する太陽電池モジュールブスバー３とからなる。また、

太陽電池モジュール１は、裏側に端子箱５を固定し、この端子箱５にマイクロインバーターを組み込んでいる。端子箱５はバイパスダイオード４を収納すると共に、太陽電池出力ケーブル６を電気的且つ機械的に接続し、太陽電池モジュール１の裏側に固定している。太陽電池出力ケーブル６の端部には太陽電池出力ケーブル端子７を設けている。

【００１０】

図１９は端子箱５内の回路図である。図１９に示すように、太陽電池セル２の直列回路は３等分しており、３つのサブストリングを設けている。各サブストリングは、それぞれ太陽電池モジュールブスバー３を通して入力端子８に接続し、バイパスダイオード４と出力端子９を接続する。３つのサブストリングの内、いずれか１つのサブストリングまたは２つのサブストリングが影の影響で電圧を出さなくなった場合、電圧を出さなくなったサブストリングを、バイパスする位置に接続されるバイパスダイオード４が導通する。

【００１１】

このようにしてバイパスダイオード４が電圧を出さなくなったサブストリングをバイパスするので、１つのサブストリングが影の影響で電圧を出さなくなって太陽電池セル２全体の直流出力電圧が三分の二に下がる、あるいは、２つのサブストリングが影の影響で電圧を出さなくなって太陽電池セル２全体の直流出力電圧が三分の一に下がったとしても、ＡＣモジュール１０は交流電力を出力することができる。また、バイパスダイオード４の働きにより、影が掛かったサブストリングに他のサブストリングから電流が流れることがないので、影が掛かったサブストリングに含まれる太陽電池セル２は発熱することがなく、樹脂材料が劣化してＡＣモジュール１０が故障する心配がない。

【先行技術文献】

【特許文献】

【００１２】

【特許文献１】特開２００６－４１４４０号公報

【発明の概要】

【発明が解決しようとする課題】

【００１３】

一般的に、ＡＣモジュールは、相互間をケーブルで並列接続した上で屋根の上に固定するが、屋根の上でのＡＣモジュールの設置位置は、屋根の向きや大きさに応じて家屋毎に異なる。そのため、ケーブルの段数や長さはＡＣモジュールの設置位置に応じて選択、手配する必要がある。特に、ケーブルの長さは屋根に応じて大きく変わることが多い。

【００１４】

したがって、決められた長さを持つ規格品の中から実際に配線するケーブルを選択するのが現実的である。しかし、規格品の中から実際に使用するケーブルを選ぶとなると、長さが足りなくてはケーブルとして意味をなさないので、長めのケーブルを選ぶほか無く、ケーブルの余長分が発生せざるを得ない。

【００１５】

このため、ケーブルの余長分が生じた分だけ、無駄な電力損失が発生するといった問題が生じる。また、ケーブルの余長分が生じることで、余長分を置くスペースを確保しなくてはならない。したがって、ＡＣモジュールの設置工事を実施する際に、ケーブルの余長分が邪魔になり、ＡＣモジュールの設置工事がやり難くなるといった不具合が生じる。

【００１６】

さらに、ＡＣモジュールを屋根に固定する場合に、ＡＣモジュール自体に直接、固定用の穴などを開けるのではなく、固定レールを屋根の水流れ方向に沿って屋根の野路板とルーフィング材の真上に固定し、この固定レールにＡＣモジュールを取り付けている。そのため、ＡＣモジュールから引き出したケーブルの配線工事に際して、任意の位置で固定レールを横切って水平方向にケーブルを渡そうとしても、固定レールがあるので、これを跨ぐようにしてしか、ケーブルを配線することができない。その結果、ケーブルの配線構成の自由度が少なくなり、この観点からもＡＣモジュールの設置工事の施工性の改善が求められている。

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【００１７】
交流出力のＡＣモジュールは、１枚単位での設置が可能であり、設置場所も選ばないので増設が容易である。したがって、ＡＣモジュールの設置工事が面倒となってしまっては、これらのメリットが活かされなくなる。そこで従来から、ＡＣモジュールを用いた太陽光発電装置では、施工性の向上が急務となっている。
【００１８】
さらに、分散電源に注目が集まる現在、太陽光発電装置に対するニーズは多様化しており、そのレベルも高くなっている。そのため、太陽光発電装置においては系統連系の安全性やメンテナンス性をより高めることが期待されている。
【００１９】
本発明に係る実施形態は、以上の課題を解消するために提案されたものであり、交流出力のＡＣモジュールを備えた太陽光発電装置において、電力損失を抑え、施工性を高め、系統連系の安全性を確保し、さらにはメンテナンス性の向上を図った太陽光発電装置を得ることを目的とするものである。
【課題を解決するための手段】
【００２０】
上記目的を達成するために、本発明の実施形態は、交流電力を出力するＡＣモジュールと、前記ＡＣモジュール相互を並列接続する交流組ケーブルと、交流電力を集めるＡＣ集電箱を有する太陽光発電装置において、次の構成要素（１）~（４）を有することを特徴とする。
（１）屋根に前記ＡＣモジュールおよび前記交流組ケーブルを複数設置する。
（２）屋根またはその近傍にＡＣプルボックスを設置する。
（３）前記ＡＣプルボックスに複数の前記交流組ケーブルを接続する。
（４）前記ＡＣプルボックスから前記ＡＣ集電箱までを交流ケーブルで接続する。
【図面の簡単な説明】
【００２１】
【図１】第１の実施形態の構成全体のブロック図。
【図２】第１の実施形態におけるＡＣモジュールからＡＣ集電箱までの接続構成を示すブロック図。
【図３】第１の実施形態におけるＡＣモジュールの平面図。
【図４】第１の実施形態におけるＡＣモジュールの運転許可条件の例を示す図。
【図５】第１の実施形態におけるＡＣモジュールの回路図。
【図６】（Ａ）は第１の実施形態においてＡＣモジュールを屋根に固定した際の水流れ方向の断面図、（Ｂ）は第１の実施形態においてＡＣモジュールを屋根に固定した際の平面図。
【図７】（Ａ）は第２の実施形態においてＡＣモジュールを屋根に固定した際の水流れ方向の断面図、（Ｂ）は第２の実施形態においてＡＣモジュールを屋根に固定した際の平面図。
【図８】（Ａ）は第３の実施形態においてＡＣモジュールを屋根に固定した際の水流れ方向の断面図、（Ｂ）は第３の実施形態においてＡＣモジュールを屋根に固定した際の平面図。
【図９】他の実施形態における導体ブスバーの斜視図。
【図１０】他の実施形態における導体ブスバーの平面図。
【図１１】他の実施形態におけるＡＣモジュールの回路図。
【図１２】他の実施形態におけるＡＣモジュールの回路図。
【図１３】他の実施形態におけるＡＣモジュールの回路図。
【図１４】他の実施形態におけるＡＣモジュールの回路図。
【図１５】他の実施形態におけるＡＣモジュールの回路図。
【図１６】他の実施形態におけるＡＣモジュールの回路図。
【図１７】他の実施形態におけるＡＣモジュールの回路図。

【図１８】従来のＡＣモジュールの平面図。
【図１９】従来のＡＣモジュールの回路図。
【発明を実施するための形態】
【００２２】
以下、本発明に係る太陽光発電装置の実施形態について、図面を参照して具体的に説明する。下記の実施形態はいずれも、ＡＣモジュールを用いた太陽光発電装置である。そのため、図１８および図１９に示した従来技術と同一の構成要素については、同一符号を付して説明は省略する。
【００２３】
[第１の実施形態]
図１～図６を用いて第１の実施形態を説明する。
[構成]
図１は第１の実施形態の全体構成を示すブロック図、図２はＡＣモジュールからＡＣ集電箱までの接続構成を示すブロック図であり、ＡＣモジュールを低圧の配電線に接続する構成例を示している。
【００２４】
図１、図２に示すように、第１の実施形態は、複数のＡＣモジュール５１（一点鎖線内は拡大図）と、複数の交流組ケーブル５２と、ＡＣプルボックス５３と、ＡＣ集電箱５５を有している。ＡＣモジュール５１および交流組ケーブル５２は屋根に設置し、ＡＣ集電箱５５は家屋内に設置する。ＡＣ集電箱５５には住宅用分電盤６５を接続して電力系統に連系している。
【００２５】
（ＡＣモジュール）
ＡＣモジュール５１は、電圧１００Ｖ／２００Ｖの単相三線式の電気方式であり、交流電力を出力する。単相三線の各相はＵ、Ｏ、Ｗとし、Ｏを中性線とすると、ＵＯ間が交流１００Ｖ、ＷＯ間が交流１００Ｖ、ＵＷ間が２００Ｖである。また、ＡＣモジュール５１は、個別に故障監視を行い、その監視結果をＡＣ集電箱５５へ送信するようになっている。なお、ＡＣモジュール５１の回路構成および交流組ケーブルとの接続構造に関連するＡＣモジュールの構成については、後段で述べる。
【００２６】
また、図３に示すように、ＡＣモジュール５１の表面側の一つの角部分付近（図３では右上の角部分付近）には、ＡＣモジュール５１の縦寸法の約十五分の一程度の長さを持つ発光表示器６９を１つ取り付けている。発光表示器６９は、ＡＣモジュール５１が故障中であることを示す発光色と、ＡＣモジュール５１が健全に動作していることを示す発光色とを、別々の色で発光させ、ＡＣモジュール５１の動作状態を目視で判別できるようになっている。
【００２７】
（交流組ケーブル）
交流組ケーブル５２は、ＡＣモジュール５１を相互に並列接続するケーブルである。交流組ケーブル５２は、ＡＣモジュール５１から電力を集めるために、Ｕ同士、Ｏ同士、Ｗ同士をそれぞれ接続する。交流組ケーブル５２は、流す電流の大きさと排熱による温度上昇を考慮した太さの導体を持つ集電幹線を含んでいる。
【００２８】
（ＡＣプルボックス）
ＡＣプルボックス５３は、屋根またはその近傍に設置する。ＡＣプルボックス５３はコネクター２７、２９を介して複数の交流組ケーブル５２を一括して接続し、単相三線すなわちＵ、Ｏ、Ｗの三本の交流ケーブル５４に集約して出力する。交流ケーブル５４は、ＡＣプルボックス５３からＡＣ集電箱５５までを接続する。
【００２９】
(ＡＣモジュールからＡＣ集電箱までの接続構成)

このように、ＡＣモジュール５１の交流出力は、交流組ケーブル５２を介してＡＣプルボックス５３に集まり、その後、交流ケーブル５４を介して最終的にＡＣ集電箱５５に入ることになる。

【００３０】

ここで、ＡＣモジュール５１からＡＣ集電箱５５までの電気的な接続構成について、図２に従って説明する。図２の左端にＵ、Ｏ、Ｗと記載した部分は、それぞれコネクター２５であり、ＡＣモジュール５１からの交流組ケーブル５２と接続する。コネクター２５は、Ｕ、Ｏ、Ｗの３極であり、Ｏ極は接地電位である。

【００３１】

図２に示すように、交流組ケーブル５２は、コネクター２７によって分けられ、２段の交流組ケーブル５２ａ、５２ｂからなる。交流組ケーブル５２ａは３枚のＡＣモジュール５１の交流出力を集め、交流組ケーブル５２ａはコネクター２７を介して交流組ケーブル５２ｂに接続する。

【００３２】

交流組ケーブル５２ｂは９枚分のＡＣモジュール５１の交流出力を集め、コネクター２９を介してＡＣプルボックス５３に接続する。ＡＣプルボックス５３には端子台３１を、ＡＣ集電箱５５には端子台３３を、それぞれ配置し、交流ケーブル５４にて端子台３１、３３を接続する。なお、コネクター２５、２７、２９はそれぞれ、交流単相三線の各極が正しく配線されるように、色分けがなされるか、またはコネクター形状が異なっている。

【００３３】

つまり、本実施形態では、１枚のＡＣモジュール５１が出力する交流電力は、コネクター２７で９枚のＡＣモジュール５１の出力となり、さらにコネクター２９で２７枚分のＡＣモジュール５１の出力となって、最終的に、３つのコネクター２９を持つＡＣプルボックス５３で、８１枚分のＡＣモジュール５１の出力となる。

【００３４】

(ＡＣ集電箱)

図１に戻って、ＡＣ集電箱５５の構成について説明する。ＡＣ集電箱５５は、外部から操作可能な位置に非常停止ボタン６０を設けている。非常停止ボタン６０とは、連系コンタクター５６を解列すると共に、全てのＡＣモジュール５１へ非常停止指令を送信するボタンであって、設置数は適宜自由である。

【００３５】

またＡＣ集電箱５５は、連系コンタクター５６および制御装置５７を収納する。連系コンタクター５６は、電力配電線系統との連系点スイッチとして機能する。連系コンタクター５６は、出力する交流電力を、交流ケーブル６３および分散電源用ブレーカー６４を介して住宅用分電盤６５に送る。

【００３６】

(制御装置)

制御装置５７は、系統連系のための連系点スイッチの解列と投入を行い、交流ケーブル５４および交流組ケーブル５２を介して全てのＡＣモジュール５１と通信を行う装置である。また、制御装置５７は、いずれかのＡＣモジュール５１との通信ができない状態となった場合、有線または無線による別の通信系によって、ＡＣモジュール５１の内部情報を取り出し、後述する表示操作装置６１に、その時点での状況を表示する。さらに、制御装置５７は、通信が故障したＡＣモジュール５１を除外して、健全なＡＣモジュール５１の運転を再開する。

【００３７】

制御装置５７は、演算制御部５８を有しており、演算制御部５８には判定部５８Ａと、運転許可部５８Ｂを持つ。前述したようにＡＣモジュール５１は個別に故障監視を行って監視結果を制御装置５７に送信するが(段落００２５に記載)、判定部５８Ａは、ＡＣモジュール５１から監視結果を受け取り、ＡＣモジュール５１の動作健全性を判定する。運転許可部５８Ｂは、判定部５８Ａの判定結果に基づいてＡＣモジュール５１に運転許可を

与える。
【００３８】
運転許可部５８Ｂは、判定部５８Ａの判定結果が次の（１）~（５）のＡＮＤ条件であるとき、ＡＣモジュール５１に運転許可を与える（図４参照）。
（１）ＡＣモジュール５１の全数が異常なしであること。
（２）ＡＣモジュール５１の全数の通信が異常なしであること。
（３）ＡＣモジュール５１の全数が系統連系保護動作なしであること。
（４）上位サーバーから制御装置５７に停止指令がないこと。
（５）非常停止ボタン６０が全てＯＦＦであること。
【００３９】
また、ＡＣモジュール５１の故障監視の結果を受けた判定部５８Ａが、ＡＣモジュール５１に故障が発生したと判定した場合、運転許可部５８Ｂは、そのＡＣモジュール５１に運転許可を与えず、これを除外して他のＡＣモジュール５１に運転許可を与える。このとき、制御装置５７は運転不許可のＡＣモジュール５１に対し停止指令を送信する。また、制御装置５７は、通信入出力装置５９を有している。通信入出力装置５９は、通信ケーブル７０を介して表示操作装置６１と接続する。
【００４０】
（表示操作装置）
表示操作装置６１は、ネットワーク接続装置６２を介して上位インターネット６８と接続している。表示操作装置６１は、各ＡＣモジュール５１の動作状況や故障状況、故障したＡＣモジュール５１の屋根における位置、系統の状態などを表示し、整定値などの変更操作などを行う。
【００４１】
表示操作装置６１の表示画面内容としては、例えば、
（１）系統連系保護動作項目
（２）系統連系保護整定値
（３）発電電力
（４）発電電力量
（５）電圧上昇抑制動作中
（６）電圧上昇抑制動作時間
（７）操作端末タブレットの通信状況
（８）上位インターネット６８の通信状況
（９）ソフトウェアバージョン情報
（１０）非常停止ボタン６０発報
（１１）故障したＡＣモジュール５１の位置などがある。
【００４２】
また、操作画面内容としては、例えば、
（１）系統連系保護整定値の変更・確定
（２）電圧上昇抑制整定値の変更・確定
（３）その他設定項目の変更・確定などがある。
【００４３】
(住宅用分電盤)
次に住宅用分電盤６５の構成について説明する。住宅用分電盤６５は、電流検出器６６、漏電遮断器ＥＬＢ、負荷開閉器ＣＢ、安全のために２直列にしたコンタクターＣＴＴ、契約用電流制限器ＳＢを設けている。
【００４４】
このうち、電流検出器６６は、電力配電線系統への逆潮流電力を計測し、または逆潮流が電力会社との契約上行えない分散電源からの逆潮流が起こらないように分散電源を制御する。ＡＣモジュール５１から出力される交流電力は、住宅用分電盤６５の負荷開閉器ＣＢを介して住宅内の負荷機器に接続する。契約用電流制限器ＳＢには電力量計６７を接続

し、住宅用分電盤６５は電力量計６７を介して電力配電線に接続、連系を行う。

【００４５】

(ＡＣモジュールの回路構成)

続いて、ＡＣモジュール５１の回路構成について図５を用いて説明する。図５はＡＣモジュール５１に固定されたマイクロインバーターの回路図の一例であって、太陽電池モジュール１の３つのサブストリング別に個別に、直流／交流変換する回路を構成した例である。

【００４６】

図５において、マイクロインバーターは、入力コンデンサー１１、リアクトル１２、スイッチング素子１３、ダイオード１４、コンデンサー１５、スイッチング素子１６、リアクトル１７、入力コンデンサー１８、障害ノイズ除去フィルター１９、サージ電圧除去素子２０および図示されていない制御回路で構成される。

【００４７】

ＡＣモジュール５１は、スイッチング素子１３を高速にＯＮ、ＯＦＦすると、リアクトル１２の電流が高速に断続するので両端に逆起電圧が発生し、この電圧がダイオード１４を介してコンデンサー１５を充電する。コンデンサー１５に充電された直流電圧をスイッチング素子１６で交流波形に変換し、リアクトル１７、コンデンサー１８で高調波を除去し、障害ノイズ除去フィルター１９およびサージ電圧除去素子２０の回路を経て交流電力を出力する。

【００４８】

(ＡＣモジュールと交流組ケーブルとの接続構造)

次に、ＡＣモジュールと交流組ケーブルとの接続構造について、図６を用いて説明する。図６に示すように、ＡＣモジュール５１は、その周囲に屋根材となる太陽電池フレーム３５を一体的に取り付けている。

【００４９】

ＡＣモジュール５１は、屋根材とＡＣモジュール機能を兼ねており、屋根材として用いることが可能な耐火性を持った建材型ＡＣモジュールである。ＡＣモジュール５１の上部には太陽電池表面ガラス３６を設置する。太陽電池表面ガラス３６は太陽電池セル（図４には不図示）を固定している。

【００５０】

太陽電池表面ガラス３６の背面側にはインバーター箱３７を固定する。このインバーター箱３７内に図５に示した回路構成を持つマイクロインバーターを組み込んでいる。インバーター箱３７には出力ケーブル３８を接続し、その端部には端子３９を設ける。この端子３９には集電ケーブル４０が接続されるようになっている。集電ケーブル４０は交流組ケーブル５２から延びている。

【００５１】

また、ＡＣモジュール５１は太陽電池フレーム３５の側面部に略Ｌ字状の嵌合部３５ｂを形成する。左右に隣接する太陽電池フレーム３５同士の間隙には固定レール４３を配置する。固定レール４３とは、ＡＣモジュール５１を屋根の野地板４１に固定するための部材であり、屋根の水流れ方向に沿って屋根の野路板４１の直上に設置する。この固定レール４３に対して左右から、太陽電池フレーム３５の嵌合部３５ｂを嵌め込むようになっている。

【００５２】

固定レール４３の上方にはダクト部４２を配置する。ダクト部４２は上部に開口部を形成し、交流組ケーブル５２を収納するためのスペースを有している。ダクト部４２および太陽電池フレーム３５の側面には集電ケーブル４０を通すための貫通穴４２ａおよび３５ａを形成している。

【００５３】

以上のような第１の実施形態では、交流組ケーブル５２をダクト部４２に収納しておき、交流組ケーブル５２から延びる集電ケーブル４０を、ダクト部４２側の貫通穴４２ａお

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よび太陽電池フレーム３５側の貫通穴３５ａから、ダクト部４２の外方に通す。そして、ダクト部４２から外に出した集電ケーブル４０を、端子３９に接続することでＡＣモジュール５１相互を並列に接続する。その後、太陽電池フレーム３５の嵌合部３５ｂを固定レール４３にはめ込み、この状態で固定ねじ４４によって固定レール４３を屋根の野地板４１に固定する。

【００５４】

さらに、ダクト部４２を固定レール４３上部に乗せ、固定ねじ４５にてダクト部４２を固定レール４３に固定する。このとき、固定ねじ４５は、太陽電池フレーム３５の嵌合部３５ｂおよび固定レール４３を貫通することで、ダクト部４２、太陽電池フレーム３５および固定レール４３を屋根の野地板４１に固定する。最後にダクト部４２の上部に、カバー部材としてふた４６をはめ込む。

【００５５】

上述したように、第１の実施形態では、まずダクト部４２に交流組ケーブル５２を収納し、交流組ケーブル５２を、集電ケーブル４０および端子３９を介してインバーター箱３７に接続し、その後、固定レール４３と共に太陽電池フレーム３５の嵌合部３５ｂおよびダクト部４２を野地板４１に固定する。これによって太陽電池フレーム３５に一体的に取り付けられたＡＣモジュール５１を、屋根に固定している。

【００５６】

[作用]

以上の構成を有する第１の実施形態では、ＡＣモジュール５１の交流電力が電力系統の交流電圧波形に同期して系統連系運転を行うことが可能である。また、ＡＣモジュール５１の交流電力は、外部または内部にある自走発振器からの信号によりＡＣモジュール５１相互の出力電圧の位相を互いに同期させて自立運転を行うことも可能である。

【００５７】

このようなＡＣモジュール５１において、太陽電池セル２の直列回路から３個のバイパスダイオード４の両端に印可される電圧は、バイパスダイオード４で個別に並列に接続されるインバーター回路で、交流電圧に変換して商用交流波形を生成する。この構成を用いると、太陽電池モジュール１内の太陽電池セル２の直列回路を、３つのサブストリングに分割し、各サブストリングの直流出力電力を、それぞれ交流電力に変換してから合成し、ＡＣモジュール５１から交流出力電力を得る。

【００５８】

[効果]

（１）発電効率の向上

以上のような第１の実施形態によれば、太陽電池モジュール１内のサブストリング単位で最大電力追従を行うことができる。したがって、ＡＣモジュール５１では、たとえサブストリングに影が掛かったとしても、サブストリング単位で最大電力追従を行うことで、直流から交流への変換に必要な下限値まで、直流電圧が低下し難くなる。その結果、直流を交流に変換するインバーター回路が動作不能に陥る可能性が低くなる。

【００５９】

上記のＡＣモジュール５１では、たとえ大きな影が掛かったとしても、その影響を極力抑えることができ、発電効率の向上を図ることができる。しかも、次の段で述べるように余長ケーブルが発生しないので、電力損失の発生を回避することができ、この点らも発電効率も良好となる。

【００６０】

ＡＣモジュール５１のメリットは、単独で商用電力系統に連系可能なので一部が故障した場合に健全なＡＣモジュール５１だけを電源として利用できる点にある。したがって、電力損失を極力抑えた本実施形態では動作可能なＡＣモジュールが１枚だけとなっても、十分な発電量を得ることが可能となり、先のメリットを十分に引き出すことができる。

【００６１】

（２）施工性の向上

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また、本実施形態では、図２に示したように、ＡＣプルボックス５３に対しコネクター２７、２９を介して２段の交流組ケーブル５２ａ、５２ｂを接続するので、ＡＣプルボックス５３に交流組ケーブル５２ｂが近づくほど、通電電流が大きくなり、ケーブルの断面サイズが増えることになる。

【００６２】

本実施形態では、複数の交流組ケーブル５２を一括して接続するＡＣプルボックス５３を、必ず屋根またはその付近に設置するので、このＡＣプルボックス５３の位置を基準にし、交流組ケーブル５２の接続順序や、ＡＣモジュール５１の設置位置について、効率よく計画することができる。

【００６３】

したがって、屋根におけるＡＣモジュール５１の設置位置に応じて、交流組ケーブル５２の段数や長さを事前に決め易くなり、交流組ケーブル５２の長さの選択や手配が簡便になる。そのため、ダクト部４２に収納される交流組ケーブル５２の長さや段数は、固定レール４３の設定と同時に、予め決めておくことができ、ケーブルの余長分を発生させることはない。これにより、余長分の置き場所は不要となって、経済的にもスペース的にも効率がよくなり、ＡＣモジュール５１の設置工事の施工性を高めることができる。

【００６４】

しかも、第１の実施形態では、ダクト部４２内に交流組ケーブル５２を収納するため、任意の位置でダクト部４２内から交流組ケーブル５２を水平方向に延ばそうとする場合、野路板４１に固定した固定レール４３が、交流組ケーブル５２にぶつかることがなく、交流組ケーブル５２を水平方向に渡すことが可能である。したがって、交流組ケーブル５２の配線構成の自由度は格段に高くなり、ＡＣモジュールの設置工事の施工性は大幅に向上する。

【００６５】

（３）メンテナンス性の向上

また、第１の実施形態においては、ふた４６を外せば、ダクト部４２内に収納された交流組ケーブル５２がすぐに現れるので、交流組ケーブル５２のメンテナンス作業は容易である。さらに、固定ねじ４５を外すことで固定レール４３からダクト部４２および太陽電池フレーム３５を取り外し、交流組ケーブル５２の集電ケーブル４０を端子３９から外すことで、ＡＣモジュール５１を屋根から取り外すことも可能である。このとき、固定レール４３は固定ねじ４４によって屋根に取り付けられたままなので、ＡＣモジュール５１を再度取り付ける時も作業が容易であり、作業効率を高めることができる。

【００６６】

また、第１の実施形態においては、制御装置５７に接続した表示操作装置６１が、ＡＣモジュール５１の故障状況や、故障したＡＣモジュール５１の屋根における位置を表示するので、この表示を見た作業員は、屋根から外して確認すべきＡＣモジュール５１について、交換部品や工具など十分な準備を整えてから、実際に屋根に上ることができる。

【００６７】

さらには、ＡＣモジュール５１の表面側に取り付けた発光表示器６９が、ＡＣモジュール５１が故障中であることを示す発光色と、ＡＣモジュール５１が健全に動作中であることを示す発光色とを、別々の色で発光している。そのため、屋根に上がった作業員は発光表示器６９の発光色を見ただけで、ＡＣモジュール５１の動作状態を目視で簡単に判別することができる。したがって、作業員は、確認すべきＡＣモジュール５１を即座に見つけることができ、迅速にメンテナンス作業を実施することができる。

【００６８】

（５）操作性の向上

さらに、表示操作装置６１は上位インターネット６８に接続可能なので、上位のサーバーに運転情報を送る、或いは、上位のサーバーから運転および表示ソフトウエアのダウンロードを行って更新することも可能であり、使い勝手が良い。

【００６９】

（６）安全性の向上
第１の実施形態では、ＡＣ集電箱５５の外部から操作可能な位置に非常停止ボタン６０を設けたので、これを操作することで、非常時に際しては、連系コンタクター５６を解列して系統連系保護を図ると同時に、全ＡＣモジュール５１を即座に停止させることができる。したがって、火災などが起きて消防士が屋根から家屋に侵入しようとする場合でも、発電動作中のＡＣモジュール５１に感電するおそれがなく、緊急時の安全性を確保することができる。
【００７０】
[第２の実施形態]
[構成]
図７を用いて第２の実施形態を説明する。第２の実施形態は、上記第１の実施形態と同様の構成を有しており、交流組ケーブル５２に代替して、導体ブスバー７１を用いることに特徴がある。導体ブスバー７１は、表面を絶縁樹脂で被覆した銅またはアルミニウム製の部材である。この導体ブスバー７１に集電ケーブル４０が接続されている。
【００７１】
なお、図６に示した第１の実施形態では、固定ねじ４５が固定レール４３を貫通して屋根の野路板４１まで達している状態を示しているが、図７に示した第２の実施形態では、固定ねじ４５は野路板４１まで到達することなく、ダクト部４２および太陽電池フレーム３５を固定レール４３にだけ固定した構成である。
【００７２】
[作用および効果]
以上のような第２の実施形態では、導体ブスバー７１を用いることにより、ＡＣモジュール５１と交流組ケーブル５２との配線接続配作業に比べて、配線接続作業をより簡略化することができ、施工性がいっそう向上する。
【００７３】
[第３の実施形態]
[構成]
図８を参照して第３の実施形態を説明する。第３の実施形態は、導体ブスバー７１を用いる点は前記第２の実施形態と同様であるが、ダクト部４２の配置位置に特徴がある。すなわち、第３の実施形態では、ダクト部４２を固定レール４３の上方ではなく下方に配置する。このため、ダクト部４２は屋根の野地板４１の上部に位置する。なお、ダクト部４２および太陽電池フレーム３５の側面に集電ケーブル４０を通すための貫通穴４２ａおよび３５ａを形成する点は、図６に示した第１の実施形態と同様である。
【００７４】
第３の実施形態においては、ダクト部４２内に一対の導体ブスバー７１を収納してからダクト部４２を屋根の野地板４１上に配置し、導体ブスバー７１から延びる集電ケーブル４０を、ダクト部４２側の貫通穴４２ａおよび太陽電池フレーム３５側の貫通穴３５ａから、ダクト部４２の外に出す。そして、ダクト部４２の外に出した集電ケーブル４０を端子３９に接続することでＡＣモジュール５１相互を配線接続する。
【００７５】
その後、固定レール４３をダクト部４２の上に乗せ、太陽電池フレーム３５の嵌合部３５ｂを固定レール４３にはめ込み、この状態で固定ねじ４４により固定レール４３を屋根の野地板４１に固定する。さらに、ダクト部４２の上部に固定レール４３を乗せ、固定ねじ４５にて太陽電池フレーム３５を固定レール４３に固定する。最後にふた４６を挟み込んで固定する。
【００７６】
[作用および効果]
以上の第３の実施形態では、ダクト部４２を固定レール４３の上方ではなく下方に配置し、ここに導体ブスバー７１を収納するので、導体ブスバー７１に対して固定レール４３やふた４６がカバーとなって、ダクト部４２内の導体ブスバー７１付近に雨水などが浸入

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するおそれがない。したがって、優れた安全性を得ることができる。

【００７７】

［他の実施形態］

なお、上記の実施形態は、本明細書において一例として提示したものであって、発明の範囲を限定することを意図するものではない。すなわち、その他の様々な形態で実施されることが可能であり、発明の範囲を逸脱しない範囲で、種々の省略や置き換え、変更を行うことが可能である。これらの実施形態やその変形例は、発明の範囲や要旨に含まれると同様に、特許請求の範囲に記載された発明とその均等の範囲に含まれるものであって、以下のような他の実施形態を包含する。

【００７８】

（１）図９に示す導体ブスバー７２では、被覆の一部を除去した部分で、端子４８を介して集電ケーブル４９と電気接触して、ねじで固定している。

（２）図１０に示す導体ブスバー７３では、ブスバー状の集電幹線７３ａに集電ケーブル４０と端子３９を電気的に接続し、その全体を絶縁被覆５０で被覆している。

これらの実施形態では、ＡＣモジュール５１と導体ブスバー７２、７３との接続構造を、より簡略化することができ、更なる施工性の向上が望める。

【００７９】

（３）連系コンタクターや非常停止ボタンの設置数や設置箇所は適宜選択可能である。例えば、ＡＣプルボックス５３内に連系コンタクターや非常停止ボタンを設けてもよい。また、ＡＣプルボックス５３内にＡＣモジュール５１の動作を停止させるために直流コンタクターを設置することも可能である。これにより、屋根付近の作業員がＡＣプルボックス５３からＡＣモジュール５１を制御することができ、作業員の作業効率が向上する。

【００８０】

（４）ＡＣモジュール５１は建材型ＡＣモジュールとしたが、屋根材とは別部材からなるＡＣモジュールであってもよい。

（５）交流組ケーブル５２あるいは導体ブスバー７２、７３の段数は適宜変更可能であり、３段以上にして電力を集めてもよい。

【００８１】

（６）ＡＣプルボックス５３が受電するコネクターは１組でなく、複数組とし、複数組の交流組ケーブル５２を接続することも可能である。

（７）ＡＣモジュール５１を屋根に固定するための固定レールと、交流組ケーブル５２あるいは導体ブスバー７２、７３を収納するダクト部４２とは、一体的であってもよく、その配置方向は屋根の水流れ方向に限らず、水流れ方向と直交する方向であってもよい。

（８）ダクト部４２の上部に設けた開口部を塞ぐ部材としては、ふたに限らず、テープであってもよい。

【００８２】

（９）さらにＡＣモジュール５１の他の回路構成としては次のようなものが含まれる。

（９－ａ）

上記の図５に示したＡＣモジュール５１の回路は、直流電圧を昇圧した後に交流に変換するが、太陽電池モジュール１の直流側とマイクロインバーター出力の交流側の絶縁を持たない「非絶縁回路」である。これに対して、太陽電池モジュール１の直流側と、マイクロインバーター出力の交流側を絶縁する「絶縁回路」とすることも可能である。

【００８３】

例えば、図１１の回路例では、高周波絶縁変圧器２３を使ったサブストリング型マイクロインバーターを示している。図１１の回路構成を持つＡＣモジュール５１においては、コンデンサー１１に充電した電圧を、スイッチング素子１３で高周波電圧に変換し、この高周波電圧を、高周波絶縁変圧器２３を介して昇圧する。そして、昇圧した高周波電圧をダイオード２１で整流して直流に変換し、スイッチング素子１６で商用交流波形に変換する。

【００８４】

このような回路構成によれば、太陽電池モジュール１内の太陽電池セル２の回路と、交流回路とを絶縁することができる。そのため、交流回路への直流流出を原理的に無くすことができる。しかも、高周波絶縁変圧器２３の一次巻き線と二次巻き線の巻き数比を選択することが可能となる。したがって、マイクロインバーターと太陽電池モジュール１の組合せの自由度を上げることができる。

【００８５】

（９－ｂ）

高周波絶縁変圧器を用いるサブストリング型マイクロインバーターの回路には通常、ＭＯＳＦＥＴトランジスターに逆接続ダイオードが内蔵されている。そこで、この内蔵された逆接続ダイオードを、太陽電池モジュール１のバイパスダイオード４として用いることも可能である（図１２の回路図参照）。

【００８６】

つまり、このような回路構成とすることによって、太陽電池モジュール１に従来必要であったバイパスダイオード４を、サブストリング型マイクロインバーターのスイッチングトランジスタの逆接続ダイオードの機能で代替することができる。バイパスダイオード４は、電流が流れると、ダイオードの導通損失で決まる電流損失を生じて発熱し、長期の使用後に劣化の可能性がある。また、太陽電池モジュール１の出力電流がダイオードを通過する時の電圧降下分によって出力電圧が下がり、結果的に太陽電池モジュールの出力電力の損失が起こるおそれがある。

【００８７】

これに対して、従来のバイパスダイオード４を無くした回路構成を持つ実施形態によれば、回路を簡素化することができ、劣化と導通損失を抑えて、低コスト化を計ることができる。

【００８８】

（９－ｃ）

図１２は、３台の直流電圧昇圧回路の合成電流を一括して交流に変換する方式の構成を示す。この構成では、マイクロインバーター内で、直流から交流に変換するインバーター回路を１つとし、かつ高周波絶縁変圧器を使わないチョッパー回路としている。

【００８９】

このような回路構成によれば、回路をより単純化することができ、小型化および低価格化をさらに進めることができる。

【００９０】

（９－ｄ）

図１３は、３台の直流昇圧回路がそれぞれ高周波変圧器で絶縁する方式とし、かつ直流・交流変換を行うインバーター回路を１個とする場合の構成を示す。

【００９１】

このような回路構成によれば、太陽電池セル２の特性に起因する理由で、交流側と太陽電池セル２側を絶縁する必要がある場合に、高周波絶縁変圧器を有しながら、インバーター回路を共通１台とすることによって回路を単純化することができ、小型化および低価格化を実現することが可能である。

【００９２】

（９－ｅ）

図１４は、３台の直流昇圧回路がそれぞれ高周波変圧器で絶縁する方式で、かつ、サブストリングをバイパスするスイッチング素子またはダイオードを用いない場合の構成を示す。この回路構成では、上記の図１２に示した回路構成と同様、ＭＯＳＦＥＴトランジスターに内蔵された逆接続ダイオードを、太陽電池モジュール１のバイパスダイオード４として用いる。

【００９３】

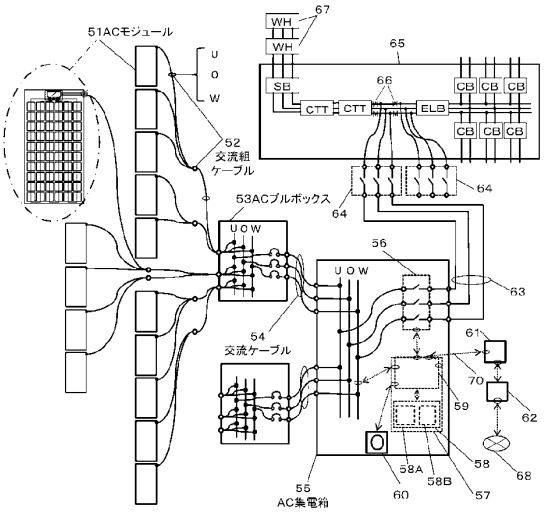
これにより、劣化および導通損失の抑制を図り、回路の簡素化と低コスト化を実現することができる。

【００９４】
（９－ｆ）
図１５に示す回路構成では、３つのサブストリングから入力する電圧を、バイパスダイオード４が無い状態で、スイッチング素子１３を組み合わせた高周波のインバーター回路に入力する。そして、高周波変圧器２３を介してダイオード２１を組み合わせた整流回路で直流に変換し、スイッチング素子１６を組み合わせたインバーター回路で、交流に変換して、交流電力を出力する。
【００９５】
太陽電池モジュール１のサブストリングの１つ又は複数に影が掛かってサブストリングの出力電圧が得られない状態では、スイッチング素子１３には逆電圧が印可される。逆電圧は、この図には示されていない寄生ダイオードを介してバイパスが行われる。寄生ダイオードは、スイッチング素子１３に逆並列に接続されており、図１４におけるバイパス用素子と同様の働きをする。
【００９６】
このような回路構成とすることによって、太陽電池モジュール１に従来必要であったバイパスダイオード４を、サブストリング型マイクロインバーターのスイッチングトランジスタの逆接続ダイオードの機能で代替することができる。よって、従来のバイパスダイオード４を無くして、劣化と導通損失を抑えることができる、回路の簡素化ならびに低コスト化を計ることができる。
【００９７】
（９－ｇ）
図１６に示した回路構成は、図１５におけるダイオード２１とスイッチング素子１６で構成される整流・インバーター回路を１つの回路にまとめた構成である。
（９－ｈ）
図１７は図１６において高周波変圧器２３を一台にまとめた構成である。それぞれの働きは前に述べたものと同様である。
【００９８】
これらの回路構成とすることによって、整流・インバーター回路、さらには高周波絶縁変圧器の部品数を減らすことができ、サブストリング型マイクロインバーターの小型化、低コスト化を図ることができる。
【符号の説明】
【００９９】
１　太陽電池モジュール
２　太陽電池セル
３　太陽電池モジュールブスバー
４　バイパスダイオード
５　端子箱
６　太陽電池出力ケーブル
７　太陽電池出力ケーブル端子
８　入力端子
９　出力端子
１０　ＡＣモジュール
１１、１８　入力コンデンサー
１２、１７　リアクトル
１３　スイッチング素子
１４　ダイオード
１５　コンデンサー
１６　スイッチング素子
１９　障害ノイズ除去フィルター
２０　サージ電圧除去素子

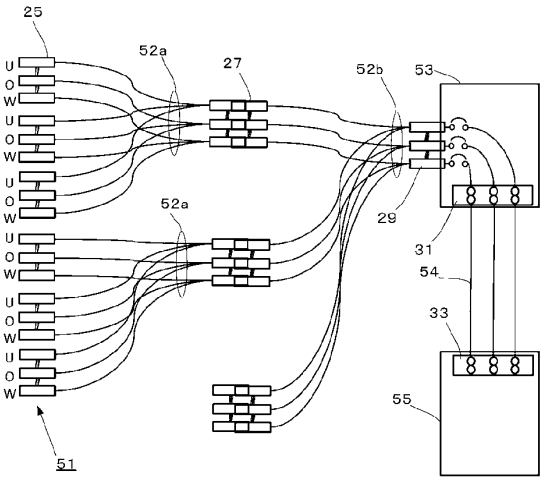
Voltage EX1003
Page 46 of 214

２３　　高周波絶縁変圧器
２５、２７、２９　　コネクター
３１、３３　　端子台
３５　　太陽電池フレーム
３６　　太陽電池表面ガラス
３７　　インバーター箱
３８　　出力ケーブル
３９　　端子
４０　　集電ケーブル
４１　　野路板
４２　　ダクト部
４３　　固定レール
４４、４５　　固定ねじ
４６　　ふた
５１　　ＡＣモジュール
５２、５２ａ、５２ｂ　　交流組ケーブル
５３　　ＡＣプルボックス
５４、６３　　交流ケーブル
５５　　ＡＣ集電箱
５６　　連系コンタクター
５７　　制御装置
５８　　演算制御部
５８Ａ　判定部
５８Ｂ　運転許可部
５９　　通信入出力装置
６０　　非常停止ボタン
６１　　表示操作装置
６２　　ネットワーク接続装置
６４　　分散電源用ブレーカー
６５　　住宅用分電盤
６６　　電流検出器
６７　　電力量計
６８　　上位インターネット
６９　　発光表示器
７０　　通信ケーブル
７２、７３　　導体ブスバー

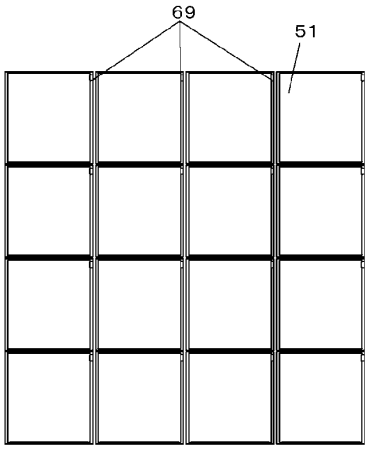
【図１】


51ACモジュール
WH
WH
67
65
SB
66
CTT
CTT
ELB
CB
CB
CB
CB
CB
CB
U
O
W
52
交流組
ケーブル
64
64
53ACブルボックス
U O W
56
U O W
63
54
交流ケーブル
61
70
59
62
58
68
58A
58B
55
AC集電箱
60
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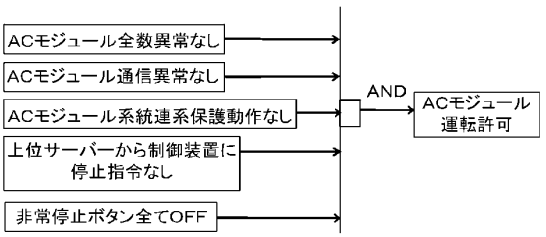
【図２】


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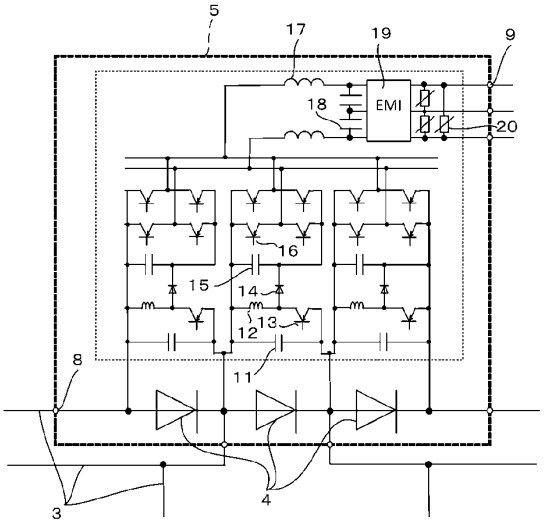
【図３】


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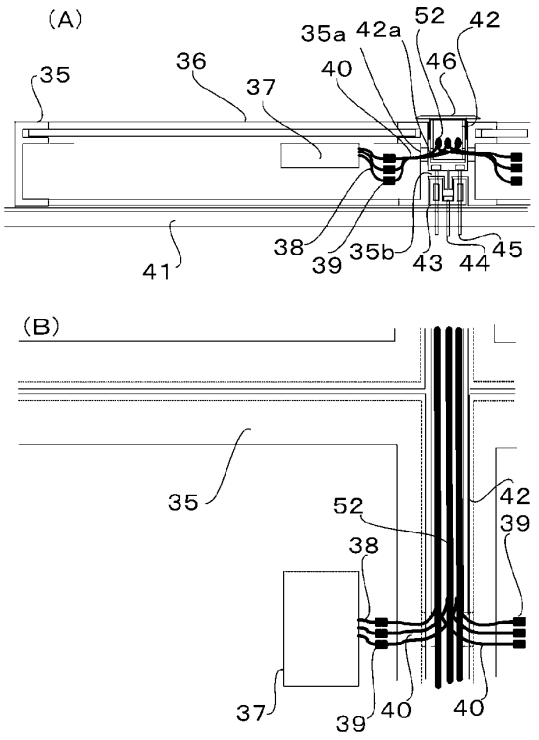
【図４】


ACモジュール全数異常なし
ACモジュール通信異常なし
ACモジュール系統連系保護動作なし
上位サーバーから制御装置に
停止指令なし
非常停止ボタン全てOFF
AND
ACモジュール
運転許可

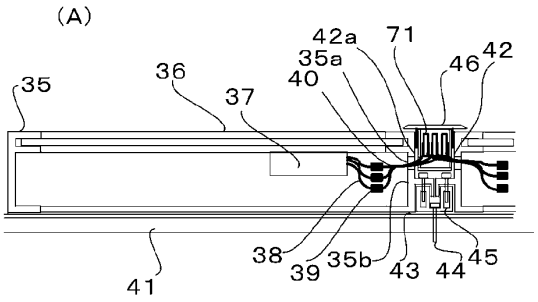
【図５】

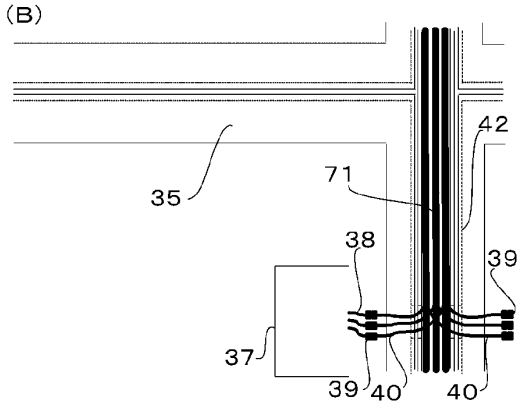

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【図６】

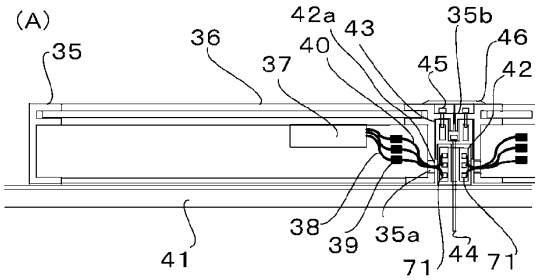

(A)
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36
37
35a
42a
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52
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42
38
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35b
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44
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41
(B)
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52
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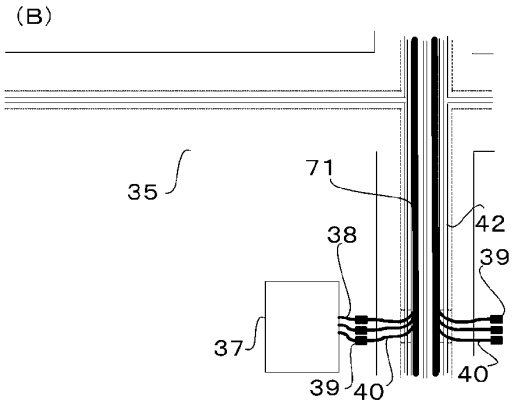
【図７】


(A)
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42a
35a
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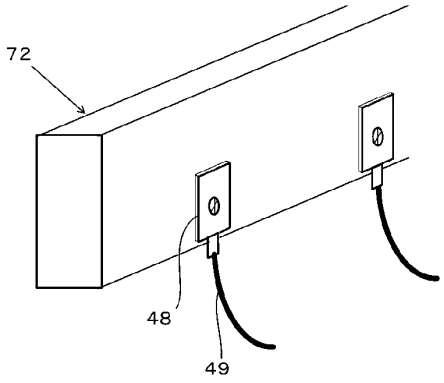

(B)
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【図８】

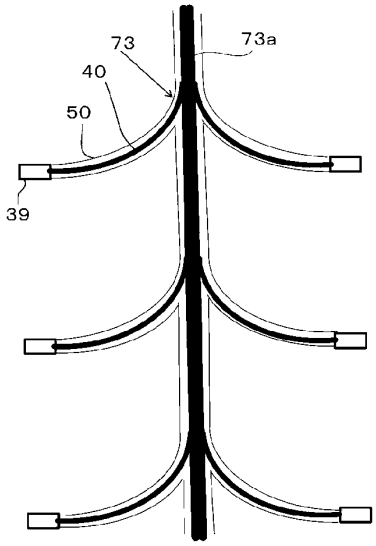

(A)
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(B)
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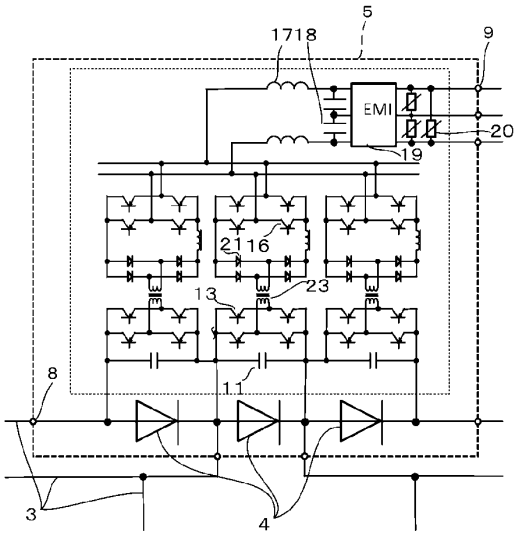
【図９】


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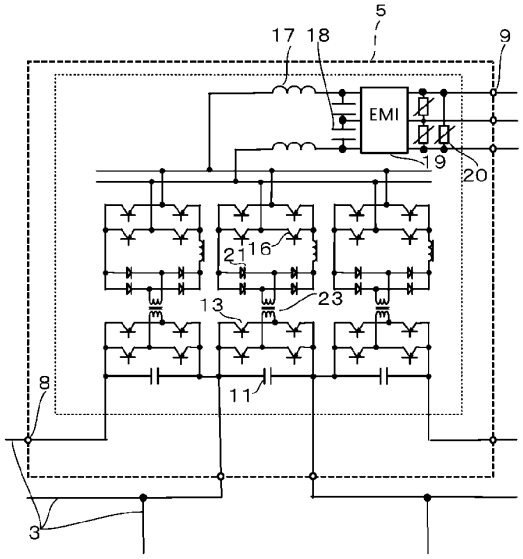
【図１０】



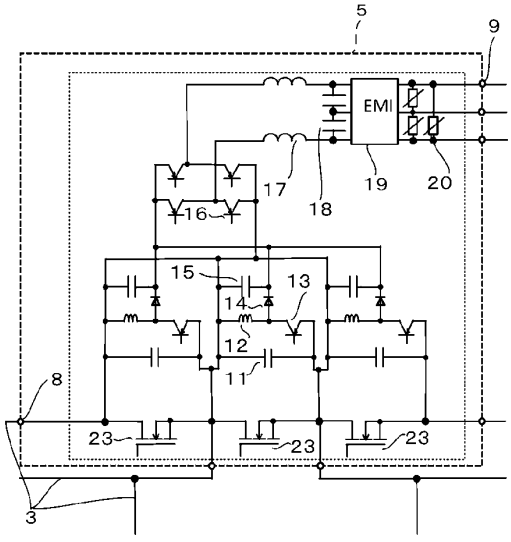
【図１１】



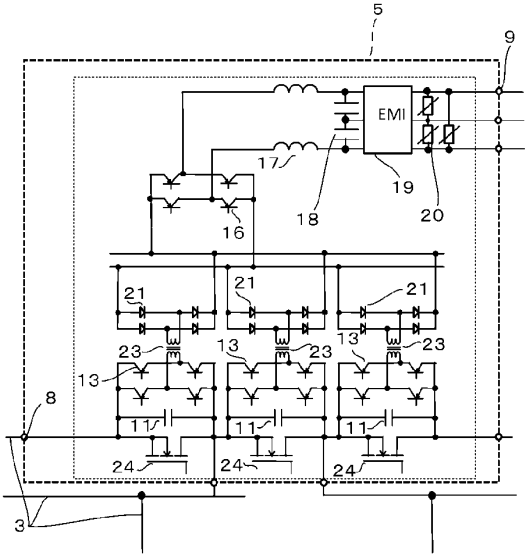
【図１２】



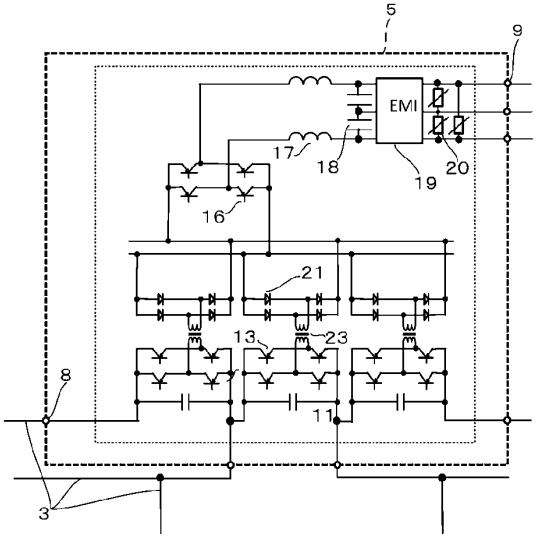
【図１３】



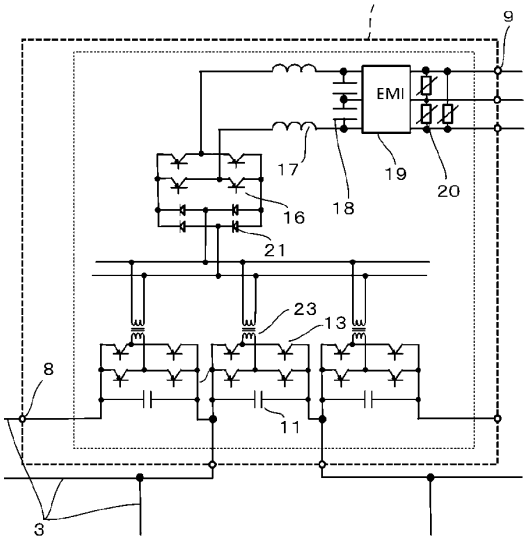
【図１４】



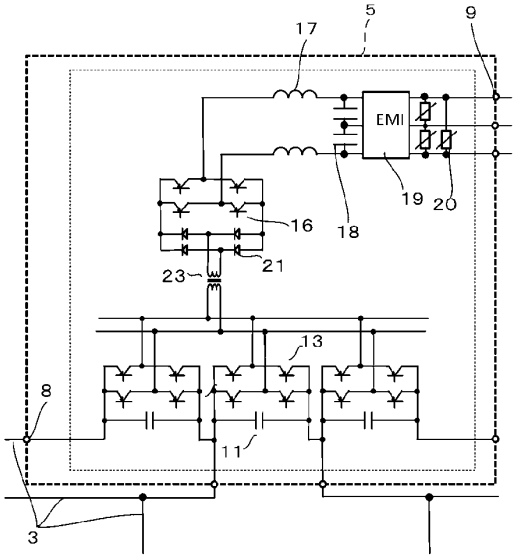
【図１５】



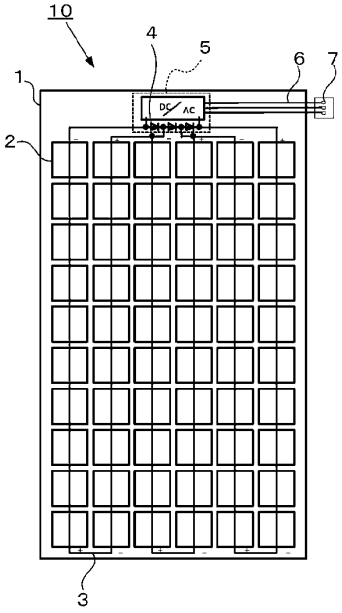
【図１６】



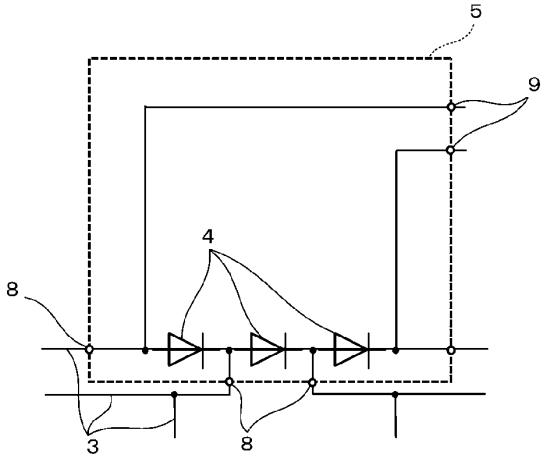
【図１７】



【図１８】



【図１９】



Title: LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER
Filed: November 29, 2023
Serial No.: 18/523,464
Examiner: Ryan Smith Cannon
First Named Inventor: Dean Solon
Attorney Docket No.: S4079.10001US05

Proposed Examiner's Amendment

1. (**Proposed**) A lead assembly for electrically coupling one or more drop lines to a feeder cable, the lead assembly comprising:

a feeder cable having a first diameter;

a first drop line having a second diameter different than the first diameter, the first drop line terminating at a first drop line connector, the first drop line connector configured to be capable of detachable connection to a wire harness having a plurality of branches that are each configured to receive electrical power generated by a corresponding photovoltaic (PV) panel resulting in combined electrical power at the first drop line connector;

a second drop line having a third diameter different than the first diameter, the second drop line terminating at a second drop line connector; and

one or more mold structures disposed about and conforming to a region of electrical interconnection between the feeder cable, the first drop line, and the second drop line, the one or more mold structures substantially sealing the region of electrical interconnection from external environmental conditions;

wherein the combined electrical power received at the first drop line connector is delivered to the feeder cable at the region of electrical interconnection; and

wherein, in the region of electrical interconnection ~~one or more mold structures~~, the first drop line and the second drop line extend in opposite directions along a longitudinal axis that is parallel to a longitudinal axis of the feeder cable.

22. (**Proposed**) A lead assembly for electrically coupling one or more drop lines to a feeder cable, the lead assembly comprising:

a feeder cable comprising a conductive core and insulation, wherein the feeder cable has a first diameter through the conductive core and insulation of the feeder cable and a current rating of 30 amps;

a drop line, wherein the drop line terminates at a drop line connector, the drop line comprises a conductive core and insulation, and the drop line has a second diameter through the conductive core and insulation of the drop line that is different than the first diameter; and

a mold structure disposed about and conforming to a region of electrical interconnection between the feeder cable and the drop line, wherein the mold structure substantially seals the region of electrical interconnection from external environmental conditions,

wherein the lead assembly has a voltage rating of 600 VDC, 1000 VDC, or 1500 VDC;

wherein the drop line and the feeder cable extend parallel to one another within away from the region of electrical interconnection, and the mold structure tapers to has distinct apertures openings through which the drop line and the feeder cable exit the mold structure.

27. (**Proposed**) The lead assembly of claim 22, wherein:

the drop line comprises a first drop line and the drop line connector comprises a first drop line connector;

the first drop line connector connects to a first central trunk of a first wire harness;

each branch of a plurality of branches of the first wire harness couples a different one of a first plurality of photovoltaic (PV) panels to the first central trunk;

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

the first drop line connector and the first drop line electrically couple the first solar array to the feeder cable;

the lead assembly further comprises a second drop line and a second drop line connector;

the second drop line connector connects to a second central trunk of a second wire harness;

each branch of a plurality of branches of the second wire harness couples a different one of a second plurality of PV panels to the second central trunk;

the second plurality of PV panels electrically coupled by the second wire harness form a second solar array; and

the second drop line connector and the second drop line electrically couple the second solar array to the feeder cable.

28. (**Proposed**) A solar power system comprising:

the lead assembly of claim 22;

a first plurality of photovoltaic (PV) panels electrically coupled by a first wire harness to form a first solar array, the first wire harness including a first central trunk and a first plurality of branches, each branch of the first plurality of branches electrically coupling a different one of the first plurality of PV panels to the first central trunk; and

a second plurality of PV panels electrically coupled by a second wire harness to form a second solar array, the second wire harness including a second central trunk and a second plurality of branches, each branch of the second plurality of branches electrically coupling a different one of the second plurality of PV panels to the second central trunk,

wherein:

the drop line comprises a first drop line, the drop line connector comprises a first drop line connector, and the lead assembly further comprises a second drop line and a second drop line connector;

the first drop line connector connects to the first central trunk;

the first drop line connector and the first drop line electrically couple the first solar array to the feeder cable;

the second drop line connector connects to the second central trunk; and

the second drop line connector and the second drop line electrically couple the second solar array to the feeder cable.

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)					
				Application Number	18523464
				Filing Date	2023-11-29
				First Named Inventor	Dean SOLON
				Art Unit	OPAP
				Examiner Name	Unassigned
Sheet	1	Of	4	Attorney Docket Number	S4079.10001US05

FOREIGN PATENT DOCUMENTS

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]
/R.S.C./	1.	2003-77584	JP		2003-03-14	YUKITA ELECTRIC WIRE CO LTD		
/R.S.C./	2.	2003-293536	JP		2003-10-15	SEKISUI CHEMICAL CO LTD		
/R.S.C./	3.	2005-39981	JP		2005-02-10	TOYOKUNI DENSEN KK		
/R.S.C./	4.	4044484	JP		2008-02-06	KANEGAFUCHI CHEMICAL IND		
/R.S.C./	5.	4080663	JP		2008-04-23	YUKITA ELECTRIC WIRE CO LTD		
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/R.S.C./	7.	2008187814	JP		2008-08-14	CHUGOKU ELECTRIC POWER		
/R.S.C./	8.	4169490	JP		2008-10-22	KUBOTA KK		
/R.S.C./	9.	4-171359	JP		2008-10-22	TOYOKUNI DENSEN KK		
/R.S.C./	10.	4606774	JP		2011-01-05	YAZAKI CORP		
/R.S.C./	11.	4730794	JP		2011-07-20	SMK KK		
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/R.S.C./	16.	2014-229639	JP		2014-12-08	YUNIKON DENSHI KK		
/R.S.C./	17.	2015-60813	JP		2015-03-30	HOSIDEN CORP		
/R.S.C./	18.	2015-133822	JP		2015-07-23	AUTO NETWORK		
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/R.S.C./	22.	10-1428689	KR		2014-08-11	YANG SEUNG ILL		
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/R.S.C./	25.	90/11608	WO		1990-10-04	SKYLINE HOLDING AG		
/R.S.C./	26.	01/09990	WO		2001-02-08	DRAKA UK LIMITED		
/R.S.C./	27.	2010/124614	WO		2010-11-04	BYD CO LTD		
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/R.S.C./	29.	2012/023748	WO		2012-02-23	MS TECHVISION CO., LTD		
/R.S.C./	30.	2012/166412	WO		2012-06-12	COOPER TECHNOLOGIES CO		

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)				Application Number	18523464
				Filing Date	2023-11-29
				First Named Inventor	Dean SOLON
				Art Unit	OPAP
				Examiner Name	Unassigned
Sheet	2	Of	4	Attorney Docket Number	S4079.10001US05

FOREIGN PATENT DOCUMENTS

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]
/R.S.C./	31.	2012/083785	WO		2012-06-28	DONGGUAN ANWELL DIGITAL MACHINERY CO., LTD.		

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Examiner Initial*	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, page(s), volume-issue number(s), publisher, city and/or country where published	T[5]
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)				Application Number	18523464
				Filing Date	2023-11-29
				First Named Inventor	Dean SOLON
				Art Unit	OPAP
				Examiner Name	Unassigned
Sheet	3	Of	4	Attorney Docket Number	S4079.10001US05

NON PATENT LITERATURE DOCUMENTS			
Examiner Initial*	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, page(s), volume-issue number(s), publisher, city and/or country where published	T[5]
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/R.S.C./	16.	"Wire Gauges - Current Ratings", retrieved from https://web.archive.org/web/20140715051530/www.engineeringtoolbox.conn/ wire-gauges-d_419.html on June 6, 2019, Year: 2015	
/R.S.C./	17.	The World of Lapp – Products for photovoltaic 2012, Lapp Group, 2012	

EXAMINER SIGNATURE			
Examiner Signature	/RYAN S CANNON/	Date Considered	01/22/2024

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)				Application Number	18523464
				Filing Date	2023-11-29
				First Named Inventor	Dean SOLON
				Art Unit	OPAP
				Examiner Name	Unassigned
Sheet	4	Of	4	Attorney Docket Number	S4079.10001US05

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Paul G. Johnson/	Date (YYYY-MM-DD)	2024-01-19
Name/Print	Paul G. Johnson	Registration Number	58539

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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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.

Bibliographic Data

Application No: 18/523,464

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.
11/29/2023	136	1726	S4079.10001US05
RULE			

APPLICANTS

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INVENTORS

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CONTINUING DATA

This application is a CON of 18341655 06/26/2023

18341655 is a CON of 17301609 04/08/2021 PAT 11689153

17301609 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**

12/13/2023

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UNITED STATES

FILING FEE RECEIVED

$6,160

18/523,464 proposed amendments

Claim 1:

In line 12, change "disposed about a region" to –disposed about and conforming to a region--.

After the last line, add –wherein, in the one or more mold structures, the first drop line and the second drop line extend in opposite directions along a longitudinal axis that is parallel to a longitudinal axis of the feeder cable--.

Claim 22:

In line 9, change "disposed about a region" to –disposed about and conforming to a region--.

After the last line, add –wherein the drop line and the feeder cable extend parallel to one another away from the region of electrical interconnection, and the mold structure tapers to distinct apertures through which the drop line and the feeder cable exit the mold structure--.

Claim 27:

Before the second line, add –the drop line comprises a first drop line and the drop line connector comprises a first drop line connector;--

In line 9, change "the second drop line connector" to –the lead assembly comprises a second drop line and a second drop line connector, wherein the second drop line connector--.

Claim 28:

Before the 12th line, add –the drop line comprises a first drop line, the drop line connector comprises a first drop line connector, and the lead assembly comprises a second drop line and a second drop line connector;--

18/341,655 proposed amendments

Claim 1:

After the last line, add –wherein the one or more drop line pathways and the feeder pathway extend parallel to one another away from the nexus, and the monolithic mold tapers to distinct apertures through which the one or more drop lines and the feeder cable exit the monolithic mold--.

Claim 17:

After the last line, add –wherein the first drop line pathway and the second drop line pathway extend in opposite directions along a longitudinal axis that is parallel to a longitudinal axis of the feeder pathway--.

Claim 22:

After the last line, add –wherein the first drop line pathway and the second drop line pathway extend in opposite directions along a longitudinal axis that is parallel to a longitudinal axis of the feeder pathway--.

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L833	34	(Artificial Intelligence) More like doc: US-2299140-A Text: (DE-4026718-A1 OR IE-912988-A1 OR WO-9203832-A1 OR DE-4026718-C2 OR GB-548221-A OR DE-4026718-C3 OR PT-98763-A OR US-2798899-A OR TN-SN91076-A1 OR US-2427507-A OR US-2881243-A OR JP-S5833617-Y2 OR US-2253138-A OR US-2479919-A OR DE-2550184-A1 OR US-3793476-A OR GB-2286294-A OR US-308890-A OR WO-03098643-A1 OR EP-1504457-A1).did.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/26 04:08 PM
L836	34	(Artificial Intelligence) More like doc: US-3700786-A Text: (GB-8719869-D0 OR DE-2210048-A1 OR GB-1324563-A OR PL-172173-B1 OR EP-0305058-A2 OR JP-H0215510-A OR GB-2209428-A OR DE-4026718-A1 OR US-6717058-B2 OR CN-1725559-A OR US-6566605-B1 OR DE-4026718-C2 OR US-20030196829-A1 OR US-4487992-A OR CA-2071887-A1 OR WO-9209089-A1 OR US-5952615-A OR GB-1361609-A OR US-3775552-A OR JP-S58207812-A).did.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/26 04:16 PM
L837	34	(Artificial Intelligence) More like doc: US-2299140-A Text:	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2024/02/26 04:21 PM

		(DE-4026718-A1 OR IE-912988-A1 OR WO-9203832-A1 OR DE-4026718-C2 OR GB-548221-A OR DE-4026718-C3 OR PT-98763-A OR US-2798899-A OR TN-SN91076-A1 OR US-2427507-A OR US-2881243-A OR JP-S5833617-Y2 OR US-2253138-A OR US-2479919-A OR DE-2550184-A1 OR US-3793476-A OR GB-2286294-A OR US-308890-A OR WO-03098643-A1 OR EP-1504457-A1).did.	CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L839	36	(Artificial Intelligence) More like doc: US-2166420-A Text: (US-2028793-A OR EP-0554158-A1 OR US-2322903-A OR EP-2323139-A2 OR US-20110117771-A1 OR EP-2323139-B1 OR US-8047866-B2 OR US-2277177-A OR DE-1415609-A1 OR US-2105790-A OR JP-3164785-U OR US-2522169-A OR US-2435284-A OR US-2264439-A OR US-2234579-A OR KR-200463700-Y1 OR KR-20110005075-U OR TW-M379150-U OR EP-2323139-A3 OR US-1751143-A).did.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/26 04:24 PM
L841	34	(Artificial Intelligence) More like doc: US-4464583-A Text: (CA-1211152-A OR CN-115473086-A OR EP-4105948-A1 OR US-20220375653-A1 OR EP-3672004-A1 OR EP-3672004-B1 OR EP-0087267-A1 OR AU-2006268241-A1 OR WO-2007008957-A9	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA,	OR	ON	ON	2024/02/26 04:28 PM

		OR WO-2007008957-A2 OR EP-1902448-A2 OR US-20070097601-A1 OR US-4161012-A OR US-7450363-B2 OR US-3961127-A OR EP-2897241-A1 OR US-20150200529-A1 OR DE-59601877-D1 OR AT-E180114-T1 OR US-7803003-B2).did.	VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L843	31	(Artificial Intelligence) More like doc: US-10840615-B2 Text: (US-20200006869-A1 OR AU-2019293240-B2 OR EP-3815188-A1 OR AU-2019293240-A1 OR WO-2020006238-A1 OR EP-3815188-B1 OR CN-112805880-A OR CN-112805880-B OR US-20200412027-A1 OR US-11121480-B2 OR EP-3866264-A1 OR AU-2021200897-A1 OR US-20210257749-A1 OR US-11431114-B2 OR CN-113270782-A OR US-7686661-B2 OR US-20100029147-A1 OR MX-2021000075-A OR US-7845990-B2 OR US-20100130076-A1).did.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/26 05:40 PM
L846	45	(Artificial Intelligence) More like doc: JP-2015198508-A Text: (WO-2017109871-A1 OR JP-2007274841-A OR JP-4664851-B2 OR WO-2017109872-A1 OR JP-2013016640-A OR JP-2012094751-A OR JP-5691891-B2 OR JP-2014107370-A OR JP-3189106-U OR CN-102867870-B OR CN-102867870-A OR JP-H11270085-A OR WO-2015087638-A1 OR CN-113890003-A OR EP-2486640-A2 OR US-20110084556-A1 OR US-20130009662-	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/26 07:14 PM

		A1 OR US-20120104872-A1 OR TW-201334355-A OR JP-2013243867-A).did.					
L866	39	(Artificial Intelligence) More like doc: US-3852516-A Text: (US-4358634-A OR US-4732628-A OR EP-0641495-B1 OR US-3836702-A OR EP-0641495-A1 OR US-3896260-A OR GB-1558657-A OR EP-0023099-A1 OR EP-0023099-B1 OR US-4262167-A OR CA-1145824-A OR US-2930835-A OR JP-S60194715-A OR US-3209069-A OR GB-2154075-A OR EP-2555335-A1 OR EP-0153799-A1 OR JP-2021034188-A OR AR-009634-A1 OR US-3141060-A).did.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/02/27 05:46 PM

PE2E SEARCH - Search History (Interference)

There are no Interference searches to show.

PE2E SEARCH - Search History (Similarity Search)

No Similarity Results available

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特開2014-50227
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(51)Int.Cl.		F I		テーマコード（参考）
H02M 7/48	(2007.01)	H02M 7/48	Z	5F151
H01L 31/042	(2014.01)	H01L 31/04	R	5H007

審査請求 未請求　請求項の数 6　OL　（全 12 頁）

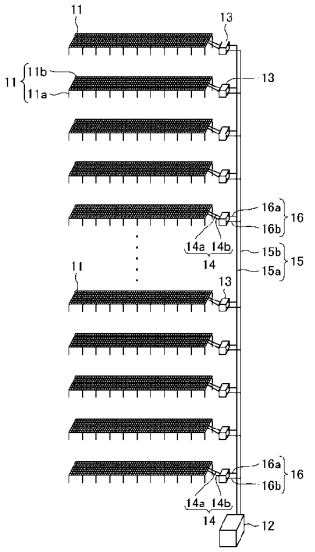
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Fターム(参考)　5F151 JA12 JA27 KA03
5H007 BB07 HA03 HA07

(54)【発明の名称】太陽光発電システムおよび太陽光発電システムの設置方法

(57)【要約】
【課題】パワーコンディショナの入力端子数を上回る太陽光パネルを接続可能としつつ、設置工期を短縮化し、コスト上昇を抑制する。
【解決手段】複数の太陽光パネル１１のそれぞれに対応して設けられた接続ボックス１３と、太陽光パネル１１と接続ボックス１３とを電気的に接続するパネル接続ケーブル１４と、太陽光パネル１１が発電した直流電力を交流電力に変換するパワーコンディショナ１２と、一方端がパワーコンディショナ１２と電気的に接続された幹線ケーブル１５と、それぞれの接続ボックス１３に対応して幹線ケーブル１５から分岐して設けられて接続ボックス１３と接続され、幹線ケーブル１５と協働して接続ボックス１３とパワーコンディショナ１２とを電気的に接続する分岐線ケーブル１６とを有する太陽光発電システムである。
【選択図】図１



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【特許請求の範囲】
【請求項１】
太陽からの光エネルギーで電気を発生させる複数の太陽光パネルと、
それぞれの前記太陽光パネルに対応して設けられた接続ボックスと、
前記太陽光パネルと当該太陽光パネルに対応した前記接続ボックスとを電気的に接続するパネル接続ケーブルと、
前記太陽光パネルが発電した直流電力を交流電力に変換するパワーコンディショナと、
一方端が前記パワーコンディショナと電気的に接続された幹線ケーブルと、
それぞれの前記接続ボックスに対応して前記幹線ケーブルから分岐して設けられて前記接続ボックスと接続され、前記幹線ケーブルと協働して前記接続ボックスと前記パワーコンディショナとを電気的に接続する分岐線ケーブルと、
を有することを特徴とする太陽光発電システム。
【請求項２】
前記幹線ケーブルの他方端または中間部には、前記幹線ケーブルを把持するとともに造営材に取り付けられた支持手段に支持された把持手段が取り付けられている、
ことを特徴とする請求項１記載の太陽光発電システム。
【請求項３】
前記パネル接続ケーブルは、
前記太陽光パネルのプラス電極の出力端子と前記接続ボックスのプラス電極の入力端子とを電気的に接続するプラス極側パネル接続ケーブルと、
前記太陽光パネルのマイナス電極の出力端子と前記接続ボックスのマイナス電極の入力端子とを電気的に接続するマイナス極側パネル接続ケーブルとで構成され、
前記プラス極側パネル接続ケーブルと前記マイナス極側パネル接続ケーブルとは、相互に撚り合わされているか、または相互に接合されている、
ことを特徴とする請求項１または２記載の太陽光発電システム。
【請求項４】
前記プラス極側パネル接続ケーブルおよび前記マイナス極側パネル接続ケーブルには、
これらのケーブルの心線を被覆したケーブルシースに、前記プラス極側パネル接続ケーブルおよび前記マイナス極側パネル接続ケーブルそれぞれの極性が識別可能な識別標識が設けられている、
ことを特徴とする請求項３記載の太陽光発電システム。
【請求項５】
前記幹線ケーブルおよび前記分岐線ケーブルの少なくとも何れかのケーブルは、
プラス極性の電流が流れるケーブルとマイナス極性の電流が流れるケーブルとで構成され、
これらのケーブルの心線を被覆したケーブルシースには、それぞれのケーブルの極性が識別可能な識別標識が設けられている、
ことを特徴とする請求項１～４の何れか一項に記載の太陽光発電システム。
【請求項６】
太陽からの光エネルギーで電気を発生させる複数の太陽光パネル、それぞれの前記太陽光パネルに対応した接続ボックス、および前記太陽光パネルが発電した直流電力を交流電力に変換するパワーコンディショナを現場に設置し、
前記太陽光パネルと当該太陽光パネルに対応した前記接続ボックスとを電気的に接続するパネル接続ケーブルを、設置された現場の寸法に合わせた長さにして予め用意しておき、
一方端が前記パワーコンディショナと電気的に接続される幹線ケーブル、およびそれぞれの前記接続ボックスに対応して前記幹線ケーブルから分岐して前記接続ボックスと接続される分岐線ケーブルを、設置された現場の寸法に合わせた長さにして予め用意しておき、
複数の前記太陽光パネル、複数の接続ボックスおよび前記パワーコンディショナの設置

された現場において、前記パネル接続ケーブル、前記幹線ケーブルおよび前記分岐線ケーブルを取り付ける、
ことを特徴とする太陽光発電システムの設置方法。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、太陽光発電システムおよび太陽光発電システムの設置方法に関し、特に太陽光発電システムを構築する各構成要素の接続に適用して有効な技術に関するものである。
【背景技術】
【０００２】
太陽からの光エネルギーを使い、光起電力効果を応用して電気を発生させる太陽光発電システムは、環境負荷の小さな電力生産が可能であることから、近年急速に注目を集めている。
【０００３】
太陽光発電システムは、太陽光で電気を発生させる太陽光パネルと、太陽光パネルに対応して設けられて当該太陽光パネルが発電した電気の電圧調整を行う接続ボックスと、太陽光パネルが発電した直流電力を交流電力に変換するパワーコンディショナとを備えている。そして、太陽光パネルと接続ボックスとが電気的に接続され、接続ボックスとパワーコンディショナとが電気的に接続されている。
【０００４】
さて、パワーコンディショナには、太陽光パネルが発電した電力が接続ボックスを通して入力される入力端子が備えられている。ここで、接続ボックスを直接入力端子と接続する構造をとった場合には、接続ボックスと対応している太陽光パネルの設置数は、最多でもパワーコンディショナの端子数までという制約を受けることになる。
【０００５】
そこで、太陽光パネルを多数設置して発電を行うメガソーラー発電の太陽光発電システム１１０においては、このような制約をなくすために、図７に示すような構成になっている。
【０００６】
すなわち、太陽光パネル１１１（と太陽光パネル１１１に対応した接続ボックス１１３）をパワーコンディショナ１１２の入力端子数（より詳しくは、プラスの入力端子とマイナスの入力端子の組数）と同数にグループ化し（図示する場合には、パワーコンディショナ１１２の２組の入力端子に合わせて、グループＧ１とグループＧ２の２つにグループ化し）、各グループＧ１，Ｇ２に対して一つずつ集電ボックス１１７を設置する。次に、グループＧ１の接続ボックス１１３とこのグループＧ１に対応した集電ボックス１１７とを接続ケーブル１１８で電気的に接続する。同様にして、グループＧ２の接続ボックス１１３とこのグループＧ２に対応した集電ボックス１１７とを接続ケーブル１１８で電気的に接続する。そして、それぞれのグループＧ１，Ｇ２に対応した集電ボックス１１７とパワーコンディショナ１１２とを接続ケーブル１１９で電気的に接続する。
【０００７】
このように接続ボックス１１３とパワーコンディショナ１１２との間に、接続ボックス１１３を集約する集電ボックス１１７を介在させることにより、パワーコンディショナ１１２の端子数に制約されることなくメガソーラー発電を実現している。
【０００８】
なお、太陽光パネルとパワーコンディショナとの間の接続については、例えば特開２００５－１５８７８９号公報に記載された技術が知られている。
【先行技術文献】
【特許文献】
【０００９】
【特許文献１】特開２００５－１５８７８９号公報

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【発明の概要】
【発明が解決しようとする課題】
【００１０】
しかしながら、前述のように集電ボックス１１７を用いた接続では、接続ボックス１１３からパワーコンディショナ１１２に至る経路のケーブル数が多くなるために、ケーブルの取付工数が多くなって太陽光発電システム１１０の設置工期が長くなってしまう。
【００１１】
また、このようにケーブル数が多くなることに加えて、集電ボックス１１７が必要になるために、太陽光発電システム１１０のコストが上昇することになる。
【００１２】
本発明は、上述の技術的背景からなされたものであって、パワーコンディショナの入力端子数を上回る太陽光パネルを接続可能としつつ、設置工期を短縮化できる太陽光発電システムに関する技術を提供することを目的とする。
【００１３】
また、本発明は、パワーコンディショナの入力端子数を上回る太陽光パネルを接続可能としつつ、コストの上昇を抑制することのできる太陽光発電システムに関する技術を提供することを目的とする。
【課題を解決するための手段】
【００１４】
上記課題を解決するため、請求項１に記載の本発明の太陽光発電システムは、太陽からの光エネルギーで電気を発生させる複数の太陽光パネルと、それぞれの前記太陽光パネルに対応して設けられた接続ボックスと、前記太陽光パネルと当該太陽光パネルに対応した前記接続ボックスとを電気的に接続するパネル接続ケーブルと、前記太陽光パネルが発電した直流電力を交流電力に変換するパワーコンディショナと、一方端が前記パワーコンディショナと電気的に接続された幹線ケーブルと、それぞれの前記接続ボックスに対応して前記幹線ケーブルから分岐して設けられて前記接続ボックスと接続され、前記幹線ケーブルと協働して前記接続ボックスと前記パワーコンディショナとを電気的に接続する分岐線ケーブルと、を有することを特徴とする。
【００１５】
請求項２に記載の本発明の太陽光発電システムは、上記請求項１に記載の発明において、前記幹線ケーブルの他方端または中間部には、前記幹線ケーブルを把持するとともに造営材に取り付けられた支持手段に支持された把持手段が取り付けられている、ことを特徴とする。
【００１６】
請求項３に記載の本発明の太陽光発電システムは、上記請求項１または２に記載の発明において、前記パネル接続ケーブルは、前記太陽光パネルのプラス電極の出力端子と前記接続ボックスのプラス電極の入力端子とを電気的に接続するプラス極側パネル接続ケーブルと、前記太陽光パネルのマイナス電極の出力端子と前記接続ボックスのマイナス電極の入力端子とを電気的に接続するマイナス極側パネル接続ケーブルとで構成され、前記プラス極側パネル接続ケーブルと前記マイナス極側パネル接続ケーブルとは、相互に撚り合わされているか、または相互に接合されている、ことを特徴とする。
【００１７】
請求項４に記載の本発明の太陽光発電システムは、上記請求項３に記載の発明において、前記プラス極側パネル接続ケーブルおよび前記マイナス極側パネル接続ケーブルには、これらのケーブルの心線を被覆したケーブルシースに、前記プラス極側パネル接続ケーブルおよび前記マイナス極側パネル接続ケーブルそれぞれの極性が識別可能な識別標識が設けられている、ことを特徴とする。
【００１８】
請求項５に記載の本発明の太陽光発電システムは、上記請求項１～４の何れか一項に記載の発明において、前記幹線ケーブルおよび前記分岐線ケーブルの少なくとも何れかのケ

ーブルは、プラス極性の電流が流れるケーブルとマイナス極性の電流が流れるケーブルとで構成され、これらのケーブルの心線を被覆したケーブルシースには、それぞれのケーブルの極性が識別可能な識別標識が設けられている、ことを特徴とする。

【００１９】

上記課題を解決するため、請求項６に記載の本発明の太陽光発電システムの設置方法は、太陽からの光エネルギーで電気を発生させる複数の太陽光パネル、それぞれの前記太陽光パネルに対応した接続ボックス、および前記太陽光パネルが発電した直流電力を交流電力に変換するパワーコンディショナを現場に設置し、前記太陽光パネルと当該太陽光パネルに対応した前記接続ボックスとを電気的に接続するパネル接続ケーブルを、設置された現場の寸法に合わせた長さにして予め用意しておき、一方端が前記パワーコンディショナと電気的に接続される幹線ケーブル、およびそれぞれの前記接続ボックスに対応して前記幹線ケーブルから分岐して前記接続ボックスと接続される分岐線ケーブルを、設置された現場の寸法に合わせた長さにして予め用意しておき、複数の前記太陽光パネル、複数の接続ボックスおよび前記パワーコンディショナの設置された現場において、前記パネル接続ケーブル、前記幹線ケーブルおよび前記分岐線ケーブルを取り付ける、ことを特徴とする。

【発明の効果】

【００２０】

本発明によれば、パワーコンディショナを幹線ケーブルと接続し、太陽光パネルに対応した接続ボックスを幹線ケーブルから分岐した分岐線ケーブルと接続しているので、集電ボックスを用いた接続に比較してケーブル数が少なくなることから、パワーコンディショナの入力端子数を上回る太陽光パネルを接続可能としつつ、設置工期を短縮化することが可能になる。

【００２１】

また、本発明によれば、パワーコンディショナを幹線ケーブルと接続し、太陽光パネルに対応した接続ボックスを幹線ケーブルから分岐した分岐線ケーブルと接続しているので、ケーブル数が少なくなるとともに集電ボックスが不要になるので、パワーコンディショナの入力端子数を上回る太陽光パネルを接続可能としつつ、コストの上昇を抑制することが可能になる。

【図面の簡単な説明】

【００２２】

【図１】本発明の一実施の形態に係る太陽光発電システムを示す概念図である。

【図２】図１の太陽光発電システムにおける接続ボックス、幹線ケーブルおよび分岐線ケーブルの部分を拡大して示す説明図である。

【図３】図２のＡ部を拡大して示す断面図である。

【図４】本発明の一実施の形態に係る太陽光発電システムに用いられたパネル接続ケーブルを示す斜視図である。

【図５】図４のパネル接続ケーブルを示す正面図である。

【図６】本発明の一実施の形態に係る太陽光発電システムに用いられたパネル接続ケーブルの変形例を示す斜視図である。

【図７】比較例としての太陽光発電システムを示す概念図である。

【発明を実施するための形態】

【００２３】

以下、本発明の一例としての実施の形態について、図面に基づいて詳細に説明する。なお、実施の形態を説明するための図面において、同一の構成要素には原則として同一の符号を付し、その繰り返しの説明は省略する。

【００２４】

図１は、本発明の一実施の形態に係る太陽光発電システム１０を示す概念図である。

【００２５】

図１に示す太陽光発電システム１０は、太陽光を太陽光パネル１１を用いて直接的に電

力に変換する発電システムであり、太陽からの光エネルギーで電気（直流電力）を発生させる複数の太陽光パネル１１と、太陽光パネル１１が発電した直流電力を交流電力に変換する１台のパワーコンディショナ１２とを備えている。

【００２６】

なお、本実施の形態の太陽光発電システム１０は、出力が１メガワット（１，０００キロワット）程度以上の規模の発電システム、つまりメガソーラー発電システムとなっている。

【００２７】

太陽光パネル１１は、架台１１ａと、この架台１１ａ上に取り付けられたパネル本体１１ｂとで構成されており、例えば休耕田や耕作放棄地などに設置されている。但し、設置場所はこれらに限定されるものではなく、建造物の屋根や駐車場など、様々な場所が選定される。

【００２８】

架台１１ａは、例えば鋼材に溶融亜鉛メッキしたものからなり、棒状の鋼材を組み合わせることによって構成されている。また、パネル本体１１ｂは、光起電力効果を応用して電気を発生させる太陽電池をいくつも並べて相互接続してパネル状にしたものからなる。このパネル本体１１ｂは、架台１１ａにより水平面に対して約１０°～３０°傾斜しており、日本のような北半球では南向きに設置されて（南半球では北向きに設置されて）、太陽から多くの光エネルギーを得ることができるよう配慮されている。

【００２９】

それぞれの太陽光パネル１１に対応して、接続ボックス１３が設けられている。接続ボックス１３は、太陽光パネル１１で発電した電気を集めてパワーコンディショナ１２に送り出すためのものである。

【００３０】

太陽光パネル１１とこの太陽光パネル１１に対応した接続ボックス１３とは、パネル接続ケーブル１４により電気的に接続されている。ここで、太陽光パネル１１を構成する太陽電池の総数がＭ枚で、太陽電池Ｎ枚を一組として回路を組んだ場合、（Ｍ／Ｎ）セットそれぞれから電気配線される。

【００３１】

したがって、太陽光パネル１１のプラス電極の出力端子と接続ボックス１３のプラス電極の入力端子とを電気的に接続する（Ｍ／Ｎ）本のプラス極側パネル接続ケーブル１４ａと、太陽光パネル１１のマイナス電極の出力端子と接続ボックス１３のマイナス電極の入力端子とを電気的に接続する（Ｍ／Ｎ）本のマイナス極側パネル接続ケーブル１４ｂの、合わせて（（Ｍ／Ｎ）×２）本のパネル接続ケーブル１４により電気的に接続されている。

【００３２】

前述したパワーコンディショナ１２には、幹線ケーブル１５の一方端が電気的に接続されている。この幹線ケーブル１５は、パワーコンディショナ１２のプラス電極の入力端子と接続されてプラス極性の電流が流れるプラス極側幹線ケーブル１５ａと、パワーコンディショナ１２のマイナス電極の入力端子と接続されてマイナス極性の電流が流れるマイナス極側幹線ケーブル１５ｂの、合わせて２本で構成されている。

【００３３】

したがって、本実施の形態では、パワーコンディショナ１２の入力端子は、プラス電極の入力端子およびマイナス電極の入力端子がそれぞれ１つずつという、最小限の端子数となっている。但し、パワーコンディショナ１２の端子数はこれに限定されるものではない。

【００３４】

なお、幹線ケーブル１５の他端あるいは中間部に、当該幹線ケーブル１５を把持するケーブルグリップ（図示せず）などの把持手段を取り付け、このケーブルグリップを造営材に取り付けられたフックなどの支持手段に支持するようにしてもよい。

【００３５】
図２に示すように、幹線ケーブル１５からは分岐線ケーブル１６が分岐して設けられている。この分岐線ケーブル１６は、それぞれの接続ボックス１３に対応して設けられて接続ボックス１３と接続されており、幹線ケーブル１５と協働して接続ボックス１３とパワーコンディショナ１２とを電気的に接続している。
【００３６】
分岐線ケーブル１６は、プラス極側幹線ケーブル１５ａから分岐して接続ボックス１３のプラス電極の入力端子と接続されてプラス極性の電流が流れるプラス極側分岐線ケーブル１６ａと、マイナス極側幹線ケーブル１５ｂから分岐して接続ボックス１３のマイナス電極の入力端子と接続されてプラス極性の電流が流れるマイナス極側分岐線ケーブル１６ｂで構成されている。
【００３７】
図３に示すように、分岐線ケーブル１６は、当該分岐線ケーブル１６の心線１６－１の端部が分岐スリーブ１７を介して幹線ケーブル１５の心線１５－１と接続されており、分岐スリーブ１７が位置する分岐部は、絶縁処理および防水処理を施すため樹脂モールド１８を採用している。
【００３８】
なお、本実施の形態においては、パネル接続ケーブル１４と太陽光パネル１１および接続ボックス１３との接続、幹線ケーブル１５とパワーコンディショナ１２との接続、分岐線ケーブル１６と接続ボックス１３との接続は、何れもコネクタを用いたワンタッチ接続となっている。但し、コネクタを用いずに電極（プラス電極・マイナス電極）に直接接続してもよい。
【００３９】
図４に示すように、パネル接続ケーブル１４を構成するプラス極側パネル接続ケーブル１４ａとマイナス極側パネル接続ケーブル１４ｂとが、相互に撚り合わされている。また、図５に示すように、パネル接続ケーブル１４は、中心に位置する心線１４－１と、心線１４－１を包囲する絶縁体１４－２と、絶縁体１４－２を包囲するケーブルシース１４－３とが同軸上となった構造となって、ケーブルシース１４－３が絶縁体１４－２を介して心線１４－１を被覆している。ここで、心線１４－１は、１本の導体からなる単線でもよく、複数の細い導体をまとめて被覆した撚線でもよい。
【００４０】
そして、図４に示すように、プラス極側パネル接続ケーブル１４ａにはプラス極を示す例えば赤色のストライプ１４ａ－１（識別標識）が、マイナス極側パネル接続ケーブル１４ｂにはマイナス極を示す例えば白色のストライプ１４ｂ－１（識別標識）が、それぞれのケーブルシース１４－３の長さ方向に沿って形成されている。
【００４１】
なお、パネル接続ケーブル１４ａ，１４ｂのそれぞれの極性が識別可能な識別標識としてはストライプに限定されるものではなく、例えば「＋」「－」の記号を印刷したり、相互に異なる形状のエンボス加工を施したり、ケーブルそのものの色を違えたりなど、様々な識別標識を採用することができる。また、識別標識としてストライプを適用した場合、その色は本実施の形態に示す赤および白に限定されるものではなく、様々な色を採用することができる。
【００４２】
ここで、パネル接続ケーブル１４では、１回路の接続のために、プラス極側パネル接続ケーブル１４ａとマイナス極側パネル接続ケーブル１４ｂという２条のケーブルを使用している。したがって、これらプラス極側とマイナス極側のパネル接続ケーブル１４ａ，１４ｂとが相互に分離して別々に取り扱い可能な形態、つまり単心ケーブルとなっている場合には、太陽光パネル１１および接続ボックス１３とを電気的に接続する際に、切断・束巻き等を２回行う必要がある。また、配線工事も１条ずつ２回行う必要があり、誤配線を引き起こす可能性がある。

【００４３】
しかしながら、本実施の形態では、前述のように、プラス極側パネル接続ケーブル１４ａとマイナス極側パネル接続ケーブル１４ｂとが予め撚り合わされているので、２条のパネル接続ケーブル１４ａ，１４ｂを同時に切断できることになり、切断作業が１回で完了する。また、このようにプラス極側パネル接続ケーブル１４ａとマイナス極側パネル接続ケーブル１４ｂとが予め撚り合わされているので、配線工事も１回で完了する。
【００４４】
そして、太陽光発電システム１０の設置に際しては、このような切断作業および配線工事作業を多数回行うことになるので、パネル接続ケーブルを単心ケーブル２条で構成した場合に比べて、切断時間および配線工事時間が大幅に短縮される。なお、パネル接続ケーブル１４の端部を単心ケーブルとしたい場合は、撚りを解けば単心ケーブル２条として使用することができる。
【００４５】
また、プラス極側パネル接続ケーブル１４ａとマイナス極側パネル接続ケーブル１４ｂにはそれぞれの極性を示す識別標識としてのストライプ１４ａ－１，１４ｂ－１が形成されているので、誤配線が防止される。
【００４６】
ここで、パネル接続ケーブル１４がプラス極側パネル接続ケーブル１４ａとマイナス極側パネル接続ケーブル１４ｂで構成されて極性が区別されるのみならず、前述のように、幹線ケーブル１５がプラス極側幹線ケーブル１５ａとマイナス極側幹線ケーブル１５ｂで構成されて極性が区別され、分岐線ケーブル１６がプラス極側分岐線ケーブル１６ａとマイナス極側幹線ケーブル１５ｂで構成されて極性が区別されるので、これらのケーブル１５ａ，１５ｂ，１６ａ，１６ｂについてもそれぞれの極性が識別可能な識別標識を設けるのがよい。識別標識としては、例えば本実施の形態のパネル接続ケーブル１４のように極性別に色分けされたストライプがあるが、それ以外の様々な識別標識を適用することができる。
【００４７】
但し、識別標識は、パネル接続ケーブル１４、幹線ケーブル１５、分岐線ケーブル１６の全てに採用してもよいが、一部のケーブルだけに採用してもよく、あるいは全てに採用しなくてもよい。
【００４８】
なお、パネル接続ケーブル１４は、図６に示すように、プラス極側パネル接続ケーブル１４ａとマイナス極側パネル接続ケーブル１４ｂとは、相互に接合されているケーブルでもよい。すなわち、プラス極側パネル接続ケーブル１４ａのケーブルシース１４－３とマイナス極側パネル接続ケーブル１４ｂのケーブルシース１４－３とが接合されたペアケーブルでもよい。
【００４９】
このようなペアケーブルでも、切断時間および配線工事時間が大幅に短縮されるとともに、誤配線が防止される。また、接合部分を引き裂けば単心ケーブル２条として使用することができる。
【００５０】
以上説明したように、本実施の形態の太陽光発電システム１０によれば、太陽光パネル１１が発電した直流電力を交流電力に変換するパワーコンディショナ１２を幹線ケーブル１５と接続し、太陽光パネル１１に対応して設けられた複数の接続ボックス１３を当該幹線ケーブル１５から分岐して接続ボックス１３に対応して設けられた分岐線ケーブル１６と接続しているので、図７に示すような集電ボックス１１７を用いた接続に比較して、接続ボックス１３からパワーコンディショナ１２に至る経路のケーブル数が少なくなる。
【００５１】
よって、ケーブルの取付工数が少なくなって太陽光発電システム１０の設置工期が短くなる。しかも、幹線ケーブル１５は、最少では１組のプラス極側幹線ケーブル１５ａとマ

イナス極側幹線ケーブル１５ｂで足りるので、パワーコンディショナ１２の入力端子数は少なくとも１組のプラス極端子とマイナス極端子があればよい。

【００５２】

したがって、パワーコンディショナ１２の入力端子数を上回る太陽光パネル１１を接続可能としつつ、設置工期の短縮化を図ることが可能になる。

【００５３】

また、本実施の形態の太陽光発電システム１０によれば、このようにケーブル数が少なくなることに加えて、図７に示すような集電ボックス１１７は不要になる。

【００５４】

したがって、パワーコンディショナ１２の入力端子数を上回る太陽光パネル１１を接続可能としつつ、コストの上昇を抑制することが可能になる。

【００５５】

なお、このような太陽光発電システム１０は，次のようなプロセスにより設置することができる。

【００５６】

すなわち、複数の太陽光パネル１１、各太陽光パネル１１に対応した接続ボックス１３、およびパワーコンディショナ１２を現場に設置する。また、パネル接続ケーブル１４を、設置された現場の寸法に合わせた長さに切断、加工（端子およびコネクタの装着）して予め用意しておく。さらに、幹線ケーブル１５および幹線ケーブル１５から分岐した分岐線ケーブル１６を、設置された現場の寸法に合わせた長さに切断、加工（端子およびコネクタの装着）して予め用意しておく。

【００５７】

そして、太陽光パネル１１、接続ボックス１３およびパワーコンディショナ１２の設置された現場において、パネル接続ケーブル１４、幹線ケーブル１５および分岐線ケーブル１６を取り付けて、設置作業を終了する。

【００５８】

このように、パネル接続ケーブル１４、幹線ケーブル１５および分岐線ケーブル１６を、太陽光パネル１１、接続ボックス１３およびパワーコンディショナ１２の設置された現場の寸法に合わせた長さにして用意しておき、これを現場で取り付けるようにすれば、各ケーブル１４，１５，１６を現場で切断、加工する場合に比べて、作業が効率化して設置工期の短縮化を図ることが可能になる。

【００５９】

以上本発明者によってなされた発明を実施の形態に基づき具体的に説明したが、本明細書で開示された実施の形態はすべての点で例示であって、開示された技術に限定されるものではないと考えるべきである。すなわち、本発明の技術的な範囲は、前記の実施の形態における説明に基づいて制限的に解釈されるものでなく、あくまでも特許請求の範囲の記載に従って解釈されるべきであり、特許請求の範囲の記載技術と均等な技術および特許請求の範囲の要旨を逸脱しない限りにおけるすべての変更が含まれる。

【００６０】

たとえば、本実施の形態では、全ての接続ボックス１３が分岐線ケーブル１６と接続されているが、何れか一つの接続ボックス１３については幹線ケーブル１５のパワーコンディショナ１２と接続されていない方の端部と接続され、それ以外の接続ボックス１３は分岐線ケーブル１６と接続されるようにしてもよい。

【産業上の利用可能性】

【００６１】

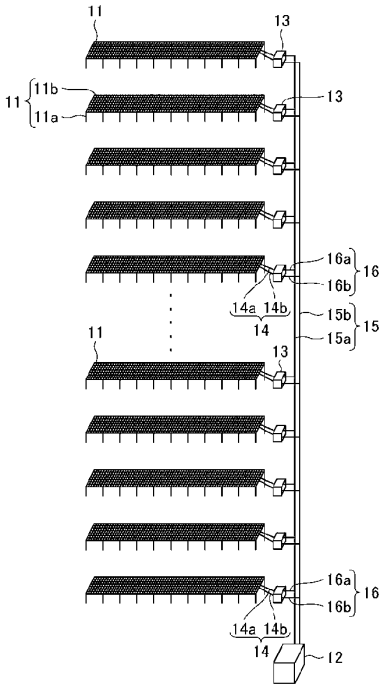
以上の説明では、本発明の太陽光発電システムをメガソーラー発電システムに適用した場合が示されているが、本発明の太陽光発電システムは、メガソーラー発電システム以外の発電システムにも適用されるものであり、よって出力はメガソーラー発電システムのレベルに限定されるものではない。

【符号の説明】

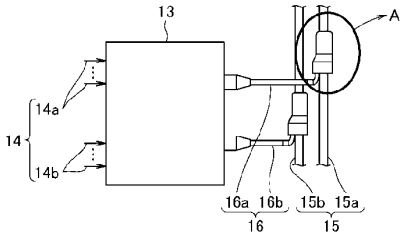
Voltage EX1003
Page 74 of 214

【００６２】
１０　太陽光発電システム
１１　太陽光パネル
１１ａ　架台
１１ｂ　パネル本体
１２　パワーコンディショナ
１３　接続ボックス
１４　パネル接続ケーブル
１４ａ　プラス極側パネル接続ケーブル
１４ａ－１　ストライプ
１４ｂ　マイナス極側パネル接続ケーブル
１４ｂ－１　ストライプ
１４－１　心線
１４－２　絶縁体
１４－３　ケーブルシース
１５　幹線ケーブル
１５ａ　プラス極側幹線ケーブル
１５ｂ　マイナス極側幹線ケーブル
１５－１　心線
１６　分岐線ケーブル
１６ａ　プラス極側分岐線ケーブル
１６ｂ　マイナス極側分岐線ケーブル
１６－１　心線
１７　分岐スリーブ
１８　樹脂モールド
１１０　太陽光発電システム
１１１　太陽光パネル
１１２　パワーコンディショナ
１１３　接続ボックス
１１７　集電ボックス
１１８　接続ケーブル
１１９　接続ケーブル

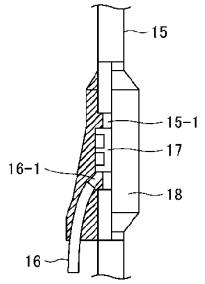
【図１】



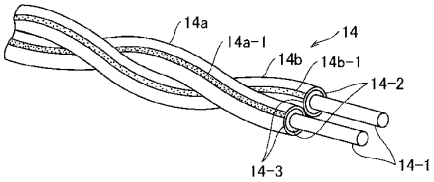
【図２】



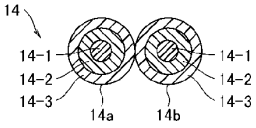
【図３】



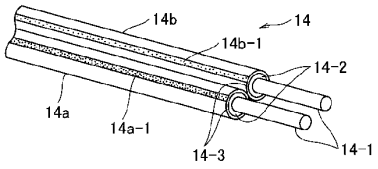
【図４】



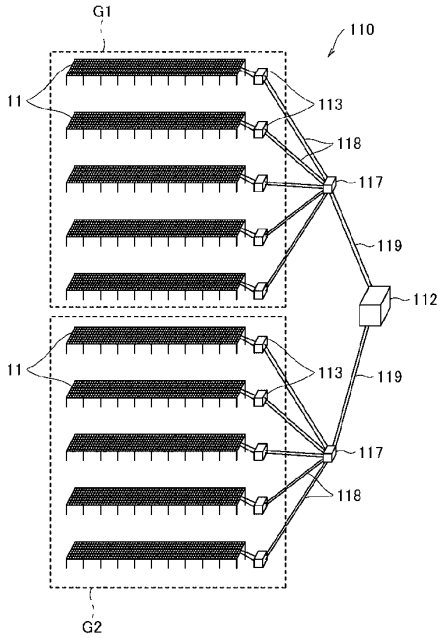
【図５】



【図６】



【図７】



From: Paul Johnson
To: Cannon, Ryan
Subject: RE: Proposed amendments for 18/523,464 and 18/341,655
Date: Wednesday, February 28, 2024 6:37:48 PM
Attachments: 18341655 (S4079.1000.1US04) Proposed Examiner"s Amendment.docx
18523464 (S4079.1000.1US05) Proposed Examiner"s Amendment.docx

CAUTION: This email has originated from a source outside of USPTO. **PLEASE CONSIDER THE SOURCE** before responding, clicking on links, or opening attachments.

Examiner Cannon,

Thanks for the proposals. See attached for my counterproposals. I incorporated all of your changes in underline and then turned on track changes to track my changes. Happy to get on a call to discuss.

Paul G. Johnson
Maschoff Brennan
435-252-1367

From: Cannon, Ryan <Ryan.Cannon@USPTO.GOV>
Sent: Wednesday, February 28, 2024 10:19 AM
To: Paul Johnson <PJohnson@mabr.com>
Subject: Proposed amendments for 18/523,464 and 18/341,655

CAUTION: External Sender

Mr. Johnson,

Please see the attached pdf for my proposals for examiner's amendment to bring the case into condition for allowance. Instant Figures 8 and 54 best represent the limitations I am attempting to capture. I will take suggestions of alternative language that represents those characteristics. This email exchange and the proposed amendments will be placed into the record of each application. Please let me know by the end of this week if you will need more time to get approval or refusal by your client.

Ryan Smith Cannon, Ph. D.
Primary Examiner, AU 1726
(571) 270-7186

Doc Code: ECOMM.AUTH/ECOMM.WTDW
Doc Description: Internet Communications Authorized/Internet Communications Authorization Withdrawn

PTO/SB/439 (11-15)

AUTHORIZATION FOR INTERNET COMMUNICATIONS IN A PATENT APPLICATION OR REQUEST TO WITHDRAW AUTHORIZATION FOR INTERNET COMMUNICATIONS

Application No.	18/523,464
Filing Date	November 29, 2023
First Named Inventor	Dean Solon
Art Unit	1726
Examiner Name	Ryan Smith Cannon
Practitioner Docket No.	S4079.10001US05

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

I. To authorize permission for Internet Communications.

☑ Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with the undersigned and practitioners in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via video conferencing, instant messaging, or electronic mail. I understand that a copy of these communications will be made of record in the application file. (MPEP 502.03)

II. To withdraw authorization for Internet Communications.

☐ The authorization given on _____, to the USPTO to communicate with the undersigned and any practitioner in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via Internet communications such as video conferencing, instant messaging, or electronic mail is hereby withdrawn. I understand that the withdrawal is effective when approved rather than when received.

I am the

☐ applicant.

☑ attorney or agent of record. Registration number 58539.

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

/Paul G. Johnson/ — Signature

February 27, 2024 — Date

Paul G. Johnson — Typed or printed name

(435) 252-1360 — Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Juristic entities must be represented by a patent practitioner (see 37 CFR 1.31, which is applicable to any paper filed on or after September 16, 2012, that is presented on behalf of a juristic entity, regardless of application filing date). Submit multiple forms if more than one signature is required, see below*.

☑ * Total of one forms are submitted.

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/523,464	**02/16/2024 04:17:54 PM Z ET**	**S4079.10001US05**

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 #	4515	FILED BY	JOLIN JOHNSON
PATENT CENTER #	64350701	FILING DATE	11/29/2023
CUSTOMER #	97149	FIRST NAMED INVENTOR	Dean SOLON
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Paul Johnson

Documents

TOTAL DOCUMENTS: 3

DOCUMENT		PAGES	DESCRIPTION	SIZE (KB)
S4079.10001US05_2024-02-16_NFOAR.pdf		12	-	249 KB
S4079.10001US05_2024-02-16_NFOAR-A....pdf	(1-1)	1	Amendment/Request for Reconsideration-After Non-Final Rejection	107 KB
S4079.10001US05_2024-02-16_NFOAR-CLM.pdf	(2-7)	6	Claims	124 KB
S4079.10001US05_2024-02-16_NFOAR-REM.pdf	(8-12)	5	Applicant Arguments/Remarks Made in an Amendment	189 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
S4079.10001US05_2024-02-16_NFOAR.pdf	F55F62094C39EA1F78113E7190A2A0FBC706C6046B27F22AC94FF456A578098E454BA1D65DA13FC31E367B2EB401282E5CBE2D768758509044EBDAE44834C15F
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S4079.10001US05_2024-02-16_NFOAR-REM.pdf	66F6BC2605D683196FDFF66BF2A66202802C715B03F42D56EBF19569EAD1E6F73A9852C981D0A76A98BDC30F6EB54065C7CF38BB1C47C7DC36F1338489F7C288

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.:	18/523,464	Art Unit 1726
Filed:	November 29, 2023	
Conf. No.:	4515	
For:	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER	
Examiner:	Ryan Smith Cannon	
Customer No.:	97149	
Attorney Docket No.:	S4079.10001US05	

RESPONSE TO OFFICE ACTION DATED JANUARY 29, 2024

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

Dear Commissioner:

In response to the Non-Final Office Action dated January 29, 2024, please consider:

AMENDMENTS TO THE CLAIMS 2

REMARKS 8

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 electrically coupling one or more drop lines to a feeder cable, the lead assembly comprising:

a feeder cable having a first diameter;

~~one or more~~ a first drop line[[s]] having a second diameter different than the first diameter, ~~each~~the first drop line ~~including a~~ terminating at a first drop line connector, the first drop line connector configured to be capable of detachable connection to a wire harness having a plurality of branches that are each configured to receive electrical power generated by a corresponding photovoltaic (PV) panel resulting in combined electrical power at the first drop line connector;

a second drop line having a third diameter different than the first diameter, the second drop line terminating at a second drop line connector; and

one or more mold structures disposed about a region of electrical interconnection between the feeder cable, the first drop line, and the ~~one or more~~second drop line[[s]], the one or more mold structures substantially sealing the region of electrical interconnection from external environmental conditions;

wherein the combined electrical power received at ~~each~~the first drop line connector is delivered to the feeder cable at the region of electrical interconnection.

2. (**Currently Amended**) The lead assembly of claim 1, wherein:

the feeder cable extends continuously through the one or more mold structures such that the feeder cable extends out of and away from the one or more mold structures in one direction and out of and away from the one or more mold structures in an opposite direction; and

the first drop line includes one end that terminates within the one or more mold structures.

3. (**Currently Amended**) The lead assembly of claim 1, wherein in the region of electrical interconnection:

the first drop line includes a section of exposed wire; and

the feeder cable includes a section of exposed wire.

4. (**Currently Amended**) The lead assembly of claim 1, wherein in the region of electrical interconnection, the first drop line is coupled to the feeder cable using at least one of a compression lug, a solder portion, a splice, or a crimp.

5. (**Original**) The lead assembly of claim 1, further comprising a feeder cable connector at an end of the feeder cable, the feeder cable connector configured to electrically couple the feeder cable to an inverter without an intervening combiner box.

6. (**Currently Amended**) The lead assembly of claim 1, wherein in the region of electrical interconnection, at least a portion of the first drop line is arranged parallel to at least a portion of the feeder cable.

7. (**Currently Amended**) The lead assembly of claim 1, wherein ~~the feeder cable has a first diameter, each of the one or more drop lines has a second diameter, and~~ the second diameter is smaller than the first diameter.

8. (**Currently Amended**) The lead assembly of claim 1, wherein ~~the one or more drop lines includes a plurality of drop lines and~~ the lead assembly is configured to combine, in the feeder cable, [[the]]combined electrical power received through the first and second drop line connectors of ~~each of the plurality of the~~ first and second drop lines and to deliver the combined ~~combined~~ electrical power to an inverter that is in electrical communication with the feeder cable.

9. (**Currently Amended**) The lead assembly of claim 1, wherein each of the ~~one or more~~first and second drop lines includes a wire of between four (4) gauge to eighteen (18) gauge.

10. (**Currently Amended**) The lead assembly of claim 1, wherein the feeder cable includes a wire of between 250 MCM to 1000 MCM.

11. (**Original**) The lead assembly of claim 1, wherein the one or more mold structures include:
an injection molded overmold that surrounds the region of electrical interconnection; or

an injection molded undermold that surrounds the region of electrical interconnection and an injection molded overmold that surrounds the injection molded undermold.

12. (**Currently Amended**) A solar power system comprising:

the lead assembly of claim 1;

a first plurality of ~~solar~~PV panels electrically coupled by ~~a first~~the wire harness to form a first solar array, the wire harness further including a first central trunk, each branch of the plurality of branches electrically coupling a different one of the first plurality of PV panels to the first central trunk; and

a second plurality of ~~solar~~PV panels electrically coupled by a second wire harness to form a second solar array, the second wire harness including a second central trunk and a second plurality of branches, each branch of the second plurality of branches electrically coupling a different one of the second plurality of PV panels to the second central trunk,

wherein:

~~the one or more drop lines includes a first drop line including a first drop line connector and a second drop line including a second drop line connector;~~

the first drop line connector connects to the first central trunk;

the first drop line connector and the first drop line electrically couple the first solar array to the feeder cable; [[and]]

the second drop line connector connects to the second central trunk; and

the second drop line connector and the second drop line electrically couple the second solar array to the feeder cable.

13-20. (**Cancelled**)

21. (**New**) The lead assembly of claim 1, wherein:

the first drop line connector connects to a first central trunk of the wire harness;

each branch of the plurality of branches of the wire harness couples a different one of a first plurality of PV panels to the first central trunk;

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

the first drop line connector and the first drop line electrically couple the first solar array to the feeder cable;

the second drop line connector connects to a second central trunk of a second wire harness;

each branch of a plurality of branches of the second wire harness couples a different one of a second plurality of PV panels to the second central trunk;

the second plurality of PV panels electrically coupled by the second wire harness form a second solar array; and

the second drop line connector and the second drop line electrically couple the second solar array to the feeder cable.

22. (**New**) A lead assembly for electrically coupling one or more drop lines to a feeder cable, the lead assembly comprising:

a feeder cable comprising a conductive core and insulation, wherein the feeder cable has a first diameter through the conductive core and insulation of the feeder cable and a current rating of 30 amps;

a drop line, wherein the drop line terminates at a drop line connector, the drop line comprises a conductive core and insulation, and the drop line has a second diameter through the conductive core and insulation of the drop line that is different than the first diameter; and

a mold structure disposed about a region of electrical interconnection between the feeder cable and the drop line, wherein the mold structure substantially seals the region of electrical interconnection from external environmental conditions,

wherein the lead assembly has a voltage rating of 600 VDC, 1000 VDC, or 1500 VDC.

23. (**New**) The lead assembly of claim 22, wherein:

the feeder cable extends continuously through the mold structure such that the feeder cable extends out of and away from the mold structure in one direction and out of and away from the mold structure in an opposite direction; and

the drop line includes one end opposite to the drop line connector that terminates within the mold structure.

24. (**New**) The lead assembly of claim 22, wherein at least one of:

in the region of electrical interconnection, the drop line is coupled to the feeder cable using at least one of a compression lug, a solder portion, a splice, or a crimp;

the lead assembly further comprises a feeder cable connector at an end of the feeder cable, the feeder cable connector configured to electrically couple the feeder cable to an inverter without an intervening combiner box; or

in the region of electrical interconnection, at least a portion of the drop line is arranged parallel to at least a portion of the feeder cable.

25. (**New**) The lead assembly of claim 22, wherein at least one of:

the second diameter of the drop line is smaller than the first diameter of the feeder cable;

the drop line includes a wire of between four (4) gauge to eighteen (18) gauge; and

the feeder cable includes a wire of between 250 MCM to 1000 MCM.

26. (**New**) The lead assembly of claim 1, wherein the mold structure includes:

an injection molded overmold that surrounds the region of electrical interconnection; or

an injection molded undermold that surrounds the region of electrical interconnection and an injection molded overmold that surrounds the injection molded undermold.

27. (**New**) The lead assembly of claim 22, wherein:

the first drop line connector connects to a first central trunk of a first wire harness;

each branch of a plurality of branches of the first wire harness couples a different one of a first plurality of photovoltaic (PV) panels to the first central trunk;

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

the first drop line connector and the first drop line electrically couple the first solar array to the feeder cable;

the second drop line connector connects to a second central trunk of a second wire harness;

each branch of a plurality of branches of the second wire harness couples a different one of a second plurality of PV panels to the second central trunk;

the second plurality of PV panels electrically coupled by the second wire harness form a second solar array; and

the second drop line connector and the second drop line electrically couple the second solar array to the feeder cable.

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

the lead assembly of claim 22;

a first plurality of photovoltaic (PV) panels electrically coupled by a first wire harness to form a first solar array, the first wire harness including a first central trunk and a first plurality of branches, each branch of the first plurality of branches electrically coupling a different one of the first plurality of PV panels to the first central trunk; and

a second plurality of PV panels electrically coupled by a second wire harness to form a second solar array, the second wire harness including a second central trunk and a second plurality of branches, each branch of the second plurality of branches electrically coupling a different one of the second plurality of PV panels to the second central trunk,

wherein:

the first drop line connector connects to the first central trunk;

the first drop line connector and the first drop line electrically couple the first solar array to the feeder cable;

the second drop line connector connects to the second central trunk; and

the second drop line connector and the second drop line electrically couple the second solar array to the feeder cable.

REMARKS

The foregoing amendment cancels claims 13-20 without prejudice; amends claims 1-4, 6-10, and 12; and adds new claims 21-28. Claims 1-13 and 21-28 are now 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.

Claim Objections

The Office Action objects to claim 8 for informalities. The amendment of claim 8 herein renders this objection moot and it is respectfully requested that it be withdrawn.

Rejections Under 35 U.S.C. §§ 102 and 103

The Office Action rejects claims 1, 2, 5, 8, and 12 under 35 U.S.C. § 102 over *Yamawaki* (US Patent No. 6,268,559).

The Office Action rejects claim 11 under 35 U.S.C. § 102 as being anticipated by, or alternatively under 35 U.S.C. § 103 as being unpatentable over, *Yamawaki* as applied to claim 1 above.

The Office Action rejects claims 3, 4, 6, 7, and 9 under 35 U.S.C. § 103 as being unpatentable over *Yamawaki* as applied to claim 1 above and further in view of *Jonczyk* (U.S. Publication No. 20100139733).

The Office Action rejects claim 10 under 35 U.S.C. § 103 as being unpatentable over *Yamawaki* as applied to claim 1 above and further in view of *Jonczyk* (US Pub. No. 20100139733).

The Office Action rejects claim 10 under 35 U.S.C. § 103 over *Yamawaki* as applied to claim 1 above in view of *Ramsey* (U.S. Publication No. 2013/0269746), supporting information is provided by *Kummer et al.* (U.S. Publication No. 2009/0300909) and *Hernandez et al.* (U.S. Publication No. 2011/0174521).

Applicant disagrees with aspects of the rejection. Nevertheless, in the interest of expediting prosecution, Applicant has amended independent claim 1 to recite, for example,

> a feeder cable having a first diameter;
> a first drop line having a second diameter different than the first diameter,
> . . .
> a second drop line having a third diameter different than the first diameter, the second drop line terminating at a second drop line connector;
> one or more mold structures disposed about a region of electrical interconnection between the feeder cable, the first drop line, and the second drop line

Support for the amendment to claim 1 is provided throughout the application as filed, including in at least Figs. 5, 7, 29, and 33 and the accompanying description, including at least page 6, line 26 to page 7, line 8 and page 8, lines 7-10. Thus, as amended, the lead assembly recited in claim 1 requires a feeder cable with a first diameter, first and second drop lines with different diameters than the first diameter, and one or more mold structures disposed about a region of electrical interconnection between the feeder cable and the first and second drop lines.

In contrast to claim 1, *Yamawaki* teaches a single-core wiring apparatus 16 (equated in the Office Action to the "lead assembly" of claim 1) that includes a trunk cable 31 (equated to the "feeder cable" of claim 1), branch cables 32 (equated to the previously recited "one or more drop lines"), and branch junctions 33 each with a molded body 33e (equated to the recited "one or more mold structures). *Yamawaki* at FIG. 8A and col. 9, line 57 to col. 10, line 19; Office Action, pages 5-6.

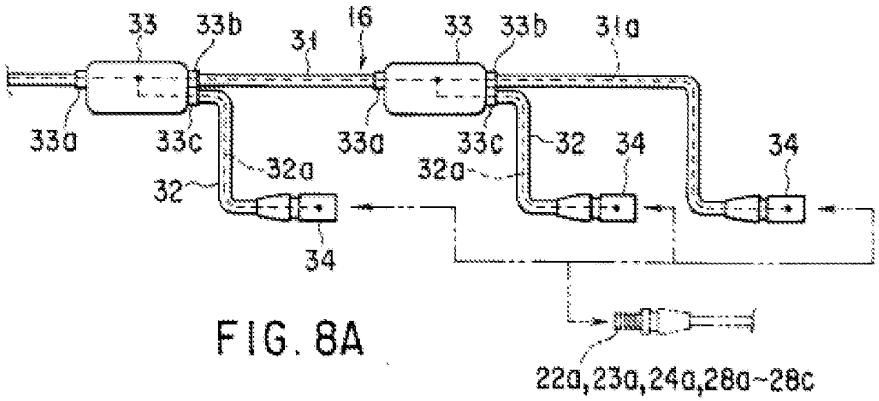


FIG. 8A

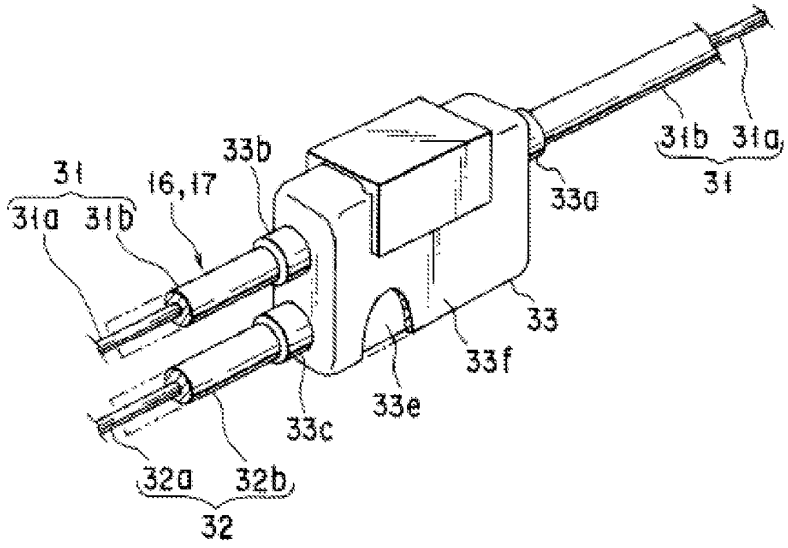


FIG. 9B

As is apparent from FIGS. 8A and 9B of *Yamawaki*, reproduced below, each of *Yamawaki's* molded bodies 33e (of branch junctions 33) couples a single branch cable 32 to the trunk cable 31. Moreover, *Yamawaki's* trunk cable 31 and branch cables 32 all appear to have the same diameter.

Because *Yamawaki's* branch cables 32 and trunk cable 31 all appear to have a same diameter, and because *Yamawaki's* wiring apparatus 16 has a one-to-one relationship between molded bodies 33e/branch junctions 33 and branch cables 32, *Yamawaki* fails to disclose "a feeder cable having a first diameter; a first drop line **having a second diameter <u>different</u> than the first**

diameter, . . . [and] **a second drop line having a third diameter different than the first diameter**" as now recited in amended claim 1.

Accordingly, the claim amendments, taken as a whole, appear to render the rejections moot. Applicant notes that portions of the claims, other than those specifically amended and/or mentioned above, may contribute to patentability. In light of the references as now understood by Applicant and the amendments made herein, claim 1 appears to be allowable. Applicant therefore respectfully requests that the rejections of claims 1-13 under 35 U.S.C. § 102 or 103 be withdrawn.

New Claims

New claim 21 depends from claim 1 and incorporates the elements thereof. As such, new claim 21 appears to be patentable over the cited references for at least the same reasons as discussed above.

New independent claim 22 includes one or more elements that are similar to elements of claim 1 discussed above. As such, new independent claim 22 appears to be patentable over the cited references for one or more of the same or similar reasons as discussed above. New claims 23-28 appear to be patentable over the cited references at least by virtue of their dependence from claim 22.

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.

CONCLUSION

In view of the foregoing, Applicant submits that the pending claims are allowable. In the event that Examiner finds remaining impediment to 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 16th day of February, 2024.

Respectfully submitted,

/Paul G. Johnson/

Paul G. Johnson
Registration No. 58,539
Attorney for Applicant
Telephone No. (435) 252-1360

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/523,464	11/29/2023	Dean SOLON	S4079.10001US05	4515

97149 7590 01/29/2024

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1389 Center Drive, Ste. 300
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Park City, UT 84098

EXAMINER
CANNON, RYAN SMITH

ART UNIT	PAPER NUMBER
1726	

NOTIFICATION DATE	DELIVERY MODE
01/29/2024	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):

bisraelsen@mabr.com
d@mabr.com

Office Action Summary	**Application No.** 18/523,464	**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 11/29/2023.

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

5a) Of the above claim(s) 13-20 is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-12 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 11/29/2023 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 1/19/2024(2).

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

4) ☐ Other: _____.

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.

DETAILED ACTION

Election/Restriction

Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-12, drawn to a solar power system, classified in H02S40/30.

II. Claims 13-20, drawn to a method of forming a lead assembly, classified in H01R43/05.

The inventions are independent or distinct, each from the other because:

Inventions II and I are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make another and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product can be made by another process, such as one in which insulation is not formed, and stripping of insulation is not required, near the region of electrical interconnection.

Restriction for examination purposes as indicated is proper because all the inventions listed in this action are independent or distinct for the reasons given above and there would be a serious search and/or examination burden if restriction were not required because one or more of the following reasons apply:

(a) the inventions have acquired a separate status in the art in view of their different classification;

(b) the inventions have acquired a separate status in the art due to their recognized divergent subject matter;

(c) the inventions require a different field of search (for example, searching different

classes/subclasses or electronic resources, or employing different search queries);

(d) the prior art applicable to one invention would not likely be applicable to another invention;

(e) the inventions are likely to raise different non-prior art issues under 35 U.S.C. 101 and/or 35 U.S.C. 112, first paragraph.

Applicant is advised that the reply to this requirement to be complete must include (i) an election of an invention to be examined even though the requirement may be traversed (37 CFR 1.143) **and (ii) identification of the claims encompassing the elected invention**.

The election of an invention may be made with or without traverse. To reserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the restriction requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable upon the elected invention.

Should applicant traverse on the ground that the inventions are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the inventions to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103 or pre-AIA 35 U.S.C. 103(a) of the other invention.

During a telephone conversation with Paul Johnson on 1/22/2024 a provisional election was made without traverse to prosecute the invention of group I, claims 1-12. Affirmation of this election must be made by applicant in replying to this Office action. Claims 13-20 withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

The examiner has required restriction between product or apparatus claims and process claims. Where applicant elects claims directed to the product/apparatus, and all product/apparatus claims are subsequently found allowable, withdrawn process claims that include all the limitations of the allowable product/apparatus claims should be considered for rejoinder. All claims directed to a nonelected process invention must include all the limitations of an allowable product/apparatus claim for that process invention to be rejoined.

In the event of rejoinder, the requirement for restriction between the product/apparatus claims and the rejoined process claims will be withdrawn, and the rejoined process claims will be fully examined for patentability in accordance with 37 CFR 1.104. Thus, to be allowable, the rejoined claims must meet all criteria for patentability including the requirements of 35 U.S.C. 101, 102, 103 and 112. Until all claims to the elected product/apparatus are found allowable, an otherwise proper restriction requirement between product/apparatus claims and process claims may be maintained. Withdrawn process claims that are not commensurate in scope with an allowable product/apparatus claim will not be rejoined. See MPEP § 821.04. Additionally, in order for rejoinder to occur, applicant is advised that the process claims should be amended during prosecution to require the limitations of the product/apparatus claims. **Failure to do so may result in no rejoinder.** Further, note that the prohibition against double patenting rejections of 35 U.S.C. 121 does not apply where the restriction requirement is withdrawn by the examiner before the patent issues. See MPEP § 804.01.

Claim Objections

Claims 8 objected to because of the following informalities: the fourth line recites "the combined combined electrical power". Appropriate correction is required.

Claim Rejections - 35 USC § 102

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis (i.e., changing from AIA to pre-AIA) for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

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, 2, 5, 8, and 12 is/are rejected under 35 U.S.C. 102(a)(1) as being anticipated by US Patent 6,268,559 to Yamawaki (included in Applicant's 1/19/2024 IDS).

Claim 1 and its dependent claims recite, for instance, that the lead assembly is for electrically coupling one or more drop lines to a feeder cable, or that the drop line connector is configured to be capable of detachable connection to a wire harness having a plurality of branches that are each configured to receive electrical power generated by a corresponding photovoltaic (PV) panel resulting in combined electrical power at the drop line connector are intended use limitations. 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 intended use limitations will be considered alongside structural limitations in the analysis.

Yamawaki teaches a lead assembly 16 for electrically coupling one or more drop lines 32 to a feeder cable 31 (Figs. 8, 9), the lead assembly comprising

- A feeder cable 31 ("trunk cable" in the text, C9/L56-C10/L16)

- One or more drop lines 32, each drop line including a drop line connector 34 (C11/L3-14), the drop line connector configured to be capable of detachable connection (C11/L27-33) to a wire harness 2 (Fig. 7, C9/L36-48) having a plurality of branches 32 that are each configured to receive electrical power generated by a corresponding photovoltaic (PV) panel M resulting in combined electrical power at the drop line connector (C7/L54-C8/L11, C8/L27-42)
- One or more mold structures 33e disposed about a region of electrical interconnection (Fig. 9A) between the feeder cable 31 and the one or more drop lines 32, the one or more mold structures substantially sealing the region of electrical interconnection from external environmental conditions (C10/L17-61, C13/L15-18)
- Wherein the combined electrical power received at each drop line connector 34 is delivered to the feeder cable 31 at the region of electrical interconnection.

Per **claim 2**, Yamawaki teaches the limitations of claim 1. The feeder cable 31 extends continuously through the one or more mold structures 33e (C10/L17-19: "A plurality of branch junctions are attached individually to longitudinally intermediate portions of the trunk cable 31.") such that the feeder cable extends out of and away from the one or more mold structures in one direction (left in Fig. 9A) and out and away from the one or more mold structures in an opposite direction (right in Fig. 9A), and the drop line 32 includes one end that terminates within the one or more mold structures.

Per **claim 5**, Yamawaki teaches the limitations of claim 1. The assembly further comprises a feeder cable connector 18 configured to electrically couple the feeder cable to an inverter (Figs. 1, 2, C7/L52-59, C8/L43-45). The reference does not teach an intervening combiner box, therefore a skilled artisan would expect the feeder cable connector to be configured to electrically couple the feeder cable to an inverter without an intervening combiner box.

Per **claim 8**, Yamawaki teaches the limitations of claim 1. The one or more drop lines 32 includes a plurality of drop lines and the lead assembly is configured to combine, in the feeder cable 31, the

combined electrical power received through the drop line connector 34 of each of the plurality of drop lines and to deliver the combined electrical power to an inverter 13 that is in electrical communication with the feeder cable (Figs. 1, 2, C7/L52-59, C8/L43-45).

Regarding claim 12, Yamawaki teaches a solar power system (Figs. 1, 2, 7) comprising

- The lead assembly of claim 1 (see rejection of claim 1 above for detailed analysis)
- A first plurality of solar panels MN (such as leftmost MN of Fig. 2) coupled by a first wire harness (27 of Fig. 7) to form a first solar array (C7/L54-C8/L5, C8/L43-C9/L2, C9/L36-48)
- A second plurality of solar panels MN (such as middle MN of Fig. 2) electrically coupled by a second wire harness (27 of Fig. 7) to form a second solar array
- Wherein
    - The one or more drop lines 32 (three unlabeled drop lines are illustrated in Fig. 2; a skilled artisan would understand that each boxed element 33 of Fig. 2 corresponds to a distinct instance of previously described structure) includes a first drop line connector 34 and a second drop line 32 including a second drop line connector 34
    - The first drop line connector 34 and the first drop line 32 electrically coupled the first solar array to the feeder cable 31 (the feeder cable is not labeled in Fig. 2)
    - The second drop line connector 34 and the second drop line 32 electrically couple the second solar array to the feeder cable 31.

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) 11 is/are rejected under 35 U.S.C. 102 as being anticipated by, or alternatively is rejected under 35 U.S.C. 103 as being unpatentable over Yamawaki as applied to claim 1 above.

Regarding claim 11, the limitation that the overmold injection molded and that the undermold are injection molded are product-by-process limitations. Yamawaki teaches that the one or more mold structures include an overmold 33f (Fig. 9B) that surrounds the region of electrical interconnection and an undermold 33e (seen in cutaway in Fig. 9B) that surrounds the undermold (C10/L33-61). The cited prior art teaches all of the positively recited structure of the claimed apparatus or product. The determination of patentability is based upon the apparatus structure itself. The patentability of a product or apparatus does not depend on its method of production or formation. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. See *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) (see MPEP § 2113).

Yamawaki teaches that the undermold and the overmold are formed of polymers/thermoplastics. Since the reference teaches the structural limitations of the instant claim, the reference is deemed to be anticipatory. In the event any differences can be shown for the product through the process of the claimed as opposed to the process of Yamawaki, such differences would have

been obvious to one of ordinary skill in the art as a routine modification of the product in the absence of a showing of unexpected results.

Claim(s) 3, 4, 6, 7, and 9 is/are rejected under 35 U.S.C. 103 as being unpatentable over Yamawaki as applied to claim 1 above, and further in view of US PGPub 2010/0139733 to Jonczyk (included in Applicant's 1/19/2024 IDS).

Regarding claim 3, Yamawaki teaches the limitations of claim 1. Yamawaki does not provide detail about the region of electrical interconnection. Jonczyk 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 electrical connection between a drop line (such as 56 of Figs. 3, 4) and a feeder cable (52) by forming a region which includes a section of exposed wire of the drop line and a section of exposed wire of the feeder cable (¶0032). The combination of familiar elements is likely to be obvious when it does no more than yield predictable results. See *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421, 82 USPQ2d 1385, 1395 – 97 (2007) (see MPEP § 2143, A.).

Regarding claim 4, Yamawaki teaches the limitations of claim 1. Yamawaki does not provide detail about the region of electrical interconnection. Jonczyk 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 electrical connection between a drop line (such as 56 of Figs. 3, 4) and a feeder cable (52) by coupling the two by using a crimp (¶0032). The combination of familiar elements is likely to be obvious when it does no more than yield predictable results. See *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421, 82 USPQ2d 1385, 1395 – 97 (2007) (see MPEP § 2143, A.).

Regarding claim 6, Yamawaki teaches the limitations of claim 1. Yamawaki does not provide detail about the region of electrical interconnection. Jonczyk 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 electrical connection between a drop line (such as 56 of Figs. 3, 4) and a feeder cable (52) by arranging at least a portion of the drop line to be parallel to at least a portion of the feeder cable in a region (region 62 of Fig. 3 shows that the two elements are parallel for the length of the crimp barrel, ¶0032). The combination of familiar elements is likely to be obvious when it does no more than yield predictable results. See *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421, 82 USPQ2d 1385, 1395 – 97 (2007) (see MPEP § 2143, A.).

Regarding claim 7, Yamawaki teaches the limitations of claim 1. Yamawaki does not provide detail about the diameter of the feeder cable or drop lines. Jonczyk 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 electrical connection between a drop line (such as 56 of Figs. 3, 4) having a second diameter smaller than a first diameter of a feeder cable (52) (¶0032). The combination of familiar elements is likely to be obvious when it does no more than yield predictable results. See *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421, 82 USPQ2d 1385, 1395 – 97 (2007) (see MPEP § 2143, A.).

Regarding claim 9, Yamawaki teaches the limitations of claim 1. Yamawaki does not provide detail about the diameter of the drop lines. Jonczyk 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 drop lines (such as 56 of Figs. 3, 4) to have a wire of 10 or 12 gauge (¶0025). The combination of familiar elements is likely to be obvious when it does no more than yield predictable results. See *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421, 82 USPQ2d 1385, 1395 – 97 (2007) (see MPEP § 2143, A.).

Claim(s) 10 is/are rejected under 35 U.S.C. 103 as being unpatentable over Yamawaki as applied to claim 1 above, and further in view of US PGPub 2013/0269746 to Ramsey (included in

Applicant's 1/19/2024 IDS). Supporting information is provided by US PGPub 2009/0300909 to Kummer and US PGPub 2011/0174521 to Hernandez (both included in Applicant's 1/19/2024 IDS).

Regarding claim 10, Yamawaki teaches the limitations of claim 1. Yamawaki does not provide detail about the diameter of the feeder cable. ¶0023 of Kummer and Table 1 of Hernandez teach that 1000 MCM wire has as diameter of 28.39 mm. Ramsey teaches that the gauge of a wire can be varied according to the current being carried on the wire (¶0005, 0008, 0009, 0025). 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 vary the size of the wire that forms the feeder cable according to the current being carried on the wire.

"[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). The discovery of an optimum value of a known result effective variable, without producing any new or unexpected results, is within the ambit of a person of ordinary skill in the art. See *In re Boesch*, 205 USPQ 215 (CCPA 1980) (see MPEP § 2144.05, II.).

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 PST.

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

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)				Application Number	18523464
				Filing Date	2023-11-29
				First Named Inventor	Dean SOLON
				Art Unit	OPAP
				Examiner Name	Unassigned
Sheet	1	Of	6	Attorney Docket Number	S4079.10001US05

U.S. PATENTS

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/R.S.C./	18.	202256574	CN		2012-05-30	DONGGUAN NEW JINYANGGUANG ELECTRICAL TECHNOLOGY CO LTD		
/R.S.C./	19.	202258411	CN		2012-05-30	CHINA METALLURG MINING AN SHAN METALLURG DESIGN		
/R.S.C./	20.	102568970	CN		2012-07-11	DONGGUAN SLOCABLE PHOTOVOLTAIC TECHNOLOGY CO LTD		
/R.S.C./	21.	202434452	CN		2012-09-12	DONGGUAN SLOCABLE PHOTOVOLTAIC TECHNOLOGY CO LTD		
/R.S.C./	22.	202524026	CN		2012-11-07	SHANGHAI SHENGHUA ELECTRICAL CO LTD		
/R.S.C./	23.	202758911	CN		2013-02-27	NEWSUN PV TECHNOLOGY CO LTD		
/R.S.C./	24.	202797033	CN		2013-03-13	JIANGSU JIUDING SYSTEM CO LTD		
/R.S.C./	25.	103000468	CN		2013-03-27	SHITEGE ASIA PACIFIC INVEST CO LTD		
/R.S.C./	26.	202977351	CN		2013-06-05	STEGER YATAI INVEST CO LTD		
/R.S.C./	27.	103165235	CN		2013-06-19	SHANGHAI GAOQIAO CABLE FACTORY CO LTD		
/R.S.C./	28.	203038709	CN		2013-07-03	WUXI JIANGNAN CABLE CO LTD		
/R.S.C./	29.	203118602	CN		2013-08-07	CHENGDU KANGDA CABLE CO LTD		
/R.S.C./	30.	104021860	CN		2014-09-03	FAR EAST CABLE CO LTD		
/R.S.C./	31.	203967369	CN		2014-11-26	TIANJIN 609 CABLE CO LTD		
/R.S.C./	32.	104464920	CN		2015-03-25	BAOSHENG SCI & TECH INNOVATION		

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)				Application Number	18523464
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/R.S.C./	33.	204463897	CN		2015-07-08	KUNMING DUOBAO CABLE CO LTD		
/R.S.C./	34.	204760094	CN		2015-11-11	SHANGHAI ZABLE CABLE CO LTD		
/R.S.C./	35.	6940839	DE		1971-04-01	BORGMANN KG W		
/R.S.C./	36.	202006007613	DE		2006-08-17	BECK MANFRED		
/R.S.C./	37.	102006032275	DE		2008-01-03	TYCO ELECTRONICS AMP GMBH		
/R.S.C./	38.	102008027189	DE		2009-01-15	PFEFFER ROLAND		
/R.S.C./	39.	102012218366	DE		2014-02-06	ENEXTRA GMBH		
/R.S.C./	40.	102013106255	DE		2014-12-18	PHOENIX CONTACT GMBH & CO		
/R.S.C./	41.	2287915	EP		2011-02-23	GEN ELECTRIC		
/R.S.C./	42.	2495825	EP		2012-09-05	LAPP ENGINEERING & CO		
/R.S.C./	43.	2645425	EP		2013-10-02	GEN ELECTRIC		
/R.S.C./	44.	2983361	FR		2013-05-31	MICHEL et al.		
/R.S.C./	45.	59-194327	JP		1984-11-05	KINPOU DENKI KK		
/R.S.C./	46.	60-236430	JP		1985-11-25	NIPPON KOUATSU ELECTRIC CO		
/R.S.C./	47.	2-23016	JP		1990-01-25	MITSUBISHI CABLE INDUSTRIES LTD		
/R.S.C./	48.	6-84410	JP		1994-03-25	TOYOKUNI DENSEN KK		
/R.S.C./	49.	3004630	JP		1994-11-22	KYOUICHI		
/R.S.C./	50.	8-289450	JP		1996-11-01	CHUBU ELECTRIC POWER		
/R.S.C./	51.	8-289451	JP		1996-11-01	CHUBU ELECTRIC POWER		
/R.S.C./	52.	9-245533	JP		1997-09-19	FUJITA CORP		
/R.S.C./	53.	2000004516	JP		2000-01-07	SUMITOMO ELECTRIC INDUSTRIES		
/R.S.C./	54.	2000-348836	JP		2000-12-15	SUMITOMO WIRING SYSTEMS		
/R.S.C./	55.	2003031834	JP		2003-01-31	KUBOTA KK		

EXAMINER SIGNATURE

Examiner Signature	/RYAN S CANNON/	Date Considered	01/22/2024

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OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Paul G. Johnson/	Date (YYYY-MM-DD)	2024-01-19
Name/Print	Paul G. Johnson	Registration Number	58539

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

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

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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/R.S.C./	1.	2003-77584	JP		2003-03-14	YUKITA ELECTRIC WIRE CO LTD		
/R.S.C./	2.	2003-293536	JP		2003-10-15	SEKISUI CHEMICAL CO LTD		
/R.S.C./	3.	2005-39981	JP		2005-02-10	TOYOKUNI DENSEN KK		
/R.S.C./	4.	4044484	JP		2008-02-06	KANEGAFUCHI CHEMICAL IND		
/R.S.C./	5.	4080663	JP		2008-04-23	YUKITA ELECTRIC WIRE CO LTD		
/R.S.C./	6.	2008166492	JP		2008-07-17	SHOWA SHELL SEKIYU		
/R.S.C./	7.	2008187814	JP		2008-08-14	CHUGOKU ELECTRIC POWER		
/R.S.C./	8.	4169490	JP		2008-10-22	KUBOTA KK		
/R.S.C./	9.	4-171359	JP		2008-10-22	TOYOKUNI DENSEN KK		
/R.S.C./	10.	4606774	JP		2011-01-05	YAZAKI CORP		
/R.S.C./	11.	4730794	JP		2011-07-20	SMK KK		
/R.S.C./	12.	2011-253739	JP		2011-12-15	NIPPON KOUATSU ELECTRIC CO LTD		
/R.S.C./	13.	2012-115043	JP		2012-06-14	SUMITOMO WIRING SYSTEMS		
/R.S.C./	14.	5384073	JP		2014-01-08	YAZAKI CORP		
/R.S.C./	15.	2014-50227	JP		2014-03-17	NISHI NIPPON ELEC WIRE & CABLE		
/R.S.C./	16.	2014-229639	JP		2014-12-08	YUNIKON DENSHI KK		
/R.S.C./	17.	2015-60813	JP		2015-03-30	HOSIDEN CORP		
/R.S.C./	18.	2015-133822	JP		2015-07-23	AUTO NETWORK		
/R.S.C./	19.	10-0329882	KR		2003-10-11	PARK		
/R.S.C./	20.	200446192	KR		2009-10-08	LEE		
/R.S.C./	21.	200455299	KR		2011-08-29	LEE		
/R.S.C./	22.	10-1428689	KR		2014-08-11	YANG SEUNG ILL		
/R.S.C./	23.	2011013979	MX		2012-06-21	COOPER TECHNOLOGIES CO		
/R.S.C./	24.	84/00078	WO		1984-01-05	RAYCHEM CORP		
/R.S.C./	25.	90/11608	WO		1990-10-04	SKYLINE HOLDING AG		
/R.S.C./	26.	01/09990	WO		2001-02-08	DRAKA UK LIMITED		
/R.S.C./	27.	2010/124614	WO		2010-11-04	BYD CO LTD		
/R.S.C./	28.	2011/076955	WO		2011-06-30	PREFABRICADOS UNIBLOK S L U		
/R.S.C./	29.	2012/023748	WO		2012-02-23	MS TECHVISION CO., LTD		
/R.S.C./	30.	2012/166412	WO		2012-06-12	COOPER TECHNOLOGIES CO		

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/R.S.C./	31.	2012/083785	WO		2012-06-28	DONGGUAN ANWELL DIGITAL MACHINERY CO., LTD.		

NON PATENT LITERATURE DOCUMENTS

Examiner Initial*	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, page(s), volume-issue number(s), publisher, city and/or country where published	T[5]
/R.S.C./	1.	Balance of Systems Product Catalog 2012, Shoals Technologies Group	
/R.S.C./	2.	Balance of Systems Product Catalog 2013, Shoals Technologies Group	
/R.S.C./	3.	Definition of "working voltage", retrieved from https://encyclopedia2.thefreedictionary.com/voltage+rating on September 18, 2018	
/R.S.C./	4.	Enphase Engage Cable and Accessories Installation Manual, Enphase Energy, 2011	
/R.S.C./	5.	HelioFuse Datasheet, Amphenol	
/R.S.C./	6.	Helukabel “Cable systems for photovoltaic installations” and product disclosures, Helukabel, 2011	
/R.S.C./	7.	Jurchen Technology - Components for photovoltaic systems, retrieved from http://web.archive.org/web/20120428223249/http://www.jurchen-technology.com/ on 2012	
/R.S.C./	8.	Jurchen Technology - Components for photovoltaic systems, retrieved from http://web.archive.org/web/20140208150811/ht tp://www.jurchen-technology.com/ on October 9, 2023	
/R.S.C./	9.	Jurchen Technology “DC Cabling Perfectly Connected”, 2014	
/R.S.C./	10.	PRNewswire, Molded In-line Fuse From Amphenol Protects Against Ground Fault Damage, published May 4, 2012, retrieved December 22, 2022 from: https://www.prnewswire.c,om/news-releasestmolded-in-line-fuse-from-amphenol-3rotects-against-ground-fault-damage-150186315.html	
/R.S.C./	11.	Radox® Solar, Huber+Suhner Group, 2011 Ed	

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/R.S.C./	12.	Shoals Technologies Group In-Line Fuses, 2010	
/R.S.C./	13.	Solar Line - Photovoltaic interconnection system, Amphenol industrial solar technologies, https://www.amphenol-industrial.com, November 2012	
/R.S.C./	14.	SUNBOLTS Inline Fuse S417 Fuse Cable / Fuse Holder UL 1500V, https://www.bizlinktech.com/products, 2013	
/R.S.C./	15.	Sunnector Solar Assemblies & Harnesses, Cooper Interconnect, 2011	
/R.S.C./	16.	"Wire Gauges - Current Ratings", retrieved from https://web.archive.org/web/20140715051530/www.engineeringtoolbox.conn/ wire-gauges-d_419.html on June 6, 2019, Year: 2015	
/R.S.C./	17.	The World of Lapp – Products for photovoltaic 2012, Lapp Group, 2012	

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Signature	/Paul G. Johnson/	Date (YYYY-MM-DD)	2024-01-19
Name/Print	Paul G. Johnson	Registration Number	58539

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(19) 대한민국특허청(KR)
(12) 등록실용신안공보(Y1)

(45) 공고일자 2009년10월08일
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H01H 85/20 (2006.01) *H01H 85/02* (2006.01)
(21) 출원번호 20-2007-0010579
(22) 출원일자 2007년06월27일
심사청구일자 2007년06월27일
(65) 공개번호 20-2008-0006703
(43) 공개일자 2008년12월31일
(56) 선행기술조사문헌
KR2019990015282 U*
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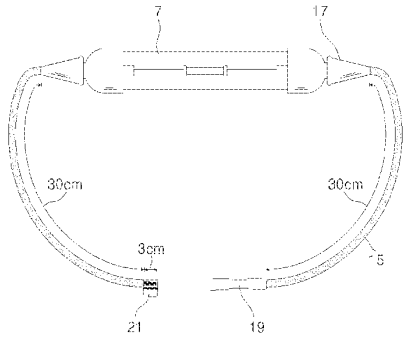
(57) 요 약

본 고안은 전선 퓨즈의 압축단자와 전선을 결합하여 일체화된 형태로 제작된 압축단자 개선형 전선퓨즈에 관한 것이다.

본 고안에 따른 압축단자 개선형 전선퓨즈는 가용체와, 상기 가용체 양단에 접속된 단자와, 상기 단자와 가용체를 내장하는 유리관과, 상기 유리관을 내장하는 외통과, 상기 외통의 양끝단에 결합되며 중앙부에 홀이 형성된 절연캡과, 상기 절연캡에 위치한 홀을 통해 노출되며 상기 단자와 연결된 압축단자와, 상기 압축단자와 연결된 전선을 포함하여 이루어지는 것을 특징으로 한다.

따라서 보수 공사, 전주이설 및 인입 전선 교체시 전선퓨즈의 재사용이 가능하며 인입 전선과 전선퓨즈의 불량한 결합으로 발생되는 고장을 막을 수 있다.

대 표 도 - 도2



실용신안 등록청구의 범위

청구항 1

양측에 단자가 접속된 가용체 및 일측이 상기 단자에 연결되고, 타측이 전선에 연결되는 압축단자를 포함하는 전선퓨즈에 있어서,

상기 압축단자의 선단에 상기 전선을 끼워넣어서 압축기에 의하여 미리 압축 결합된 상태로 제작되어, 상기 압축단자와 연결된 상기 전선을 전주상의 전선과 연결하여 사용하는 것을 특징으로 하는 압축단자 개선형 전선퓨즈.

청구항 2

삭제

청구항 3

청구항 1에 있어서,

상기 전선의 말단에는 전선 사이를 연결하기 위한 슬리브로 된 연결부가 형성된 것을 특징으로 하는 압축단자 개선형 전선퓨즈.

청구항 4

삭제

명 세 서

고안의 상세한 설명

고안의 목적

고안이 속하는 기술 및 그 분야의 종래기술

<7> 본 고안은 압축단자 개선형 전선퓨즈에 관한 것으로, 더욱 상세하게는 양단에 각기 구비된 압축단자에 의해 양단의 각 전선이 압축되어 결합된 전선퓨즈에 관한 것이다.

<8> 일반적으로 전기 공사는 전주의 상부 측에 변압기를 설치하여 감압하고 과 전력 공급으로 인한 단락사고를 방지하는 보호장치를 설치하여 수용가에 전기를 공급 한다. 이때 수용가 측의 보호를 목적으로 수용가 측의 인입 전선에 전선퓨즈를 장착한다. 따라서 인입 전선에 연결된 전선퓨즈에 과전류가 흐르게 되면 전선퓨즈 속의 가용체가 녹아 끊어져 전류를 차단한다.

<9> 이와 같은 전선퓨즈를 설치하기 위해서는 전선퓨즈 말단에 돌출된 결합부위 내부에 형성된 홈에 인입 전선을 삽입 후 결합부위를 외부에서 압착펜치 또는 Y-35등의 압착 공구를 이용해 압착하여 인입 전선을 고정하게 된다. 이때, 압착작업시 압착공구를 휴대하지 않았을 경우, 일반펜치 등의 부적절한 공구를 사용하여 적당히 시공하게 된다.

<10> 따라서 전선퓨즈의 결합부위에 인입 전선이 완전히 압착되지 않으며 이러한 틈틈 부분을 통해 수분이 침투하여 부식되거나 파손되어 수명이 짧아지며, 압착시 전선퓨즈와 인입 전선에 손상을 주는 경우 인입선 사고가 발생된다.

<11> 또한, 전선퓨즈 결합부위와 인입 전선을 현장에서 직접 결합하고 있기 때문에 전공 개개인의 기술에 따라 전력선과 인입 전선이 연결된 전선 퓨즈의 연결 길이가 상이하며 이로 인해 보수 공사 및 지장주 공사로 인한 전주 이설시 재사용이 불가능하여 많은 경제적 손실이 발생하게 되는 문제점이 있다.

고안이 이루고자 하는 기술적 과제

<12> 본 고안은 이와 같은 종래 기술의 결점을 해결하기 위하여 안출한 것으로, 각기 구비된 압축 단자에 의해 양단의 각 전선이 압축되어 결합된 개선형 전선 퓨즈를 제공하는데 그 목적이 있다.

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고안의 구성 및 작용

<13> 이와 같은 목적을 달성하기 위하여,

<14> 본 고안의 일 형태에 따르면, 가용체; 상기 가용체 양단에 접속된 단자; 상기 단자와 가용체를 내장하는 유리관; 상기 유리관을 내장하는 외통; 상기 외통의 양끝단에 결합되며 중앙부에 홀이 형성된 절연캡; 상기 절연캡에 위치한 홀을 통해 노출되며 상기 단자와 연결된 압축단자; 상기 압축단자와 연결된 전선을 포함하여 이루어지는 것을 특징으로 한다.

<15> 상기 전선의 길이는 20㎝~40㎝인 것이 바람직하다.

<16> 상기 전선의 말단에 연결부가 형성된 것이 좋다.

<17> 상기 연결부는 슬리브인 것이 바람직하다.

<18> 이하 본 고안의 바람직한 실시 예에 대하여 첨부된 도면을 참조하여 설명하기로 한다.

<19> 도 1은 본 고안에 따른 압축단자 개선형 전선퓨즈의 종단면도로써 가용체(1), 단자(3), 유리관(5), 외통(7), 절연캡(9), 압축단자(11), 단자 커버(13), 전선(15), 단자 보호관(17)으로 구성된다.

<20> 동 도면에 있어서, 가용체(1)는 바(Bar)형태로 양끝단이 단자(3)와 연결되어 고정되며 저융점 양도체로 형성된다. 저압 인입 전선을 통해 흐르는 전류가 가용체(1)를 거쳐 타단에 연결된 저압 인입 전선으로 통전하게 된다. 따라서, 과전류가 흐르게 되면 가용체(1)가 용단 되어 수용가를 안전하게 보호하게 된다.

<21> 단자(3)는 상기 가용체(1)의 일단에 각각 전기적으로 접속되며 타단은 압축단자(11)와 연결되어 가용체(1)를 고정하는 전기 전도성이 좋은 금속으로 형성된다.

<22> 유리관(5)은 내부에 상기 가용체(1)와 상기 단자(3)가 삽입되어 내장되는 원형관의 형태로 내열강화 유리재로 형성되어 가용체(1)를 보호하게 된다.

<23> 외통(7)은 상기 유리관(5)의 외주보다 크게 형성된 원형관의 형태로 외통(7) 내부로 유리관(5)이 내장되어 충격으로부터 유리관(5)을 보호하게 된다. 이러한 외통(7)은 외부에서 가용체(1)의 상태를 점검할 수 있도록 투명한 수지로 형성된다.

<24> 절연캡(9)은 상기 외통(7)과 유리관(5)의 양끝단에 위치하여 결합 되며 중앙부에 홀이 형성된다. 따라서 외통(7)과 유리관(5)의 위치를 고정하며 가용체(1)를 지지하는 역할을 한다.

<25> 압축단자(11)는 상기 절연캡(9)에 위치한 중앙부의 홀을 통하여 밖으로 노출되는 금속관으로 일측이 단자(3)와 각각 전기적으로 연결된다. 따라서 압축단자(11)의 재질은 전도성이 좋은 알루미늄이나 구리가 사용된다.

<26> 단자 커버(13)는 상기 외통(7)의 양측부를 둘러싸고 있으며 중앙부에 압축단자(11)를 노출시키며 압축단자의 홀과 대응되는 홀이 형성된다. 이러한 단자 커버(13)는 플라스틱과 같은 유연한 재질로 형성되어 이물질이나 습기로부터 보호하는 역할을 한다.

<27> 전선(15)은 상기 단자 커버(13)의 홀을 통해 압축단자(11)의 홀에 인입되며 20㎝~40㎝ 정도의 길이로 형성된다. 또한, 전선(15)의 말단에 2㎝~4㎝의 길이로 전선(15)의 피복이 벗겨져 있다.

<28> 단자 보호관(17)은 상기 전선(15)과 압축단자(11) 사이에 원추형의 고무 등과 같은 유연성 있는 재질로 이루어진다. 따라서 압축단자(11)와 전선(15)의 연결부위를 감싸고 보호하게 된다.

<29> 도 2는 본 고안에 따른 압축단자 개선형 전선퓨즈의 외형도이며, 도 3은 본 고안의 일 실시 예에 따른 압축단자 개선형 전선퓨즈를 전주에 설치한 도면이다.

<30> 도 2 및 도 3을 참조하면, 전선퓨즈는 배전 선로에서 갈라져서 직접 수용가와 연결되는 부분의 전선인 저압 인입 전선의 굵기에 따라서 각각 다른 전선퓨즈를 사용하게 된다. 따라서 각각의 전선퓨즈의 용량에 맞는 규격별 전선을 사용하게 된다. 각 규격별 전선은 DV2.6㎜, 3.2㎜, OW22㎟, 38㎟, 60㎟, 100㎟의 전선이 사용된다. 이러한 규격별 전선은 제품 생산시에 전선퓨즈 양단에 위치한 압축단자(11)에 전선(15)을 꺼워 넣은 후 압축단자(11)를 압축기로 압축하여 전선(15)과 전선퓨즈를 결합하여 사용한다. 이렇게 결합된 전선(15)은 전선퓨즈 양단에 20㎝ ~40㎝ 정도의 길이로 형성된다. 그리고 전선(15)의 말단에 2㎝~4㎝ 정도 전선 피복이 벗겨져 삽입되는 연결부(19, 21)가 형성된다. 여기서 연결부(19, 21)는 전선을 압축 결합하는 것으로 알루미늄, 구리 및

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철과 같은 금속으로 형성된다.

<31> 연결부(19, 21)는 슬리브로 구성될 수 있고, 전선(15)과 인입 전선과의 연결을 손쉽게 할 수 있게 한다. 이렇게 전선(15)을 연결한 후 단자 커버(13)와 연결되게 단자 보호관(17)을 끼워 물린 후, 전주측의 저압 간선과 전선퓨즈의 전원측은 슬리브(21)를 이용해서 압착하고, 전선퓨즈의 부하측과 인입 전선은 일체형 슬리브(19)를 이용하여 압축해서 연결하면 양단이 연결되어 수용가측을 과전류로부터 보호하게 된다.

<32> 이상에서 설명한 본 고안의 상세한 설명에서는 본 고안의 바람직한 실시 예를 참조하여 설명하였지만, 해당 기술 분야의 숙련된 당업자 또는 해당 기술분야에 통상의 지식을 갖는 자라면 후술 될 실용신안등록청구범위에 기재된 본 고안의 사상 및 기술 영역으로부터 벗어나기 않는 범위 내에서 본 고안을 다양하게 수정 및 변경시킬 수 있음을 이해할 수 있을 것이다.

고안의 효과

<33> 상술한 바와 같이, 본 고안에 따른 압축단자 개선형 전선퓨즈는 제품 생산시에 압축단자와 전선이 결합되어 출하되므로 시공시 전주에서 이루어지는 인입 전선과 전선퓨즈와의 불량한 결합으로 발생하는 불량을 제거하며 전선퓨즈의 설치작업 시간을 단축시키는 효과가 있다. 또한, 전선퓨즈 및 인입 전선에 손상을 입혀 발생하는 인입 전선 사고를 방지하여 전기 품질 향상은 물론 전선퓨즈의 재사용이 가능하여 막대한 경제적 손실의 발생을 방지하는 효과가 있다.

도면의 간단한 설명

<1> 도 1은 본 고안에 따른 압축단자 개선형 전선퓨즈의 종단면도,

<2> 도 2는 본 고안에 따른 압축단자 개선형 전선퓨즈의 외형도,

<3> 도 3은 본 고안의 일 실시 예에 따른 압축단자 개선형 전선퓨즈를 전주에 설치한 도면.

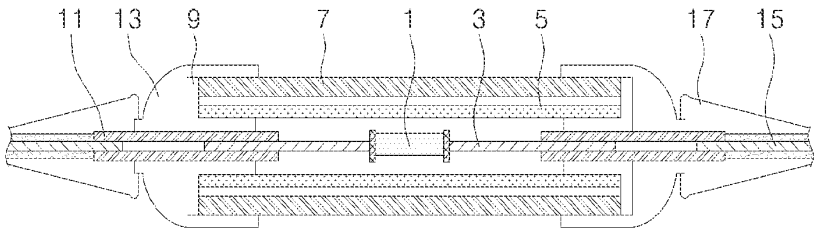
<4> <도면의 주요 부분에 대한 부호 설명>

<5> 1: 가용체 11: 압축단자

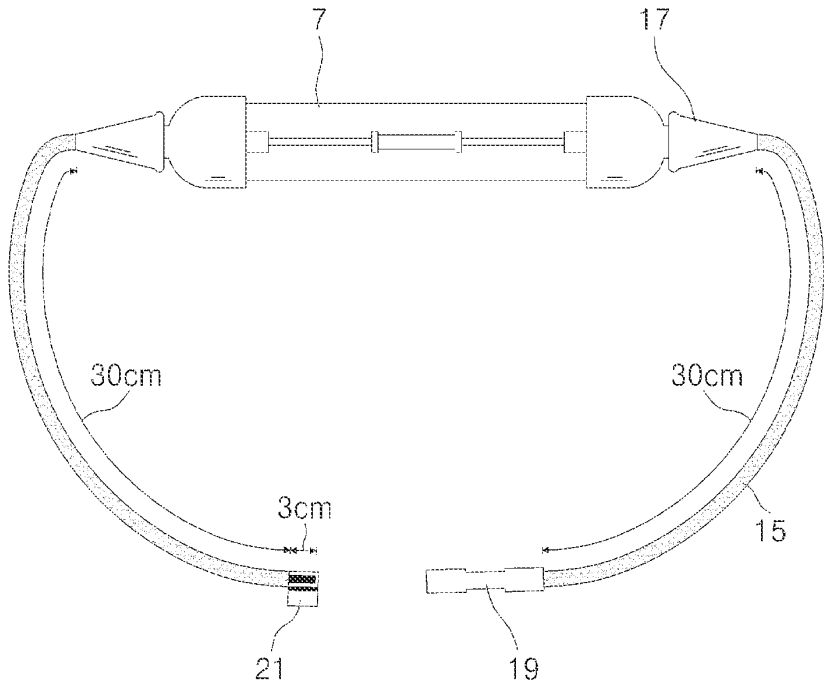
<6> 15: 전선 19, 21: 연결부

도면

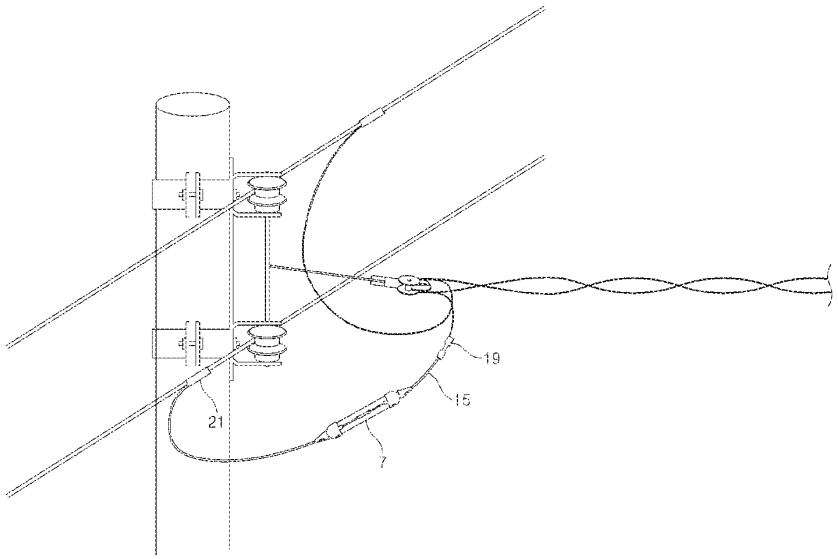
도면1



도면2



도면3



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ABSTRACT KR200800067703U

11 This invention relates to an improved compression terminal wire fuse manufactured in an integrated form by combining the compression terminal of the wire fuse and the wire. The compressed terminal improved wire fuse according to the present invention includes a fusible body, a terminal connected to both ends of the fusible body, a glass tube containing the terminal and the fusible body, an external tube containing the glass tube, and both ends of the external tube. It is characterized by comprising an insulating cap that is coupled and has a hole formed in the center, a compression terminal exposed through a hole located in the insulating cap and connected to the terminal, and a wire connected to the compression terminal. Therefore, the wire fuse can be reused during repair work, pole relocation, and incoming wire replacement, and failures caused by poor combination of the incoming wire and wire fuse can be prevented.

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)					
				Application Number	18523464
				Filing Date	2023-11-29
				First Named Inventor	Dean SOLON
				Art Unit	OPAP
				Examiner Name	Unassigned
Sheet	1	Of	4	Attorney Docket Number	S4079.10001US05

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, where relevant passages or Relevant Figures Appear	T[5]
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Sheet	2	Of	4	Attorney Docket Number	S4079.10001US05

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, where relevant passages or Relevant Figures Appear	T[5]
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Examiner Initial*	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, page(s), volume-issue number(s), publisher, city and/or country where published	T[5]
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				First Named Inventor	Dean SOLON
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Sheet	3	Of	4	Attorney Docket Number	S4079.10001US05

NON PATENT LITERATURE DOCUMENTS			
Examiner Initial*	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, page(s), volume-issue number(s), publisher, city and/or country where published	T[5]
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EXAMINER SIGNATURE			
Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)				Application Number	18523464
				Filing Date	2023-11-29
				First Named Inventor	Dean SOLON
				Art Unit	OPAP
				Examiner Name	Unassigned
Sheet	4	Of	4	Attorney Docket Number	S4079.10001US05

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Paul G. Johnson/	Date (YYYY-MM-DD)	2024-01-19
Name/Print	Paul G. Johnson	Registration Number	58539

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

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3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

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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.

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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 #
18/523,464	**01/19/2024 06:36:16 PM Z ET**	**S4079.10001US05**

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 #	4515	FILED BY	JOLIN JOHNSON
PATENT CENTER #	64007941	FILING DATE	11/29/2023
CUSTOMER #	97149	FIRST NAMED INVENTOR	Dean SOLON
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Paul Johnson

Documents

TOTAL DOCUMENTS: 56

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
S4079.10001US05_IDS-1_01-19-2024.pdf	7	Information Disclosure Statement (IDS) Form (SB08)	532 KB
Warning: This is not a USPTO supplied IDS fillable form. Data in the form cannot be automatically loaded to other USPTO systems.			
CN2336459Y.pdf	7	Foreign Reference	192 KB
CN2411542Y.pdf	7	Foreign Reference	538 KB
CN1395056A.pdf	11	Foreign Reference	1075 KB
CN2562350Y.pdf	7	Foreign Reference	403 KB

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CN201134283Y.pdf	11	Foreign Reference	710 KB
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Digest

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CN203967369U.pdf	52DF599123B292CB244AF3F2FEEF4A53ADC587A753DD342B40B80BD6DF165178688F4BE9923B1D71BD5AF562856E83AFB2AD4890BF323E39974CB000F89AC844
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CN204463897U.pdf	95DEE9BFA9856E91202A734D86F6559FCB674026198936CDB5E3D82929CE614A4FEEB60807192E250EA647469D59F75F234D2544AEE8629167D5FD165D91CC83
CN204760094U.pdf	E6B8E0706FCF0E8EEA98156F5204522D47B0265236453 4D80587ED6539A2445E564E283307F803698BF201820ABACAC9ED32F609F02DFF89AA0152E9458DF2D
DE6940839U.pdf	20C788D088DC0A89B06FE115B1CCD712F3EC6C467A850EF13CB3D646B889872EEBAD03BA65B137A792CD9197434D6A779D98364BA45E4F64F4D59D61D79B53EB
DE20200600761 3U1.pdf	469250A56D906FBBAC8F8544B71725ACB99AB2BC587E13320B56E85A64CE2E5B7F0A4AAB0EDC491D48D42B9404BFA5C9A14DFC32AA87DF1F8D4297EA4D91DCBE
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EP2495825A1.pdf	C34980AF33F8F41FECC4B0A26460AD366E00E5E03B61DE9E68F1A7C977E2F852573826 5D5FB3EE9CDAF89B878AD384480989DB3E64E98EFFB2F7464A9B1B2764

EP2645425A1.pdf	3D64D031845DCBF1BE0EA0673C167DCA85EA94A6905F76BD4E3E0E486D69A8DAC0875D0A27FA757B5F0BD067BF1F20407FC9755931F8D4DF4496717E0878C4C9
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JP2000-348836A.pdf	D49DE80E0343C7459D00A2EFEE5B63EF946A87D63FB65FEB505A20C99D5BBD340162269012241 4E85959305FB6776310519C53173979694E1D5BFF5A63EF1A40
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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.

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)				Application Number	18523464
				Filing Date	2023-11-29
				First Named Inventor	Dean SOLON
				Art Unit	OPAP
				Examiner Name	Unassigned
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Examiner Signature		Date Considered	

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CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Paul G. Johnson/	Date (YYYY-MM-DD)	2024-01-19
Name/Print	Paul G. Johnson	Registration Number	58539

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

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3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

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.

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United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/523,464	11/29/2023	Dean SOLON	S4079.10001US05	4515

97149 7590 01/09/2024

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

EXAMINER
CENTRAL, DOCKET

ART UNIT	PAPER NUMBER
OPAP	

NOTIFICATION DATE	DELIVERY MODE
01/09/2024	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):

bisraelsen@mabr.com
d@mabr.com

Decision Granting Request for Prioritized Examination (Track I)	**Application No.** 18/523,464	**Applicant(s)** SOLON, Dean	
	Examiner CHERYL P GIBSON BAYLOR	**Art Unit** OPET	**AIA (FITF) Status** Yes

1. THE REQUEST FILED 29 November 2023 IS **GRANTED** .

The above-identified application has met the requirements for prioritized examination

A. ☑ for an original nonprovisional application (Track I).
B. ☐ for an application undergoing continued examination (RCE).

2. **The above-identified application will undergo prioritized examination**. The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:

A. filing a **petition for extension of time** to extend the time period for filing a reply;

B. filing an **amendment to amend the application to contain more than four independent claims, more than thirty total claims** , or a multiple dependent claim;

C. filing a **request for continued examination** ;

D. filing a notice of appeal;

E. filing a request for suspension of action;

F. mailing of a notice of allowance;

G. mailing of a final Office action;

H. completion of examination as defined in 37 CFR 41.102; or

I. abandonment of the application.

Telephone inquiries with regard to this decision should be directed to CHERYL GIBSON BAYLOR at (571)272-3213. In his/her absence, calls may be directed to Petition Help Desk at (571) 272-3282.

/CHERYL GIBSON BAYLOR/ Paralegal Specialist, OPET	

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
18/523,464	11/29/2023		1820	S4079.10001US05	20	2

CONFIRMATION NO. 4515

FILING RECEIPT

97149
Maschoff Brennan
1389 Center Drive, Ste. 300
Suite 300
Park City, UT 84098

OC000000065801446

Date Mailed: 12/14/2023

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;

Power of Attorney: The patent practitioners associated with Customer Number 97149

Domestic Priority data as claimed by applicant

This application is a CON of 18/341,655 06/26/2023
which is a CON of 17/301,609 04/08/2021 PAT 11,689,153
which is a CON of 14/849,458 09/09/2015 PAT 10,992,254
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

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

If Required, Foreign Filing License Granted: 12/13/2023
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 18/523,464**
Projected Publication Date: 03/21/2024
Non-Publication Request: No
Early Publication Request: No
Title

LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

Preliminary Class

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.

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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).

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 18/523,464

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			N/A	320
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	700
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	800
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	* 0			OR	x =	0
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*				x =	0
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
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1820

APPLICATION AS AMENDED - PART II

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

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

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

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Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office

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Kathi Vidal

Kathi Vidal
Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office

Derrick Brent
Deputy Under Secretary of Commerce for Intellectual Property and
Deputy Director of the United States Patent and Trademark Office

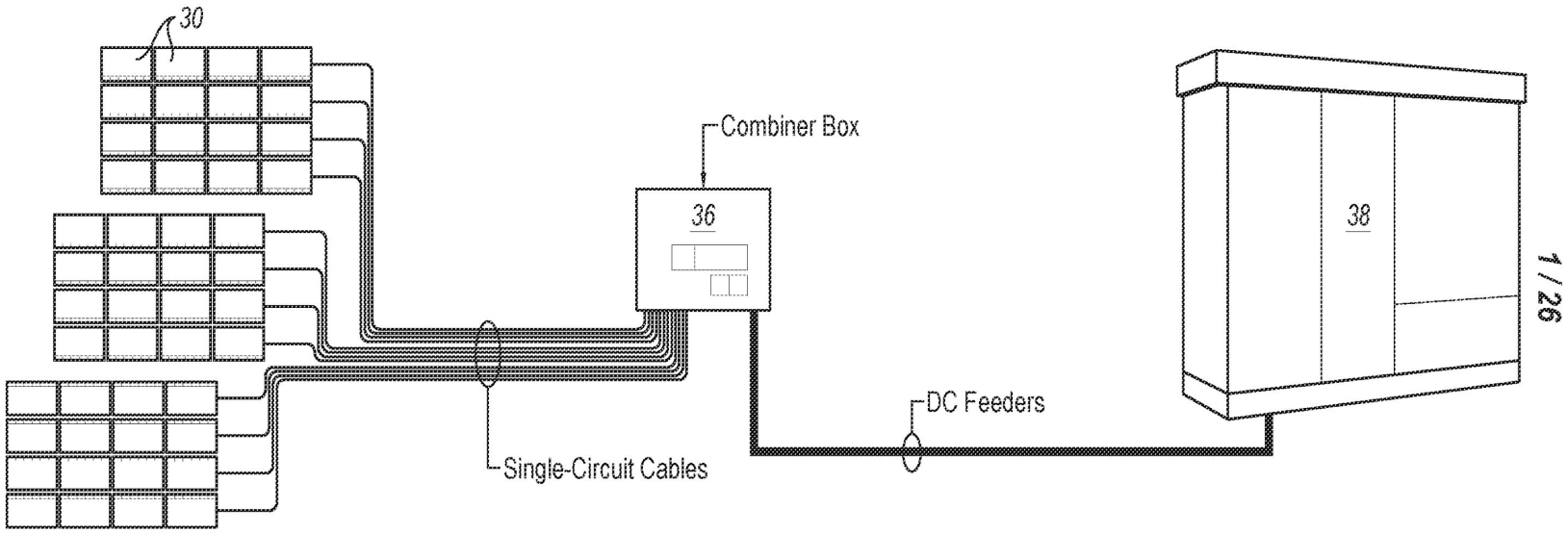


FIG. 1
Prior Art

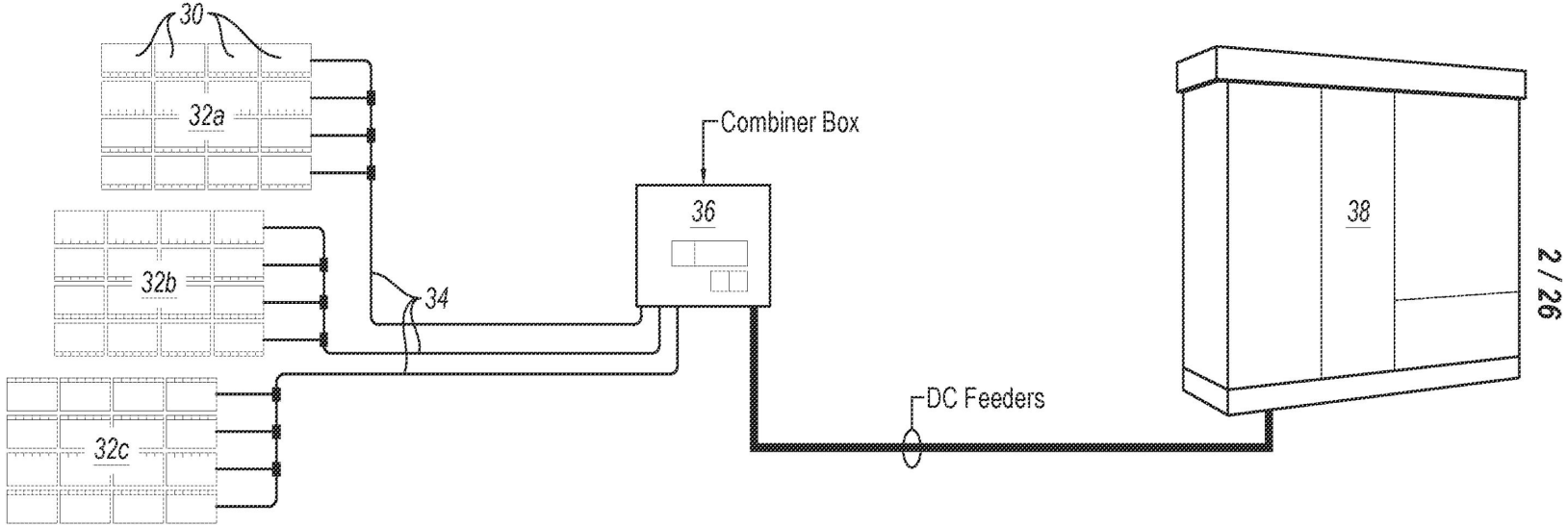


FIG. 2
Prior Art

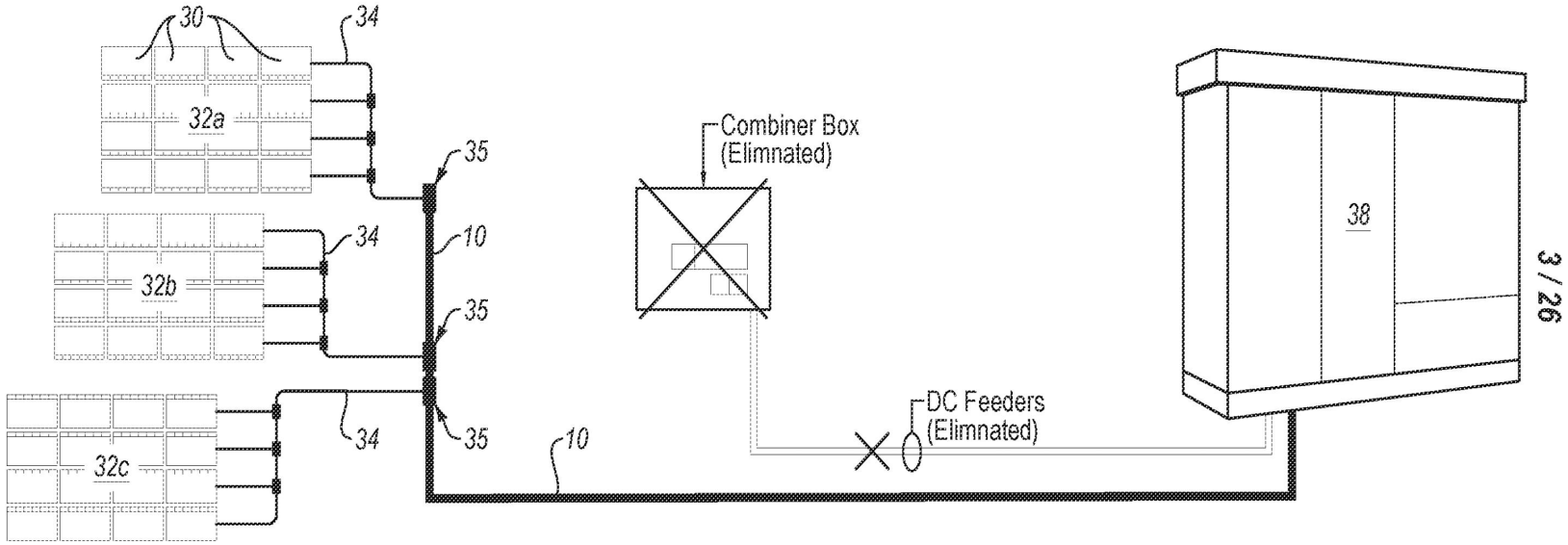

30
34
32a
35
Combiner Box
(Elimnated)
34
10
32b
35
38
34
35
DC Feeders
(Elimnated)
32c
10

FIG. 3

FIG. 4

FIG. 5

FIG. 6

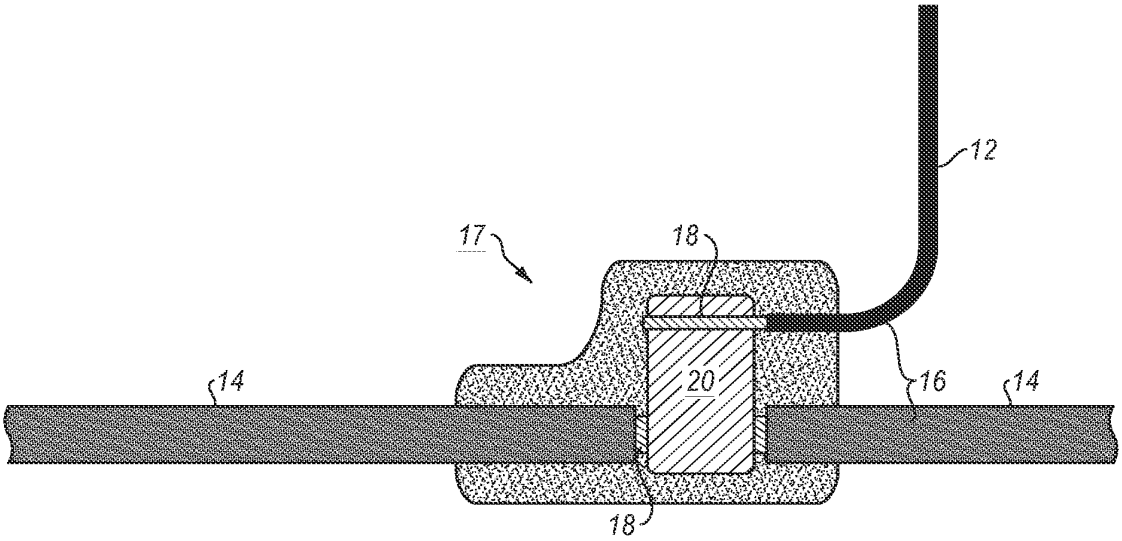


FIG. 7

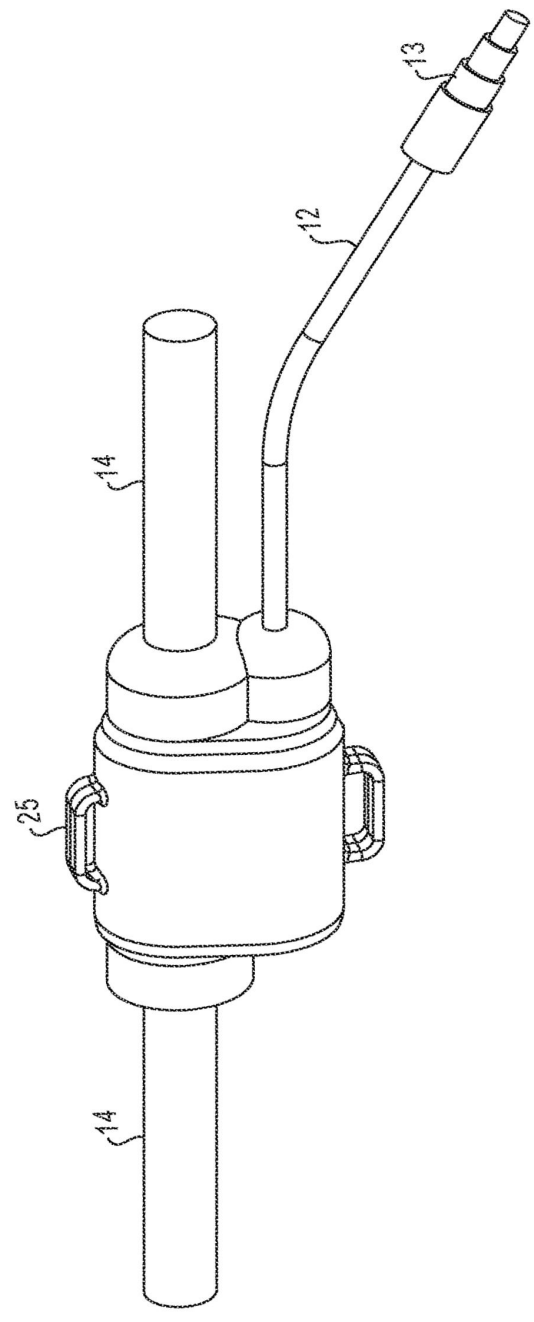


FIG. 8

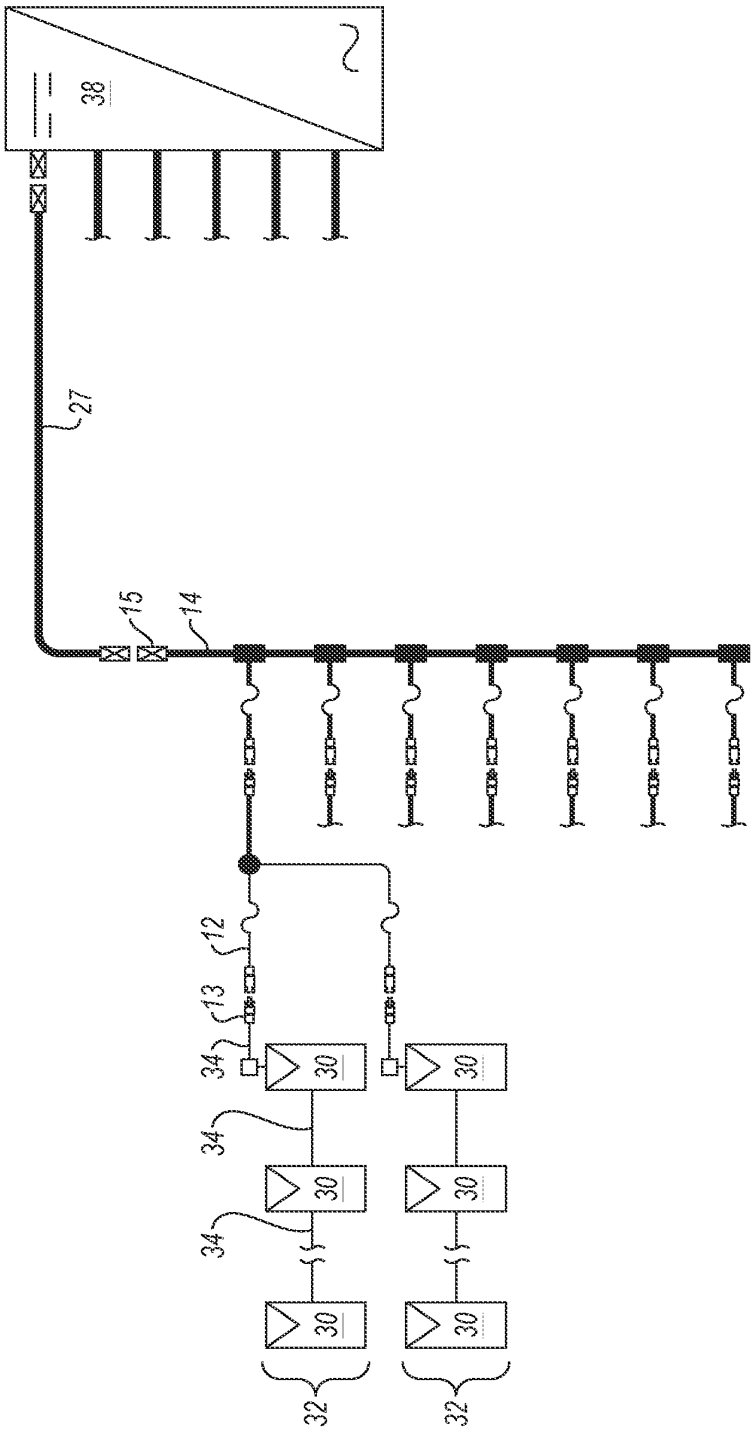


FIG. 9

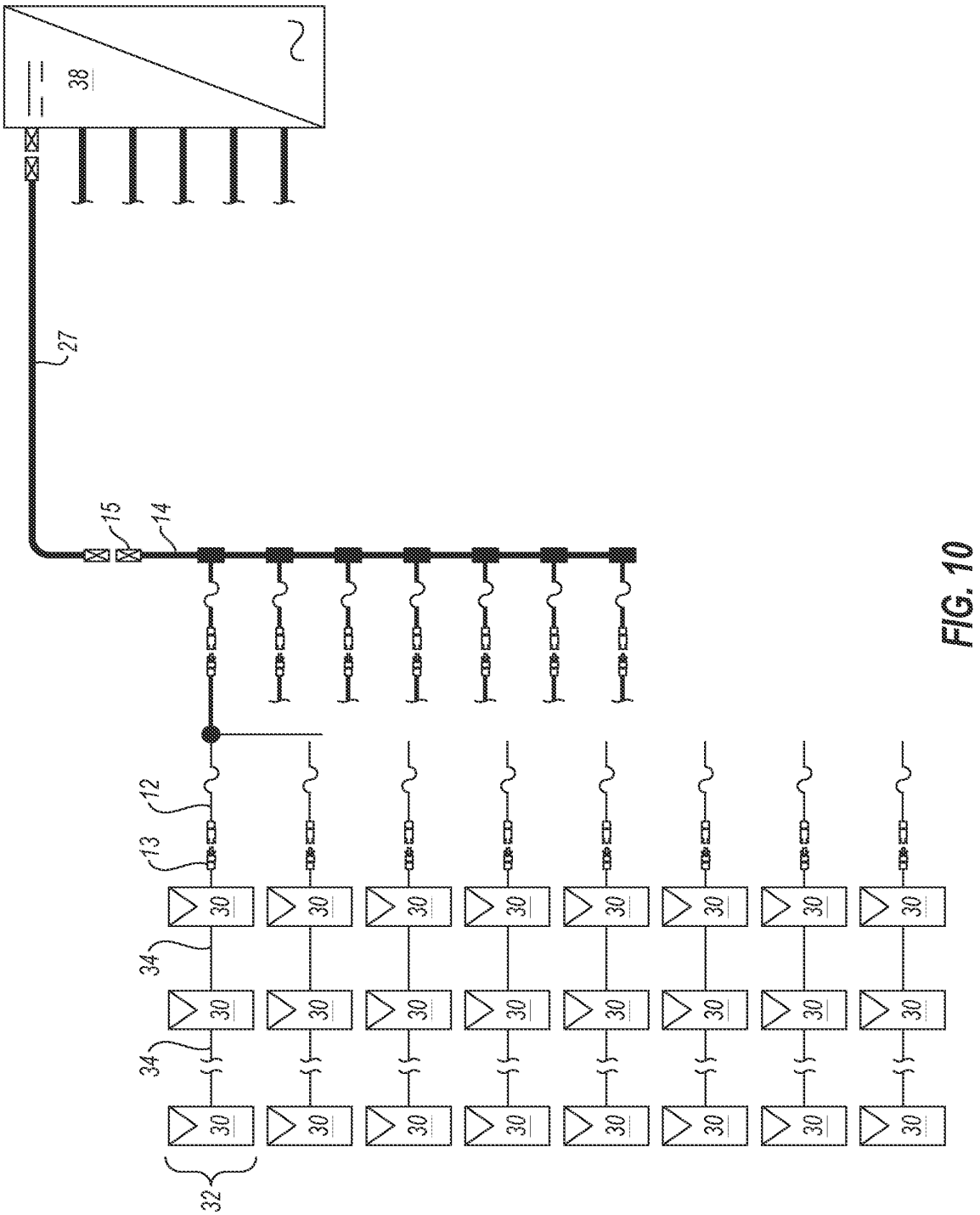


FIG. 10

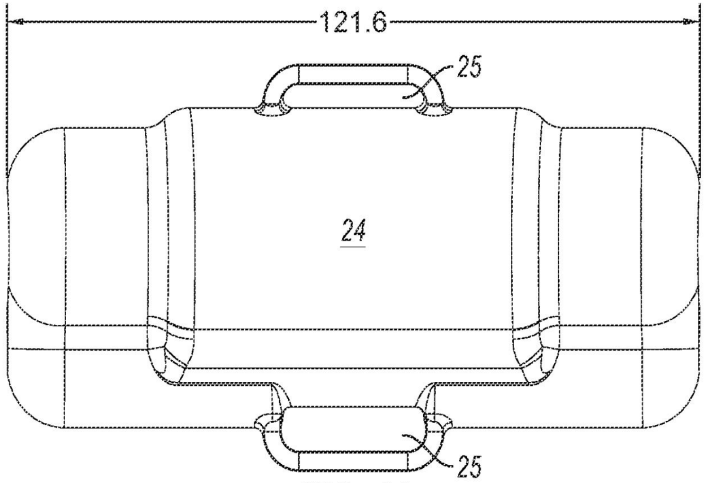


FIG. 11

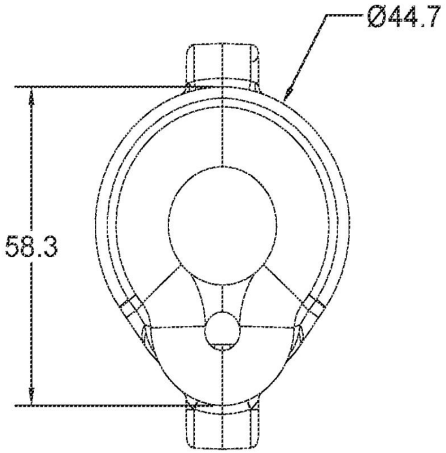


FIG. 12

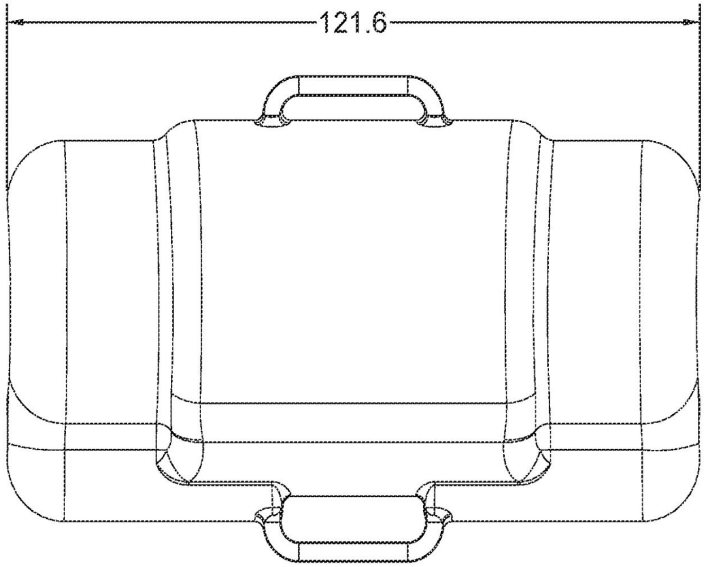


FIG. 13

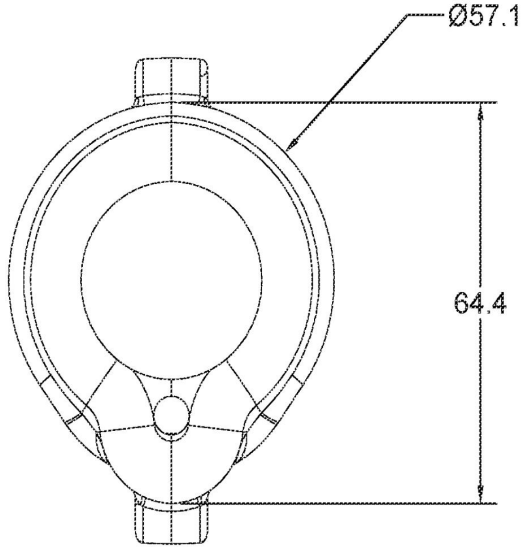


FIG. 14

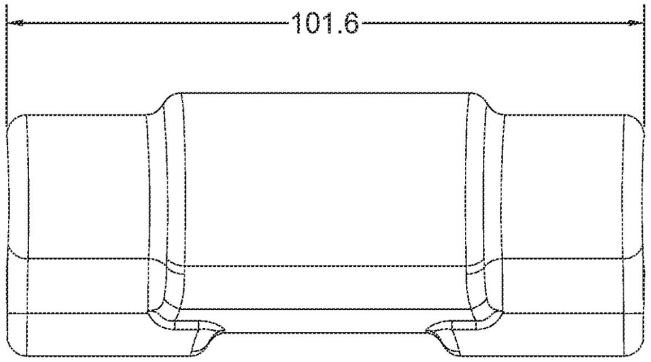


FIG. 15

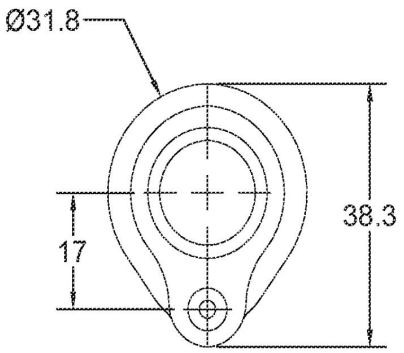


FIG. 16

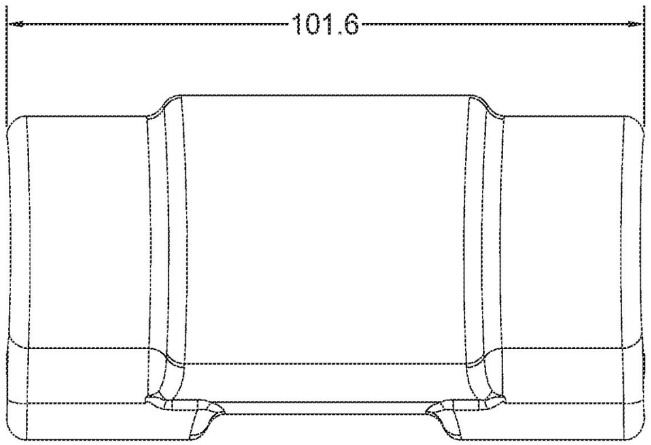


FIG. 17

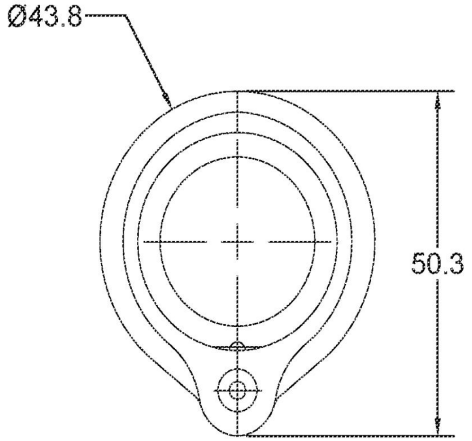


FIG. 18

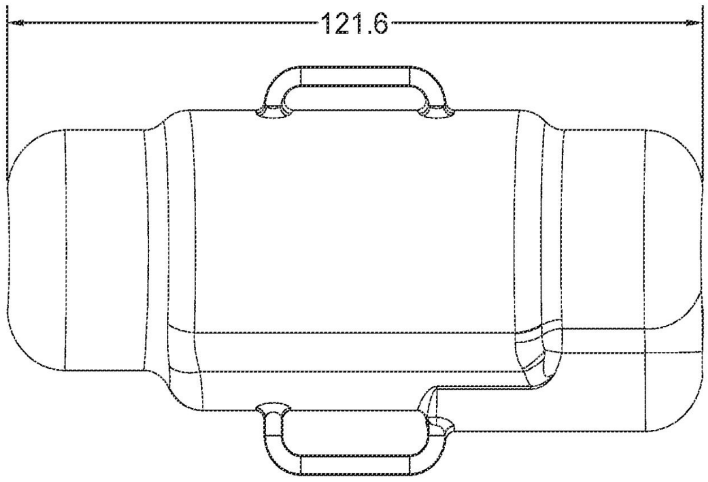


FIG. 19

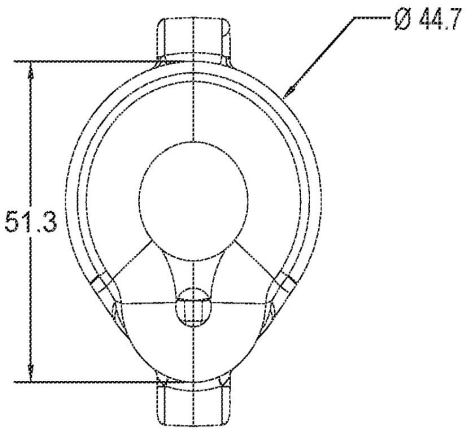


FIG. 20

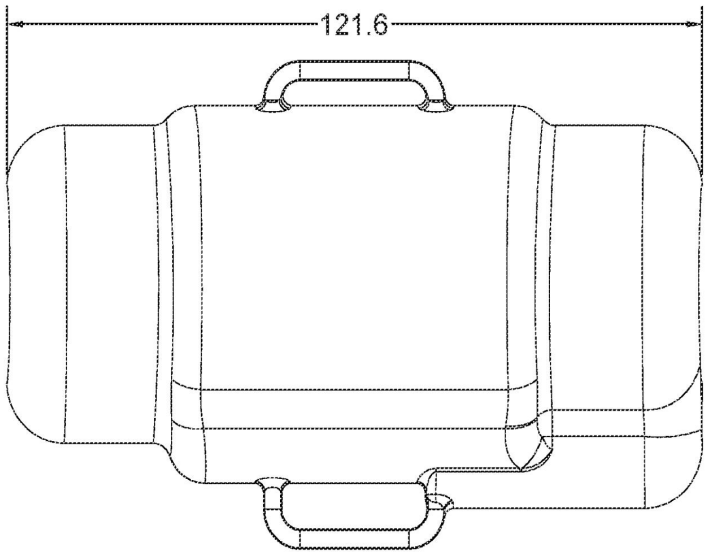


FIG. 21

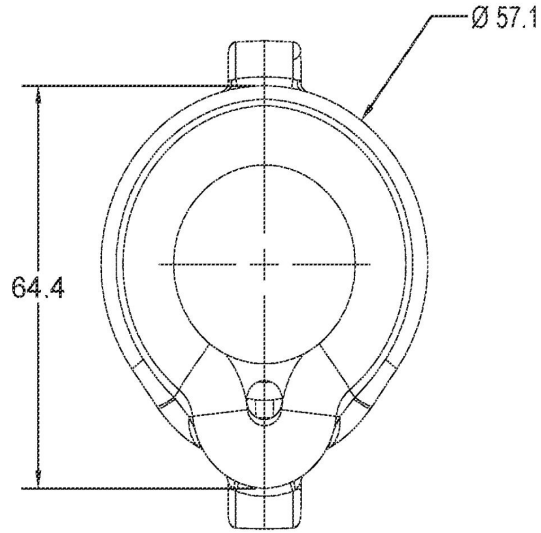


FIG. 22

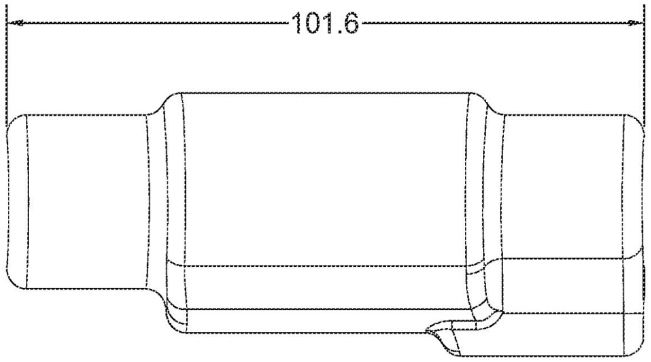


FIG. 23

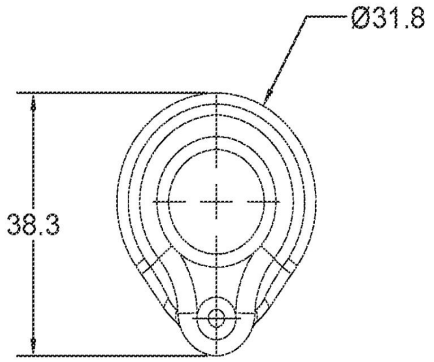


FIG. 24

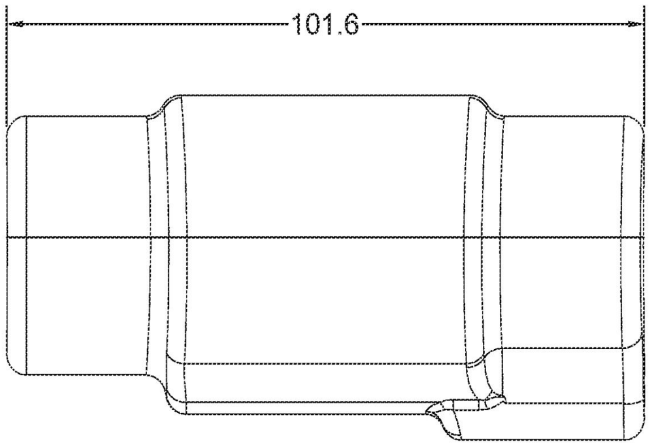


FIG. 25

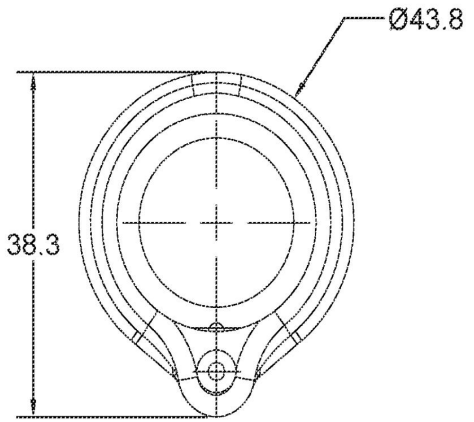


FIG. 26

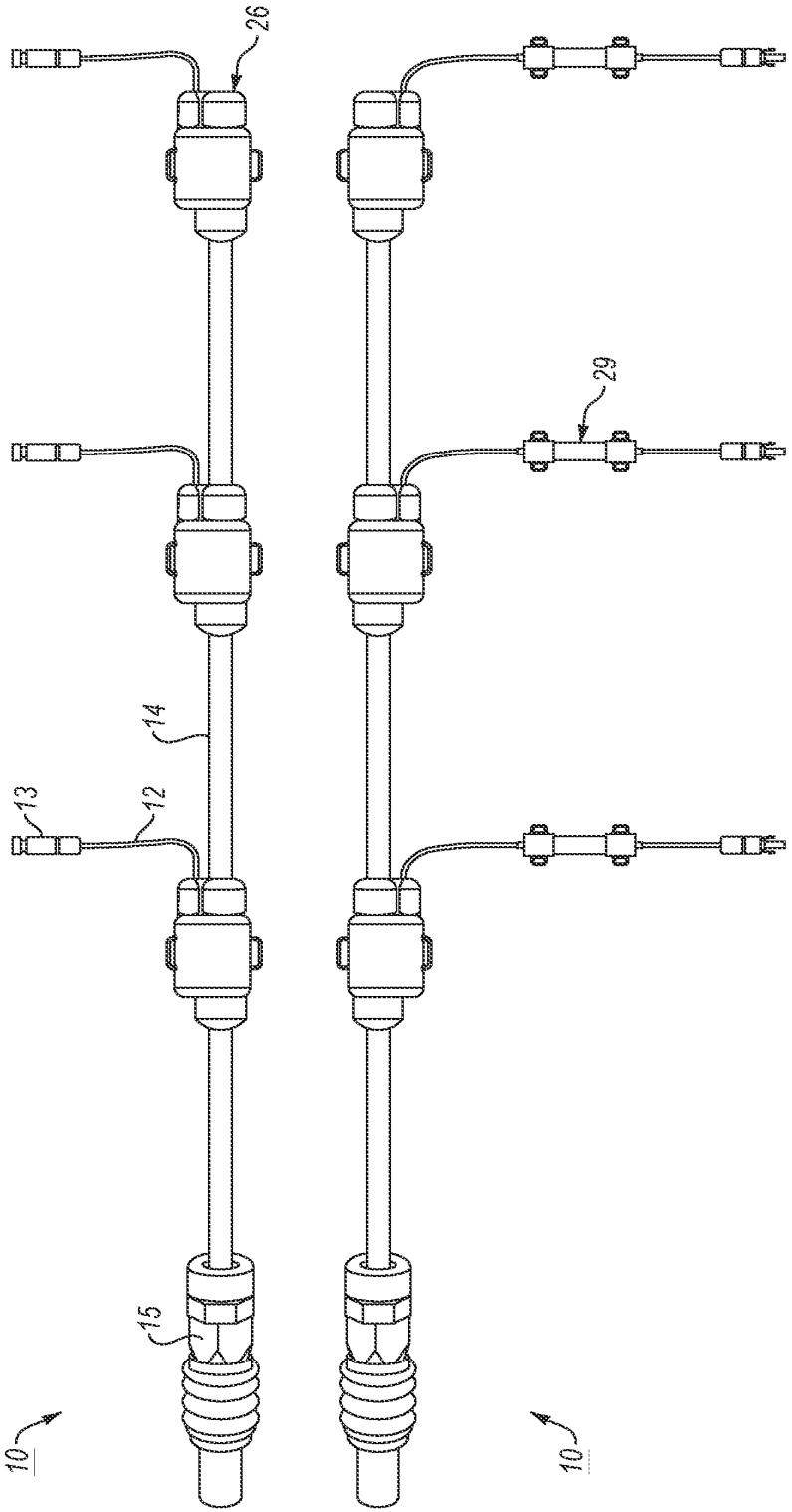


FIG. 27

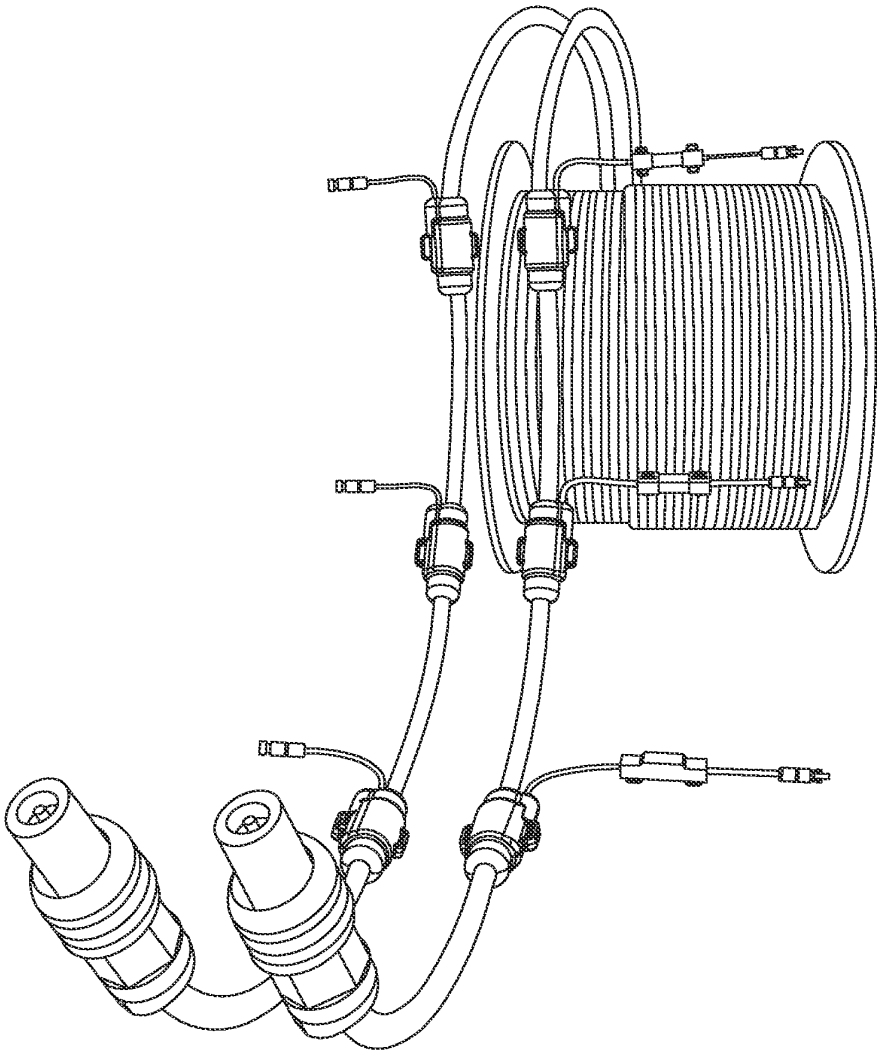


FIG. 28

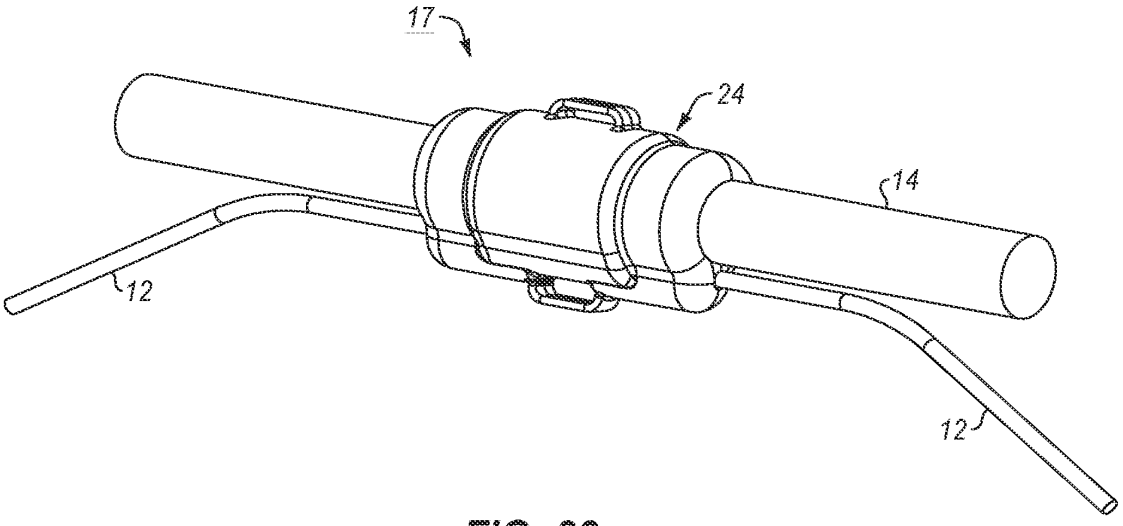


FIG. 29

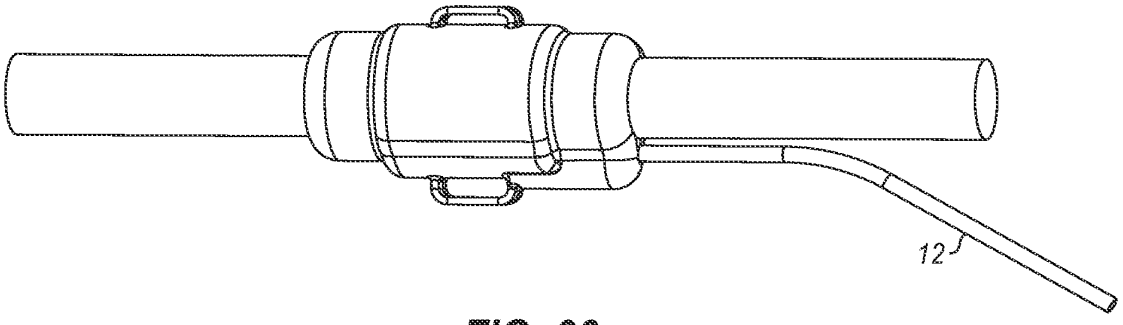


FIG. 30

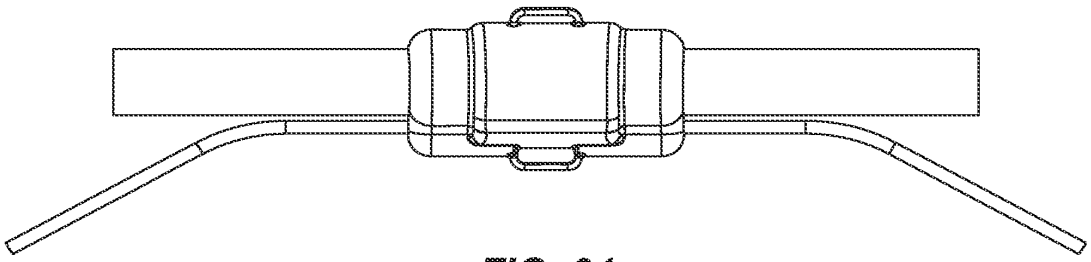


FIG. 31

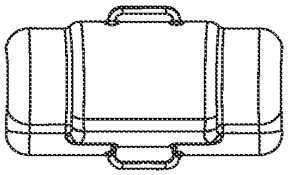


FIG. 32

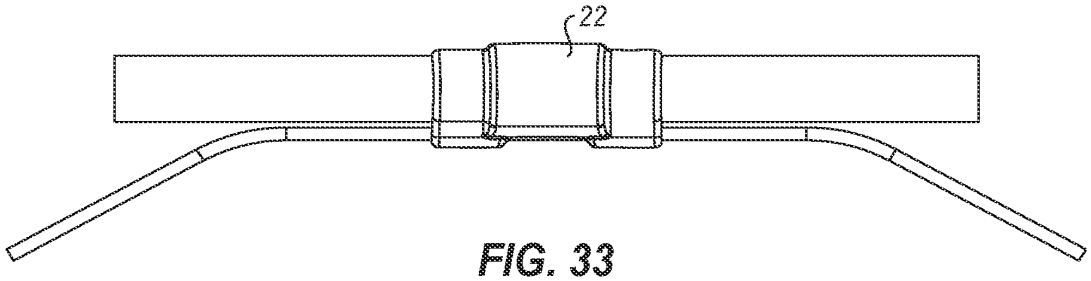


FIG. 33

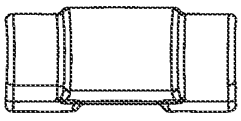


FIG. 34

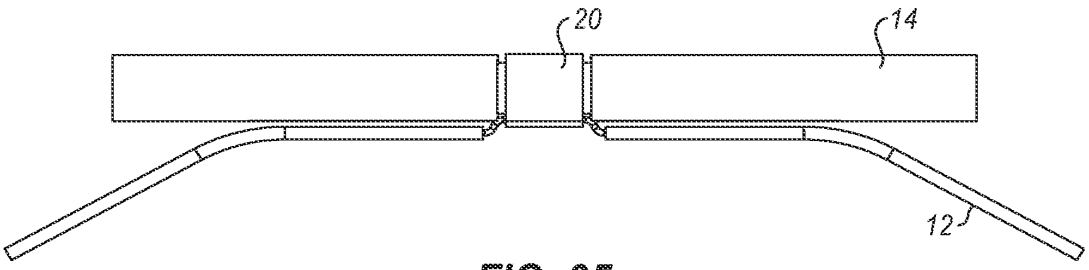


FIG. 35

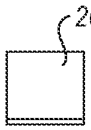


FIG. 36

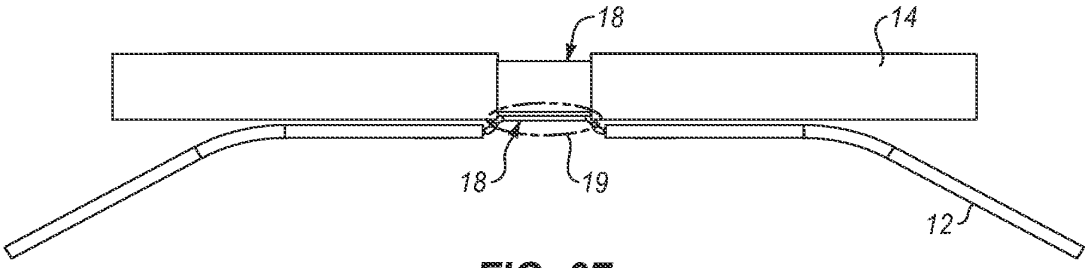


FIG. 37

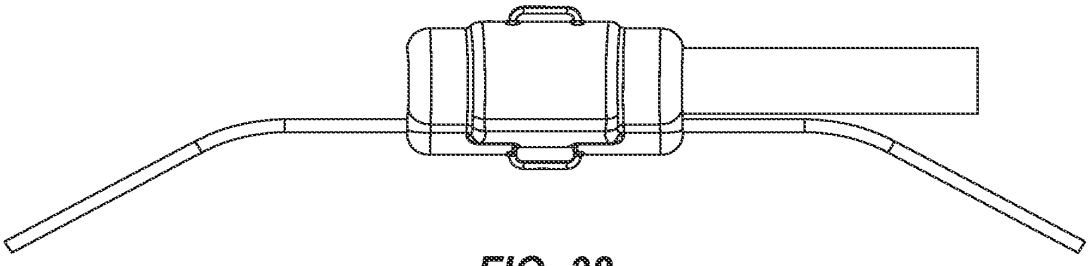


FIG. 38

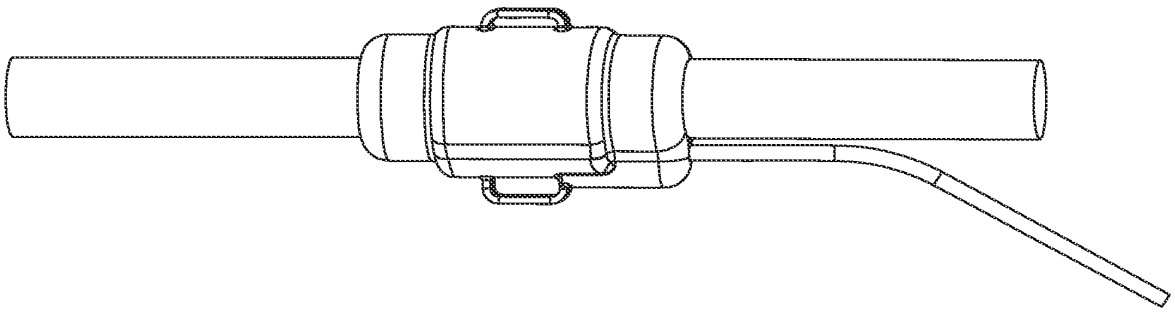


FIG. 39

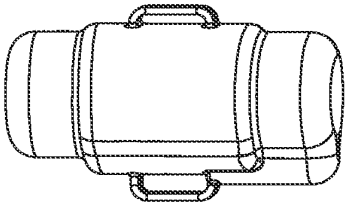


FIG. 40

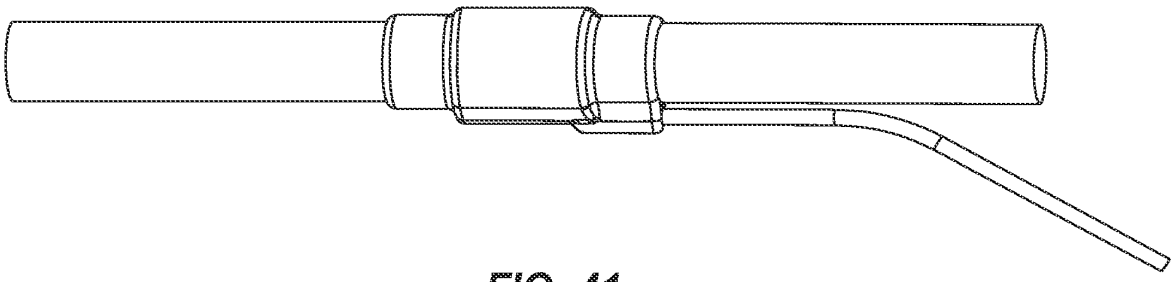


FIG. 41

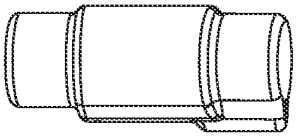


FIG. 42

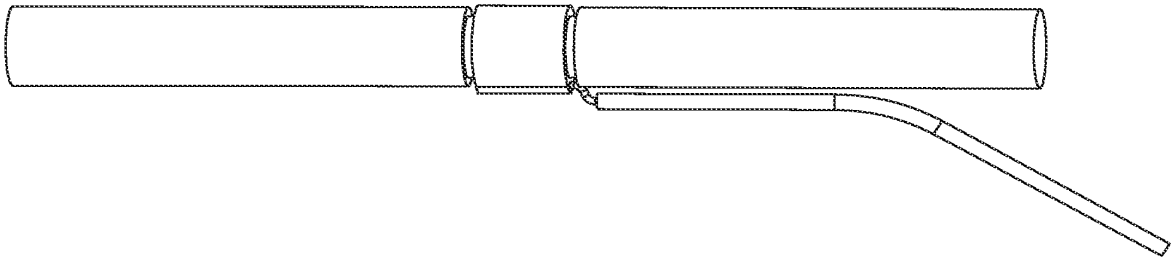


FIG. 43

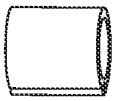


FIG. 44

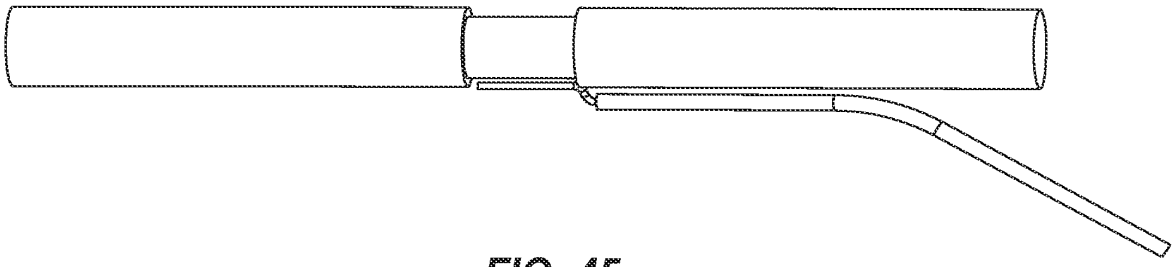


FIG. 45

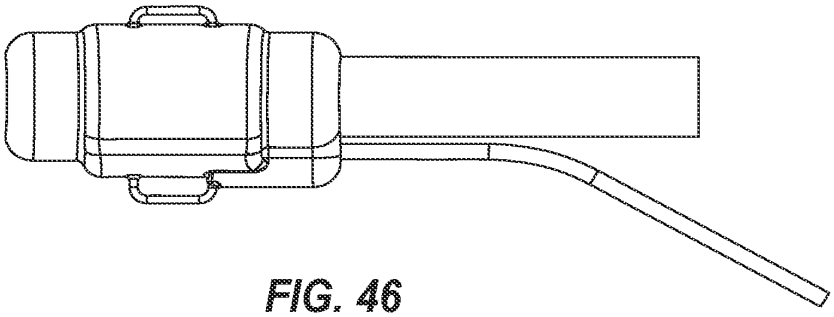


FIG. 46

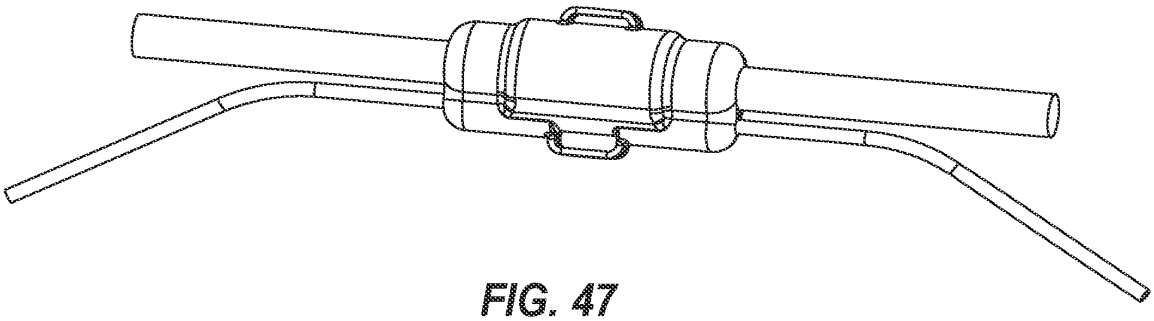


FIG. 47

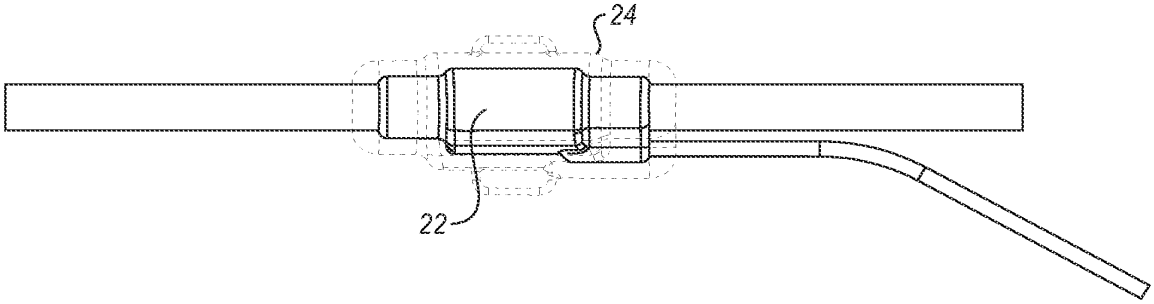


FIG. 48

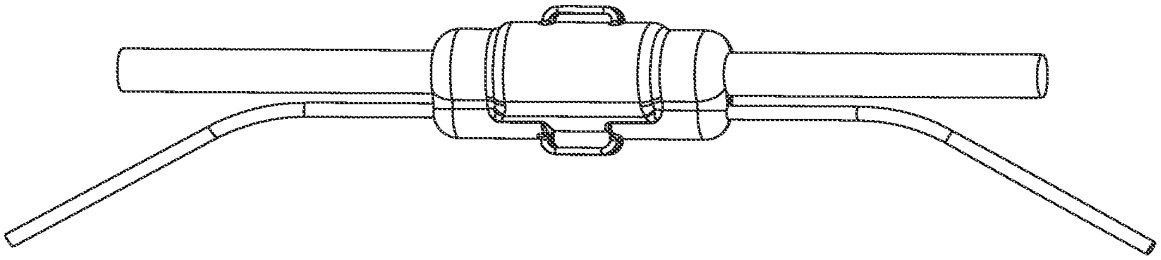


FIG. 49

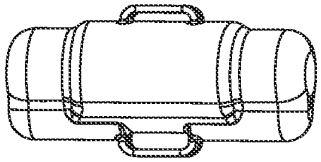


FIG. 50

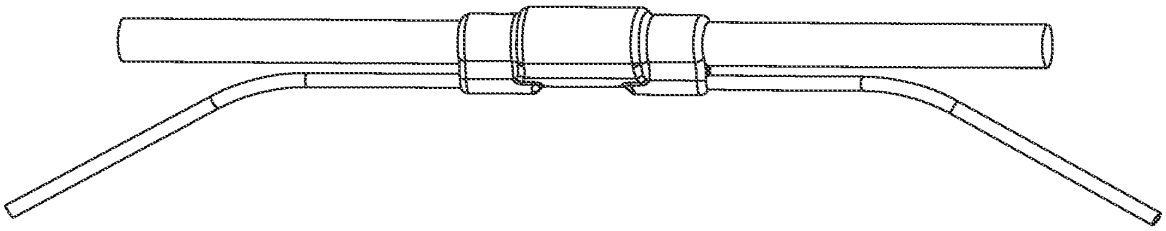


FIG. 51

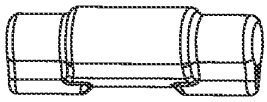


FIG. 52

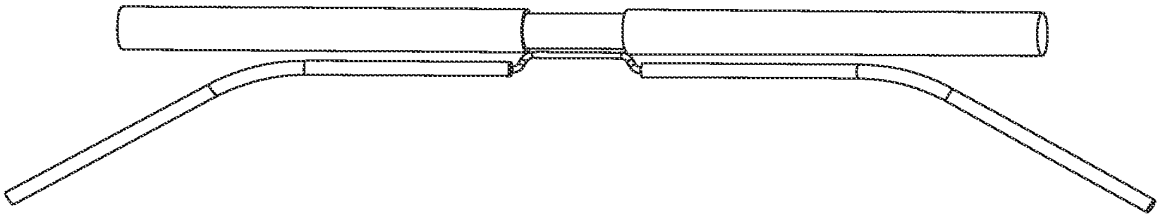


FIG. 53

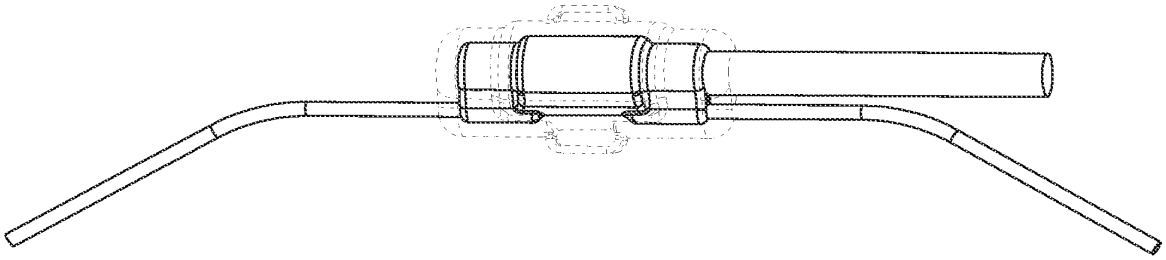


FIG. 54

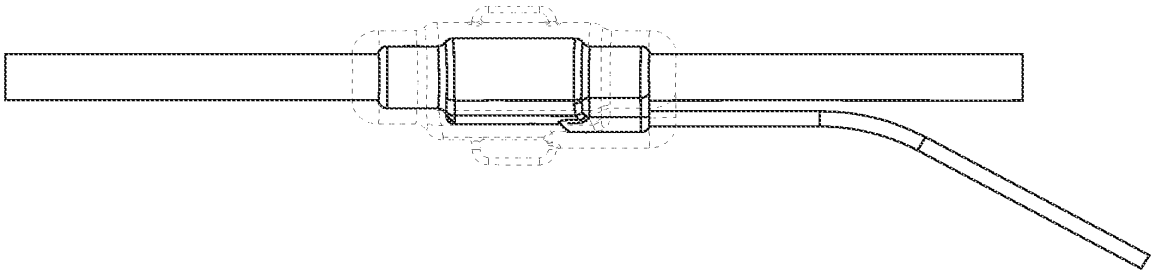


FIG. 55

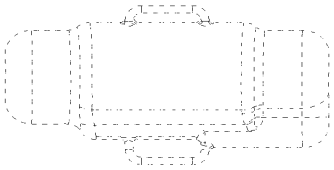


FIG. 56

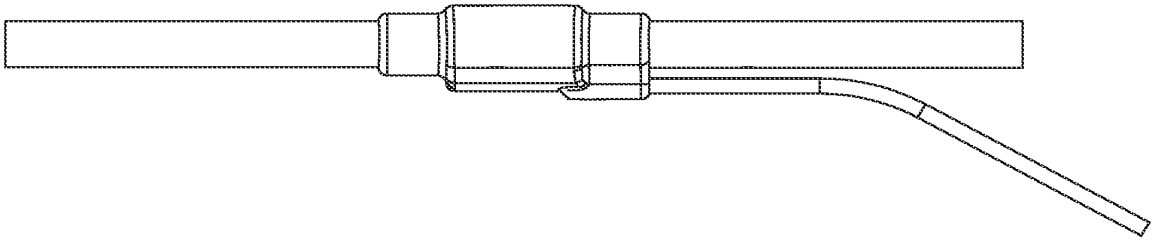


FIG. 57

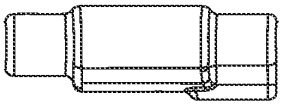


FIG. 58

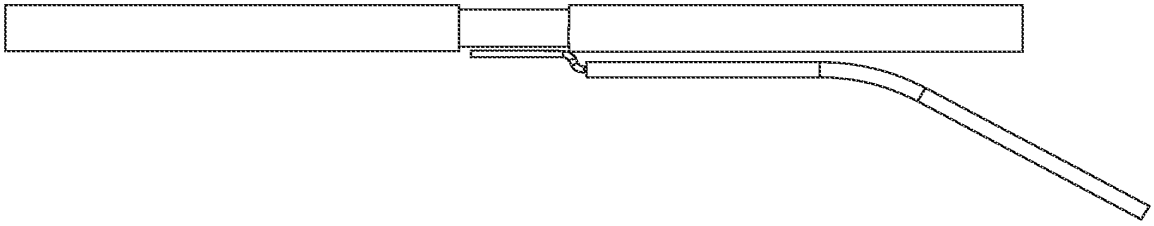


FIG. 59

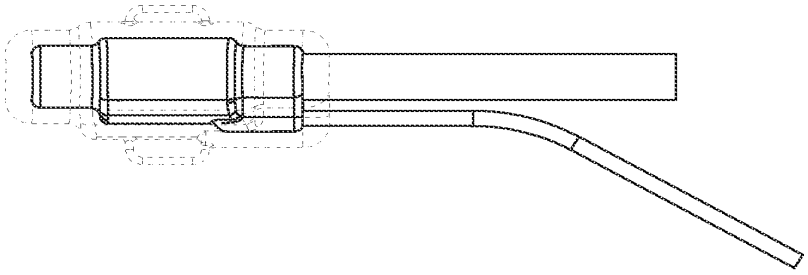


FIG. 60

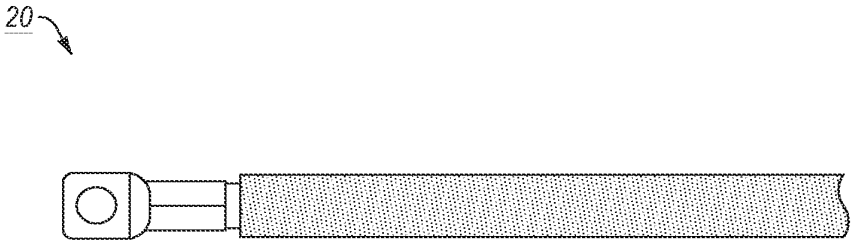


FIG. 61

PTO/AIA/01 (06-12)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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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.

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S4079.10001US05
	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	Gallatin	State/Province	TN	Country of Residence	US

Mailing Address of Inventor:

Address 1	1400 Shoals Way		
Address 2			
City	Portland	State/Province	TN
Postal Code	37148	Country	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	97149		
Email Address	docket@mabr.com	Add Email	Remove Email

Application Information:

Title of the Invention	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER		
Attorney Docket Number	S4079.10001US05	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	26	Suggested Figure for Publication (if any)	7

PTO/AIA/14 (01-22)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S4079.10001US05
	Application Number	
Title of Invention	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	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	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	18341655	2023-06-26

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S4079.10001US05
	Application Number	
Title of Invention	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER	

Prior Application Status	Patented			Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
18341655	Continuation of	17301609	2021-04-08	11689153	2023-06-27
Prior Application Status	Patented			Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
17301609	Continuation of	14849458	2015-09-09	10992254	2021-04-27
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).

			Remove
Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.			Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S4079.10001US05
	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.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S4079.10001US05
	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			

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

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S4079.10001US05
	Application Number	
Title of Invention	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER	

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. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
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	/Paul G. Johnson/			Date (YYYY-MM-DD)	2023-11-29
First Name	Paul	Last Name	Johnson	Registration Number	58539

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

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S4079.10001US05
	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.**

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.

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	Not Yet Assigned		
Filing Date	November 29, 2023		
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	S4079.10001US05		
SIGNATURE of Applicant or Patent Practitioner			
Signature	/Paul G. Johnson/	**Date**	November 29, 2023
Name	Paul G. Johnson	**Telephone**	(435) 252-1360
Registration Number	58539		

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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:

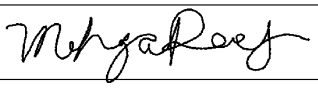
☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign

☐ 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.

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UNITED STATES
PATENT AND TRADEMARK OFFICE

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Alexandria, VA 22313 - 1450
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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/523,464	11/29/2023 05:26:46 PM Z ET	S4079.10001US05

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 #	4515	FILED BY	JOLIN JOHNSON
PATENT CENTER #	63424893	AUTHORIZED BY	Paul Johnson
CUSTOMER #	97149	FILING DATE	-
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Dean SOLON

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 0463	E2023ASH27325827	JOLIN JOHNSON

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
1830	PROCESSING FEE, EXCEPT IN PROVISIONAL APPLICATIONS	140.00	1	140.00
1817	REQUEST FOR PRIORITIZED EXAMINATION	4200.00	1	4200.00
1111	UTILITY PATENT APPL. SEARCH FEE	700.00	1	700.00
1011	BASIC FILING FEE - UTILITY (PAPER FILING ALSO REQUIRES NON-ELECTRONIC FILING FEE UNDER 1.16(T))	320.00	1	320.00
1311	PATENT APPL. EXAMINATION FEE	800.00	1	800.00

TOTAL AMOUNT:	$6,160.00

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.

LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a Continuation Application of 18/341,655, filed June 26, 2023, entitled LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER, which is a Continuation Application of 17/301,609, filed April 8, 2021, entitled LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER, which 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, all 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

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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 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.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 depicts a conventional wiring configuration with each solar panel individually wired to a central combiner box;

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;

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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;

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;

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FIG. 54 depicts the end of string for a dual drop lead assembly for 250MCM cable with the overmold depicted in phantom;

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;

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20 — Compression lug;

22 — Undermold;

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.

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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-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 components 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

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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 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

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in line fuses 29, as shown in the lower assembly of FIG. 27. Appropriate fuses include of HP10x from Mersen of Newburyport, MA.

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 electrically coupling one or more drop lines to a feeder cable, the lead assembly comprising:

a feeder cable;

one or more drop lines, each drop line including a drop line connector, the drop line connector configured to be capable of detachable connection to a wire harness having a plurality of branches that are each configured to receive electrical power generated by a corresponding photovoltaic (PV) panel resulting in combined electrical power at the drop line connector;

one or more mold structures disposed about a region of electrical interconnection between the feeder cable and the one or more drop lines, the one or more mold structures substantially sealing the region of electrical interconnection from external environmental conditions;

wherein the combined electrical power received at each drop line connector is delivered to the feeder cable at the region of electrical interconnection.

2. The lead assembly of claim 1, wherein:

the feeder cable extends continuously through the one or more mold structures such that the feeder cable extends out of and away from the one or more mold structures in one direction and out of and away from the one or more mold structures in an opposite direction; and

the drop line includes one end that terminates within the one or more mold structures.

3. The lead assembly of claim 1, wherein in the region of electrical interconnection:

the drop line includes a section of exposed wire; and

the feeder cable includes a section of exposed wire.

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4. The lead assembly of claim 1, wherein in the region of electrical interconnection, the drop line is coupled to the feeder cable using at least one of a compression lug, a solder portion, a splice, or a crimp.

5. The lead assembly of claim 1, further comprising a feeder cable connector at an end of the feeder cable, the feeder cable connector configured to electrically couple the feeder cable to an inverter without an intervening combiner box.

6. The lead assembly of claim 1, wherein in the region of electrical interconnection, at least a portion of the drop line is arranged parallel to at least a portion of the feeder cable.

7. The lead assembly of claim 1, wherein the feeder cable has a first diameter, each of the one or more drop lines has a second diameter, and the second diameter is smaller than the first diameter.

8. The lead assembly of claim 1, wherein the one or more drop lines includes a plurality of drop lines and the lead assembly is configured to combine, in the feeder cable, the combined electrical power received through the drop line connector of each of the plurality of drop lines and to deliver the combined combined electrical power to an inverter that is in electrical communication with the feeder cable.

9. The lead assembly of claim 1, wherein each of the one or more drop lines includes a wire of between four (4) gauge to eighteen (18) gauge.

10. The lead assembly of claim 1, wherein the feeder cable includes a wire of between 250 MCM to 1000 MCM.

11. The lead assembly of claim 1, wherein the one or more mold structures include:

an injection molded overmold that surrounds the region of electrical interconnection; or

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an injection molded undermold that surrounds the region of electrical interconnection and an injection molded overmold that surrounds the injection molded undermold.

12. A solar power system comprising:

the lead assembly of claim 1;

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

a second plurality of solar panels electrically coupled by a second wire harness to form a second solar array,

wherein:

the one or more drop lines includes a first drop line including a first drop line connector and a second drop line including a second drop line connector;

the first drop line connector and the first drop line electrically couple the first solar array to the feeder cable; and

the second drop line connector and the second drop line electrically couple the second solar array to the feeder cable.

13. A method, comprising:

stripping insulation from an end of a drop line to expose an end of a drop line conductor included in the drop line;

stripping insulation from an intermediate segment of a feeder cable to expose an intermediate segment of a feeder cable conductor included in the feeder cable;

electrically coupling the exposed end of the drop line conductor to the exposed intermediate segment of the feeder cable conductor, wherein at least a portion of the exposed end of the drop line conductor is arranged parallel to the exposed intermediate segment of the feeder cable conductor; and

forming a mold structure that surrounds the electrically coupled exposed end of the drop line conductor and the exposed intermediate segment of the feeder cable conductor.

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14. The method of claim 13, wherein electrically coupling the exposed end of the drop line conductor to the exposed intermediate segment of the feeder cable conductor comprises at least one of:

electrically coupling the exposed end of the drop line conductor to the exposed intermediate segment of the feeder cable conductor using a compression lug;

soldering the exposed end of the drop line conductor to the exposed intermediate segment of the feeder cable conductor;

splicing the exposed end of the drop line conductor to the exposed intermediate segment of the feeder cable conductor; or

crimping the exposed end of the drop line conductor to the exposed intermediate segment of the feeder cable conductor.

15. The method of claim 13, wherein forming the mold structure that surrounds the electrically coupled exposed end of the drop line conductor and the exposed intermediate segment of the feeder cable conductor comprises injection molding an overmold that surrounds the electrically coupled exposed end of the drop line conductor and the exposed intermediate segment of the feeder cable conductor.

16. The method of claim 13, wherein:

forming the mold structure that surrounds the electrically coupled exposed end of the drop line conductor and the exposed intermediate segment of the feeder cable conductor comprises injection molding an undermold that surrounds the electrically coupled exposed end of the drop line conductor and the exposed intermediate segment of the feeder cable conductor; and

the method further comprises injection molding an overmold that surrounds the undermold.

17. The method of claim 13, wherein forming the mold structure that surrounds the electrically coupled exposed end of the drop line conductor and the exposed intermediate segment of the feeder cable conductor includes substantially sealing the electrically coupled

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exposed end of the drop line conductor and the exposed intermediate segment of the feeder cable conductor from external environmental conditions.

18. The method of claim 13, further comprising:

attaching a drop line connector that terminates an opposite end of the drop line to a wire harness that is coupled to a plurality of photovoltaic (PV) panels; and

combining power from the plurality of PV panels at the drop line connector.

19. The method of claim 18, further comprising combining, in the feeder cable, combined power from the drop line connector with combined power from a second drop line connector that couples a second drop line to a second wire harness that is coupled to a second plurality of PV panels.

20. The method of claim 19, further comprising electrically coupling the feeder cable to an inverter without an intervening combiner box to provide the combined combined power from the drop line connector and the second drop line connector to the inverter without the intervening combiner box.

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ABSTRACT

A lead assembly includes a feeder cable, one or more drop lines, and one or more mold structures. Each drop line includes a drop line connector, the drop line connector configured to be capable of detachable connection to a wire harness having a plurality of branches that are each configured to receive electrical power generated by a corresponding photovoltaic (PV) panel resulting in combined electrical power at the drop line connector. The one or more mold structures are disposed about a region of electrical interconnection between the feeder cable and the one or more drop lines. The one or more mold structures substantially seal the region of electrical interconnection from external environmental conditions. The combined electrical power received at each drop line connector is delivered to the feeder cable at the region of electrical interconnection.

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Doc Code: TRACK1.REQ
Document Description: TrackOne Request

PTO/AIA/424 (04-14)

CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION UNDER 37 CFR 1.102(e) (Page 1 of 1)

First Named Inventor:	Dean SOLON	Nonprovisional Application Number (if known):	
Title of Invention:	LEAD ASSEMBLY FOR CONNECTING SOLAR PANEL ARRAYS TO INVERTER		

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently $0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.

2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.

3. The applicable box is checked below:

I. ☑ Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)

i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.

---OR---

(b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.

ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, **or** the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

II. ☐ Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)

i. A request for continued examination has been filed with, or prior to, this form.
ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature /Paul G. Johnson/	Date 2023-11-29
Name (Print/Typed) Paul G. Johnson	Practitioner Registration Number 58539

Note: *This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.**

☑ *Total of one forms are submitted.

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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.

UNITED STATES
PATENT AND TRADEMARK OFFICE

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www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/523,464	**11/29/2023 05:26:46 PM Z ET**	**S4079.10001US05**

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 #	4515	FILED BY	JOLIN JOHNSON
PATENT CENTER #	63424893	FILING DATE	-
CUSTOMER #	97149	FIRST NAMED INVENTOR	Dean SOLON
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Paul Johnson

Documents

TOTAL DOCUMENTS: 7

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
S4079.10001US05_2023-11-29_ADS.pdf	8	Application Data Sheet	2174 KB
S4079.10001US05_2023-11-29_TrackOneRequest.pdf	2	Track One Request	131 KB
S4079.10001US05_2023-11-29_Application-APP.TEXT.docx	15	Application body structured text document	38 KB
Warning: All artifacts (SmartArt, Drawings, Charts, etc) have been replaced with images. Bookmarks were found and have been removed.			
S4079.10001US05_2023-11-	26	Drawings-only black and white	549 KB

29_Drawings.pdf		line drawings	
S4079.10001US05_2023-11-29_Declaration.pdf	2	Oath or Declaration filed	238 KB
S4079.10001US05_2023-11-29_POA.pdf	2	Power of Attorney	165 KB
S4079.10001US05_2023-11-29_Application.pdf	15	Auxiliary PDF of Application	167 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
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S4079.10001US05_2023-11-29_POA.pdf	9D097E9AFBF243F50715EA6952FA1BD56FCECA5CDEE19A98FDD8BB67781975B289D840376CAE04FACC878FF58A6344C06D09C27DB0963879B0860BCC8250A4D1

S4079.10001US05_2023-11-29_Application.pdf	1BC63FFF9E59D8681584073F5428E97864A46C14EE75C16611496153DF8EF3947F8447E9A959B7A6F484889FC2C478566E404D3AC7CC6227EA6E6610361FA96D

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.